

Evaluating Pre-learner Driver Road Safety Education Programmes for Transition Year (Year 12) Students in the Republic of Ireland.

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This research was conducted in the School of Psychology, TCD.

1.1 DECLARATION

I hereby declare that:

- (a) The work contained in this thesis has not been submitted as an exercise for a degree at this, or at any other University;
- (b) This thesis is the result of my own investigations, and the contributions of others are duly acknowledged in the text wherever included;
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SUMMARY

Road traffic crashes (RTCs) impose a considerable burden on society and the risk of crashing is highest among young inexperienced learner and novice drivers, especially males. Research suggests that driving-related knowledge, skills and attitudes begin to develop long before adolescents are old enough to drive. In response, education programmes have been designed which target adolescent pre-learner drivers specifically, with the aim of establishing a solid basis for future driving-related education and subsequent driving behaviour. This thesis consists of nine chapters which serve to describe an evaluation study of pre-learner driver education (PLDE)¹.

Chapter 1 puts the research in context by describing the causes and consequences of road traffic crashes (RTCs). A review of driver education is presented, and relevant theoretical models are discussed. A review of previous PLDE evaluations is provided, which indicates that PLDE is successful in effecting significant improvements in driving-related knowledge, cognitive skills and attitudes in the short-term but not in the longer-term.

Chapter 2 describes the research methodology. This research was based on a quasi-experimental, longitudinal, between-groups and within-groups design whereby driving-related knowledge, risk perception skills and attitudes were measured using self-report questionnaires. Pre-intervention, post-intervention and post-intervention follow-up tests were conducted over 18 months. Hierarchical linear modeling was used to explain intra-individual, between-individual and between-group variations in driving-related knowledge, risk perception skills and attitudes as a function of time, of participating in a pre-learner driver education course and of individual differences in personality and of previous experiences in the traffic environment. A description of the processes involved in data preparation and analysis and lesser-known statistical techniques is provided.

¹ Note: Since this thesis contains quite a lot of tables and figures, for ease of use, many of these were placed in the appendices.

Chapter 3 describes the processes whereby personality was assessed using measures such as the IPIP-50 test for Big-five traits, the BIS-15 impulsiveness test and the AISS sensation seeking test. The results of confirmatory and exploratory factor analyses are reported. The reliability and validity of these tests is ascertained and debated. Chapter 4 deals with learning and previous experience and the related results showed that the research participants were very interested in driving, planned for early licensure, had some direct experience with driving and had been somewhat exposed to aberrant driving as passengers. The analyses conducted in Chapters 3 and 4 produced 14 factors which were used subsequently to predict driving-related knowledge, risk perception skills and attitudes.

Chapters 5, 6 and 7 feature the summative evaluations. The results indicated that PLDE was effective in improving driving related knowledge in the short- and the long-term. However, PLDE was generally ineffective in improving the driving-related risk perception and attitudes. However, PLDE was successful in reducing positive impressions of prototypical speeders and in improving the accessibility of negative consequences in response to a high-risk vignette scenario. Despite the application of sophisticated methodology and the inclusion of many relevant predictors, the bulk of the variation in test scores remained unexplained. The implications of these findings are discussed.

Chapter 8 consists of a review of the PLDE provision for Irish PLDs and a formative evaluation of the curriculum that formed the basis of two of the PLDE courses that featured in this research. Recommendations are made for improving the availability of PLDE in Irish secondary schools and for improving programme standards, contents and processes.

Chapter 9 summarizes the findings and discusses their theoretical, educational, methodological and policy-related implications, and recommendations are provided. Finally, the research strengths and limitations are discussed.

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Reflecting on what the time spent as a psychology student has meant to me, this verse by T. S. Elliott came to mind:

*“We shall not cease from exploration
And the end of all our exploring
Will be to arrive where we started
And know the place for the first time”*

This has been a truly awesome journey and a fascinating process of discovery!

1.2 Abbreviations²

AISS	Arnett Inventory of Sensation Seeking
BIS	Barrett Impulsiveness Scale
CRLE	Crash risk likelihood estimates scale
CSO	Central Statistics Office
DBQ	Driver Behaviour Questionnaire
DE	Driver education
DT	Driver training
DWI	Driving while intoxicated.
ECTM	European Council of Ministers for Transport
ETS	Educational Testing Service
EU	European Union
FARS	Fatal Analysis Reporting System
GDE	Goals for driver education
GDL	Graduated driver licence
HLM	Hierarchical Linear Modeling
IP	Intervention Phase – period inclusive of the T1 and the T2 tests
IPIP	International Personality Item Pool
IVF	Initial versus final phase - comparisons of T1 and T3 test scores
LDP	Learner driver permit
OECD	Organization for Economic Cooperation and Development,
PCR	Perceived controllability of risk scale
PD	Pre-driver
PDE	Pre-driver education
PDLC	Pre-driver licencing course
PIP	Post-intervention phase – period inclusive of the T2 and the T3 tests
PLD	Pre-learner driver
PLDE	Pre-learner driver education
PRAD	Perceived risk for adolescent drivers scale
PWM	Prototype willingness model
ROI	Republic of Ireland
ROTR	Rules of the Road
RSA	Road Safety Authority (Ireland)
RTC	Road traffic crash
SARTRE	Social Attitudes to Road Traffic Risk in Europe
SES	Socio-economic status
SPC	Safe Performance Curriculum
SS	Sensation seeking
SWOV	Dutch Institute for Road Safety Research
TCI	Task capability interface model
TPB	Theory of planned behaviour
TT	Theory test (for learner drivers)
TY	Transition Year
UNRSC	United Nations Road Safety Collaboration
WHO	World Health Organization
WTRT	Willingness to take risks in traffic scale

² Note: Statistical abbreviations are not included

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Chapter 1: Driver behaviour and driver education

Learning to drive is an important milestone for adolescents primarily because obtaining a driver's licence constitutes an important rite of passage into adulthood, since it facilitates increased mobility and independence (Christmas, 2008). As the traffic environment is inherently risky, the vast majority of learner drivers undertake some form of driver education and training to provide them with some level (Sagberg, Fosser, & Saetermo, 1997) of driving competency before they take to the roads (Engstrom, Gregersen, Hernetkoski, & Nyberg, 2003; Ivers et al., 2006; Shope, 2006; Williams, 2006). Although traditional forms of *driver education* (DE) and *driver training* (DT) generally succeeded in equipping learners with sufficient knowledge and psychomotor skills to allow them to become mobile, they have been less successful transmitting safe driving habits (Elander, West, & French, 1993). This constitutes a considerable problem for newly fledged drivers, who face considerable challenges when it comes to the balancing their desire for mobility with the requirement for safety, (Mayhew, 2007).

The sub-discipline of human factors psychology aims to address such problems using psychological principles as guidelines for designing and creating systems that enhance performance, increase safety and support user well being. Human factors describe physical, cognitive or behavioural properties of an individual which impacts on the systems in which they commonly operate and vice versa (Wickens, Lee, Liu, & Gordon Becker, 2004). In recent years, the development and refinement of theories which attempt to explain, predict and control risk-taking in drivers exemplifies the application of human factors principles to improving road safety. These efforts have focussed mainly on two somewhat complimentary concepts; behavioural adaptation and risk compensation (Vaa, 2007). On the one hand, behavioural adaptation describes a tendency to consciously adjust

their behaviour to meet situational contingencies, e.g. to drive faster when they are in a hurry (McKenna, 2005). On the other hand, risk compensation theory posits that behavioural adjustments can also occur as a result of unconscious decision making (Wilde, 1988). Evidence supporting this latter theory shows, for example, that drivers using cars with anti-lock brakes drive faster and operate with less headway than those using cars with standard braking systems (Sagberg et al., 1997). In combination, both of these theoretical perspectives have made a substantial contribution towards explaining driver behaviour.

1.1 Road traffic crashes

Driving has always entailed increased exposure to risk. According to Fallon and O'Neill (2005) it is likely that the first fatal car crash occurred here in Ireland in 1896, shortly after the development of the internal combustion engine and the subsequent proliferation of motorised transport. Since then, the numbers of traffic-related deaths and injuries has risen to such proportions that the World Health Organization (WHO, 2003) conceptualized road traffic crashes (RTCs) as a “hidden epidemic” because they constitute a growing, but generally overlooked threat to human health and well-being.

1.1.1 The human cost of RTCs

Following a review of the international RTC data, the United Nations Road Safety Collaboration (UNRSC) (2011) reported that the global death toll resulting from RTCs had reached almost 1.3 million people annually by 2010, which equates to approximately 3,500 deaths every day. They also estimated that approximately 50 million people suffer non-fatal injuries in crashes annually and noted that these injuries frequently result in disability. Furthermore, they predicted that the global death toll would rise to 2.4 million per year before 2020 unless improvements are made to the traffic system.

The UNRSC report (2011) also demonstrated that crash involvement represents a particular risk for younger people: It is among the top three causes of death for 15 –

44-year-olds and is the leading cause of death for 15 - 29-year-olds. This general trend is also reflected within the driver population, where young novices tend to be more crash-involved than are drivers in other age categories (Drummond, 1989; Elvik, Høye, Vaa, & Sørensen, 2009; L. Evans, 1991; Gregersen, Nyberg, & Berg, 2003; Mayhew, Simpson, & Pak, 2003; OECD - ECMT, 2006b; Sagberg, 1998).

Similar patterns of crash-related deaths and injuries are evident in the Irish crash statistics. The latest available full set of figures shows that there were 26,495 Garda³-reported collisions in 2009, in which 238 people were killed, 9,742 were injured, 604 of whom were seriously injured (RSA, 2010a). Alarming, however, there is evidence to suggest that the statistics for injuries following RTCs are underestimated in many countries, including Ireland. For instance, a recent analysis of trends in acute hospital patient care in Ireland between 2005 and 2009 showed that the number of people who were admitted to hospital with serious injuries following RTCs was 3.5 times greater than the number of serious injuries reported by the Gardaí (Sheridan, Howell, McKeown, & Bedford, 2011). Although 15- to 24-year-olds constitute 16.5% of the Irish population, and not all of them drive, motorists in this age group were involved in 37% of crashes in 2009. Thirty percent of those killed were males, whereas just 6% of those killed were young females. Thus, young male drivers were five times more likely to be killed than young female drivers. Age and gender differences in injury crashes were less acute: differences in driver injury rates between males and females was quite small (males 53% and females 47%) and young drivers, aged between 15 -24-years were involved in 25% of the total number of injury crashes and young males constituted 16% of the total whereas young females made up just 10%. However, young female drivers were involved in more property-damage only crashes (15.5%) than young male drivers (12%) (RSA, 2010a).

1.1.2 Financial and social costs of RTCs

³ The official name for the Irish police force is An Garda Síochána and members of the force are called Gardaí.

Crashes represent a considerable economic and social burden on society (OECD - ECMT, 2006b). In 2002 the Irish government commissioned Goodbody Consultants to estimate the financial cost of RTCs. Their report showed that the average cost for each fatality was just over €2.3 million and the costs for serious injury, minor injury and property damage only crashes were estimated at €304,600, €30,000, and €2,400, respectively (Bacon, 2005). After adjusting for inflation, the overall estimated cost of road traffic crashes in 2009 was €973.5 million; which includes €562.4 million for fatalities, €158 million for serious crashes, €200 million for minor injury crashes and €53.5 million for material damage crashes (RSA, 2010a). This represented 0.7% of Gross Domestic Product in Ireland in 2009. Moreover, the social costs of premature death and injury on the road and the resulting devastation of the lives of victims and their relatives are impossible to quantify. Furthermore, a considerable amount of resources are employed dealing with the aftermath of crashes, which might otherwise be used to support health and well-being in the community (OECD - ECMT, 2006b).

1.1.3 Causes of RTCs

In light of these considerations, much effort has been expended in investigating the causes of RTCs and in attempting to devise appropriate remedies (Wickens et al., 2004). Early studies (e.g. Haddon, 1968) identified three factors that contribute to crashes; human (e.g. behavioural errors and violations), roadway/environmental (e.g. road conditions) and vehicle factors (e.g. bald tyres). Subsequent research conducted in both the USA and the UK calculated the relative contribution of these factors across a large number of crashes. The findings suggested that human factors were implicated in 94% - 95% of all crashes (Sabey & Staughton, 1975; Treat, Tumbas, McDonald, & Hume, 1980). Since driver behaviour was identified as a causal factor in 92% of fatal crashes in Ireland in 2009 (RSA, 2010a), it seems that human behaviour is also the primary cause of traffic crashes in

this jurisdiction. These findings suggest that efforts to reduce RTCs should focus predominantly on tackling the human contribution to this problem.

1.1.3.1 Driving errors and violations

Human error is defined as “inappropriate human behaviour that lowers levels of system effectiveness or safety” (Wickens et al., 2004, p. 366). Reason (1990) devised and empirically tested taxonomy of errors which distinguished between two principal categories of error; errors of omission which are caused by unintentional failures in planned action, and errors of commission, which describe deliberate violations of driving rules and regulations. Based on these findings, Reason and his colleagues developed the Manchester Driver Behaviour Questionnaire (DBQ) (Reason, Manstead, Stradling, Baxter, & Campbell, 1990) in an attempt to measure self-reported errors and violations. These researches believed that driving errors represent performance limitations (e.g. attentional, perceptual and information processing skills), whereas violations reflect driving style, which is largely dictated by motivations and also habits established during a driving career (de Winter & Dodou, 2010). Following an independent review of the behavioural correlates of variations in crash risk, Elander, West and French (1993) concluded that both driving skill (what the driver ‘can’ do) and driving style (what the driver ‘does’ do) are crucial in determining driver safety.

The DBQ has been used extensively to predict RTCs. In a recent meta-analytic review of 173 DBQ studies, de Winter and Dodou (2010) reported that there was an medium sized correlation ($r = .4$) between DBQ scores and self-reported crashes, after correcting for measurement error. They also showed that errors and violations were equally strong predictors of crashes, reporting correlations of .07 and .06 for each factor respectively. This contradicts previous findings that suggested that only errors (deLucia, Bleckley, Meyer, & Bush, 2003) or only violations (see Stradling, Parker, Lajunen,

Meadows, & Xie, 1998) predicted crashes. Gender differences in the propensity to commit errors and violations were also identified in many of the studies. Males were less susceptible to errors and more prone to violations than females (de Winter & Dodou, 2010; Wells, Tong, Sexton, Grayson, & Jones, 2008). In general, the incidence of both errors and violations decreases with age, although, interestingly, data from studies with younger samples (e.g. Wells et al., 2008) suggests that the commission of violations actually increases with age in the shorter term. However, it is assumed that this result represents the confounding effects of increasing experience rather than age *per se*. This can be explained in terms of theories of behavioural adaptation and compensation, which were outlined earlier, which suggest that drivers alter their behaviour to satisfy personal motivation and situational demands (Vaa, 2007; Wilde, 1988). Another line of enquiry examined the effects of antecedent errors and violations on the types of crashes that young novice drivers suffer. For example, in a study that analysed over 2,000 crashes involving 16—19-year-old American drivers, McKnight and McKnight (2003) found that the vast majority of non-fatal crashes were due to errors of omission, (i.e. failure to operate safe routine and failure to recognise the danger in this practice), rather than the result of deliberate risk taking. Evidence also suggests that the fatal crashes of young drivers have a distinct aetiology. Gonzales, Dickinson, DiGuseppi and Lowenstein (2005) examined fatal crash records for young novice drivers in Colorado, using the U.S. Government's Fatal Analysis Reporting System database (FARS) and found that these were characterized by speeding, recklessness, single-vehicle and rollover crashes, which were mainly attributable to deliberate violations of traffic laws.

In sum, human behaviour in the form of driving errors (i.e. skill deficits) and/or violations (i.e. aberrant driving styles) are responsible for a large proportion of RTCs. Among the novice driver population, the propensity to commit errors tends to increase in the early stages of driving as a function of increasing experience and this leads to increases

in non-fatal collisions in the short-term. Fatal collisions are more strongly associated with violations of traffic regulations, which are more indicative of aberrant driving habits (style).

1.1.4 The young novice driver problem

Empirical evidence suggests that three key factors, age, inexperience and gender, contribute to the commission of errors and violations and therefore to the excessive crash risk evidenced amongst younger drivers (OECD - ECMT, 2006b). The overrepresentation of young, novice and male drivers in Irish crash statistics reflects a global phenomenon which has been described as “so robust and repeatable that it is almost like a law of nature” (L. Evans, 1991, p. 41).

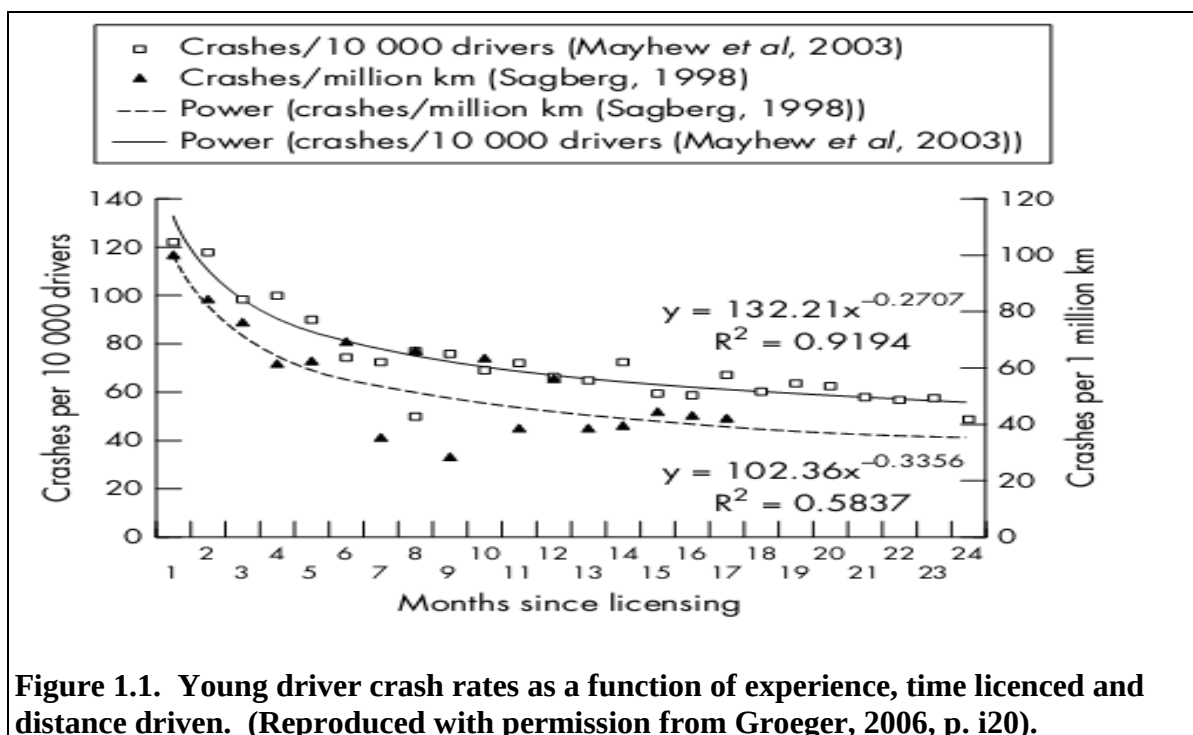
Since most individuals begin driving when they are young, it is inherently difficult to assess the absolute effects of either age or inexperience on driver behaviour. Several studies addressed this problem by estimating the relative risk of crashing for drivers in different age groups, while simultaneously controlling for driving experience. For example, using the FARS database, Evans (1991) calculated that the crash rate among American 16-year-olds was almost three times that of 18-year-olds. Also, in a study that compared the self-reported crash and violation rates of 28,500 Finnish novices from three age groups, 18-20-year-olds, 21-30-year-olds and 31-50-year-olds, Laapotti, Keskinen, Hatakka and Katila (2001) found higher incidences of crashes and offences among the younger novices, especially males. They also showed that the types of driving incidents reported by young males related more to risky driving rather than poor vehicle control skills whereas the opposite was true of young females. Vlakveld (2005; as cited in Wegman & Aarts, 2006) also isolated the effects of age and experience by analysing the crash records of Dutch drivers who were licenced at either 18-21, 23-27, or 30-40 years of age and found that for those who started driving at 18, approximately 40% of the reduction

in crash risk over time was attributable to increasing age, whereas the remaining 60% was associated with increasing experience with driving.

Evidence from a wide range of studies supports the view that inexperience is the primary cause of the young novice driver problem (OECD - ECMT, 2006b). Learning to drive takes time, because driving is a complex task which involves the coordination of a range of skills including psychomotor skills which coordinate a wide range of basic tasks (e.g. steering, braking) and also higher order cognitive skills (e.g. risk and hazard perception, problem solving), which underlie safe performance (Hatakka, Keskinen, Gregersen, Glad, & Hernetkoski, 2002; Mayhew, Simpson, & Robinson, 2002). Thus, it takes a considerable amount of effortful practice to achieve competency (Dreyfus & Dreyfus, 1986; Elvik et al., 2009). Research conducted in the U.S. by Edwards (2001) showed that just 10% of novice crashes were caused by poor vehicle control skills, whereas 90% of collisions were attributable to deficits in driving-related cognitive functioning, such as inaccurate risk perception, overestimation of driving skills and deliberate risk taking, which are largely contingent on inexperience and/or immaturity (see Arnett, Offer, & Fine, 1997; Drummond, 1989; L. Evans, 1991; McKnight & McKnight, 2003).

The results from longitudinal studies of learner and novice driver performance highlights the effects of experience and show that there is a dramatic decrease in crash involvement among young drivers in the 6-8 months immediately after they pass the driving test (Mayhew et al., 2003; Sagberg, 1998; Wells et al., 2008). For instance, Mayhew et al. (2003) found that the crash rate among 16-19-year-olds dropped by 42% in their first 7 months of independent driving. This rapid fall in crash rates soon after licencing suggests that the young driver problem is more related to inexperience than it is to age. This evidence also supports the view that driving skills develop as a power function of driving experience, i.e. improvement is rapid at first but decreases as the learner becomes more

skilled (Groeger & Brady, 2004). Using data from studies conducted in the Europe and the U.S., Groeger (2006) also demonstrated that this so-called “Power Law of Practice” applies to the decrease in crash involvement for novice drivers regardless of whether the predictor was the number of months from licensure or the overall distance travelled (see Figure 1.1). Moreover, a meta-analytic study of novice’s RTCs demonstrated that the general levelling off of risk takes a long time to complete, requiring between 5-7 years of experience before reaching mature rates (Elvik et al., 2009).



In response to such findings, McKnight (1996) suggested that the main challenge facing the driver safety community is to find ways of providing learner drivers with experiences that will produce the same benefits as actual driving, without exposing them to the same risks. To date, efforts to meet this challenge through the provision of driver education and training have received mixed reviews (Christie, 2001; Mayhew et al., 2002; Roberts & Kwan, 2001) and this issue will be discussed in more detail below.

Gender differences in crash risk are evident across the entire driving population: Males have more crashes than females and their crashes tend to be more severe (OECD -

ECMT, 2006b). Furthermore, this pattern emerges soon after licensure (Engstrom et al., 2003; Kweon & Knockelman, 2003; Wells et al., 2008). Research also indicates that the gap between young males and young females is widening over time. Twisk and Stacey (2007) reported the results of a study that compared relative risk of crashing for younger drivers against that for older drivers in the Netherlands, Sweden and Great Britain in 1994 and 2001. The results showed that whereas in 1994 young males were between 3.5 and 5 times more likely to crash than older males, by 2001, the relative risk for younger drivers ranged between 6 and 7.5 times greater than their older counterparts. In the same period, young females were only twice as likely to crash as older drivers and this ratio of risk remained stable across time. Twisk and Stacey believe that these findings indicate that young female drivers tend to profit more from current improvements in road safety to a greater extent than young men, which suggests that a lot more research needs to be done into the causes of high-risk driving in young males in order to redress this balance.

In summary, the young novice driver problem arises because this group face excessive levels of risk on the road which is mainly attributable to a combination of age and inexperience, which is further exacerbated when the driver is male (OECD - ECMT, 2006b). Inexperience poses a greater risk than age and although it takes 5-7 years to gain enough experience to achieve risk equalisation with more mature drivers, the most acute risk phase occurs within the first few months of driving (Groeger, 2006). Because of this, it is easier to mitigate the risk posed by inexperience than that associated with age-related factors (Shope, 2006). There is a marked difference in the pattern of crashes for young males compared to that for young females (Wells et al., 2008). Males have more crashes than females and their collisions are more likely to be a result of their driving style (violations), whereas females' crashes appear to be caused primarily by skill-based deficits (errors) (de Winter & Dodou, 2010). Alarming, the comparative risk for young males in relation to their female counterparts and also older males seems to have increased in recent

years, which suggests that countermeasures, including driver education and training, may be less effective in mitigating risk for young males (Twisk & Stacey, 2007).

1.2 Driver education and training

Driving is a complex task and learning to drive involves the acquisition and subsequent coordination of a range of skills, rules and knowledge that help learners to stay safe in traffic (Dreyfus & Dreyfus, 1986; Rasmussen, 1983). Formal DE and DT have good face validity; they are popular among learners and their parents (Fuller & Bonney, 2004), and also with the authorities, and other stakeholders (C. Johnson, Hardman, & Luther, 2009; Lonero et al., 1995) in all countries where this type of instruction is available (Wegman & Aarts, 2006). This is mainly because they are believed to be effective in providing aspiring drivers with basic car control skills and knowledge of the rules of the road which are prerequisites to obtaining a licence (Christie, 2001). However, empirical evidence suggests that traditional forms of DE and DT have been ineffective generally when it comes to reducing post-licence crashes (Christie, 2001; McKenna, 2010a; Roberts & Kwan, 2001). For instance, comparisons between the post-licence crash records of professionally and informally trained (i.e. instructed by parents and/or friends) novice drivers indicate that there is no statistical differences in crash outcomes between these groups (Groeger & Brady, 2004; Lynham & Twisk, 1995; Wells et al., 2008).

1.2.1 Defining driver education, driver training, pre-drivers and pre-learner drivers

Before reviewing the evidence in the DE debate it is worth making a distinction between DE, and DT, since these terms are regarded as synonymous in some sections of the literature (Christie, 2001). In North America for example, DE typically describes programs for new drivers that consist of both classroom learning and practical in-car training (Lonero, 2008). The conflation of these terms is not particularly helpful for two reasons: First, it makes it difficult to differentiate between programmes that provide

education or training alone in order to isolate the absolute effects of these somewhat distinct processes. Second, the overall conclusions reached in some systematic reviews concerning the efficacy of DE programmes are not as reliable (or informative) as they might be because they are often based on the results from a range of studies that are not equivalent because of variations in the relative amounts of education and training in the curricula of the programmes under investigation. For example, a review published by the world-renowned Cochrane Collaboration (i.e. Roberts & Kwan, 2001) included the results from studies where the ratios of practical to classroom instruction ranged between 32 hours of education and 39 hours of training in the case of the Safe Performance Curriculum condition in the DeKalb county education project (Stock, Weaver, Ray, Brink, & Safoff, 1983) and 15 hours of education and 8 hours of training for Wynne-Jones and Hurst's (1984) study of high school driver education in New Zealand.

Outside of North America, the situation with respect to DT and DE is clearer. There, researchers commonly distinguish between these two processes, thereby providing practical options for those who want to examine these processes individually. In this literature, the term *training* is used to describe the transmission of practical skills and competencies, such as accelerating, changing gears, and braking, that are needed to control and operate a vehicle (Christie, 2001; Woolley, 2000), and *education* is used to refer to class-room based instruction which focuses on the broader intellectual/cognitive aspects of learning to drive, i.e. knowledge (e.g. the rules of the road), attitudes (e.g., over-confidence) and behaviours (e.g., risk-taking) (Christie, 2001). In the interest of clarity, these latter definitions were adopted in the current research.

Similar problems beset the nomenclature used for the recipients of DE. The term *pre-driver (PD)* is used widely to describe individuals of any age who have not yet learned to drive (Deighton & Luther, 2007). However, school-based pre-driver education is an intervention strategy that is aimed at secondary school students between 15 – 16-years-old

who are still too young to obtain a learner driver permit, and thus avail of driver training (Siegrist, 1999). Therefore, this group constitute a special class of pre-drivers, and as such need their own designation. The present study used the term *pre-learner driver (PLD)*, (after Senserrick, 2007) to describe its participants, the overwhelming majority of whom were 16-years old or younger when the study commenced. In addition, the term *pre-learner driver education (PLDE)* was adopted to describe educational interventions that have been designed for these students.

1.2.2 The DeKalb county driver education project

Pre-driver education/training programmes were developed initially in the late 1940s. In 1949, the U.S. National Education Association's national Commission on Safety Education recommended a standard for driver education and training based on 30 hours of classroom training and 6 hours of behind-the-wheel training. This represented a compromise between the time needed to teach driver education and the time feasible (and funded) for teaching driving skills during school hours (J. Nicholson, 2003). Although many evaluations of school-based pre-driver education (PDE) programmes have been reported in the literature, the DeKalb County Education Project (Stock et al., 1983) is a particularly interesting example of this genre, because it is acknowledged as the most comprehensive and methodologically rigorous experiment in school-based PDE ever undertaken (Lonero et al., 1995). Thus, it has featured in a number of high-profile reviews of PDE (e.g. Christie, 2001; Deighton & Luther, 2007; Drummond, 1989; Lonero & Mayhew, 2010; Mayhew et al., 2002; Roberts & Kwan, 2001; Vernick et al., 1999). The project was conducted in the U.S. state of Georgia in the late 1970s and involved over 16,000 students, who were randomly assigned to one of three experimental groups; two treatment groups and a control group.

The first treatment group received 72 hours of instruction based on the newly developed Safe Performance Curriculum (SPC), which involved 32 hours of classroom

education, 16 hours in a driving simulator, 16 hours on a driving range, three hours instruction in evasive manoeuvring and five hours on-road training. The second treatment group took a pre-driver licencing course (PDLC), which was considered as a minimal preparation for passing the driving test. This entailed 20 hours of basic driver training, including classroom instruction, driving range and simulation instruction as well as practice driving with parents. The control group were given no formal instruction in school, rather it was expected that they would be taught to drive by their parents and/or by commercial driving schools. No restrictions were placed on either the type or the amount of instruction that they could receive (Mayhew & Simpson, 1996).

The students were monitored over the following six years where their uptake of training and driver licencing was recorded and their crash and violation records were monitored. Early results from this study showed that contrary to expectations, the SPC group were involved in more accidents than were those in the PDLC and the control groups. This outcome was mainly attributed to the fact that students in the SPC group obtained driving licences earlier than did those in the other groups, which increased their exposure to risk (Stock et al., 1983). Subsequent analyses, that attempted to control for differential rates of licencing in the groups by including data from only those students who had obtained a driving licence, reported that the mean number of collisions was lower in the SPC group than it was in both the PDLC and control group in the first six months of licenced driving, albeit that this difference was not statistically significant (Stock et al., 1983). Nevertheless, because the difference in scores between the SPC group and the controls approached significance ($p = 0.076$) Stock and his colleagues suggested that this indicted that the SPC programme was effective (Stock et al., 1983), although no effect size was reported. However, these beneficial effects were no longer evident during follow-up studies using data collected 12, 18 and 24 months after the programmes ended. The results from a further test, conducted 6 years after the programmes ended, also showed that there

were no significant reductions in crashes for the SPC group compared to the controls.

Surprisingly, however, this study revealed a small, but significant reduction in crashes for students in the PDLC group compared to the controls (Smith & Blatt, 1987). Altogether, these outcomes, even the positive ones, fell way below expectations and the apparent superiority of the PDLC remains perplexing (Mayhew & Simpson, 1996).

Aside from prompting a major theoretical debate about the value of DE (which is discussed in detail below) the various analyses of the DeKalb data served to highlight some of the methodological problems that can arise, even in well designed and properly executed studies. Although randomized control designs are widely regarded as the ‘gold standard’ in scientific research (Donaldson, 2009), it can be difficult to establish and maintain experimental control. In the DeKalb study for instance, although students were randomly assigned to the various experimental conditions and stringent efforts were made using stratified sampling, to balance these groups in terms of group numbers and student demographics (gender, socio-economic status etc.), inevitably there was differential attrition in the three groups. Some of the students assigned to the active groups never actually attended their assigned course and/or did not start driving within the time frame covered by the various studies. Furthermore, the reliability of the results from the second analysis (Stock et al., 1983), which showed some positive effects of PDE, was challenged on the grounds of potential self-selection bias, since it featured the records of just those students who completed their allotted courses and actually started driving. Finally and perhaps most importantly, there was a problem with maintaining the status quo among participants in the control group, which is a well-documented difficulty in applied research (Lonero & Mayhew, 2010). In laboratory studies it is relatively easy to ensure that the members of a control group all participate under the exact same conditions. However this type of standardisation is impossible to achieve when conducting community-based research, due to the ongoing influence of a myriad of differential factors on individuals in

their daily lives (Shaughnessy, Zechmeister, & Zechmeister, 2009). The DeKalb researchers tried to ameliorate this problem by assuming that rather than not learning how to drive at all, the participants in the control group would learn in the community using formal and informal education and training. This situation undoubtedly made it more difficult for the researchers to identify the absolute effects of school-based education and training, because rather than being compared with individuals who received no education or training at all, students in the PDE groups were being compared with individuals who almost certainly did receive some driver education and/or training, the exact form and composition of which was not quantified in any systematic way during the study.

1.2.3 The driver education debate

The results from the DeKalb study initiated widespread debate over the safety value of school-based DE, which not alone polarized opinion, but also led to the near-extinction of large scale DE projects (Williams, Preusser, & Ledingham, 2009). The sceptics in this debate, including the majority of the research community, concluded that DE doesn't work, because the empirical evidence indicated that it was not effective in reducing RTCs. In opposition, many practitioners, managers, and more recently, a growing number of researchers (e.g. Clinton and Lonero (2006c); McKenna (2010a)) argued that just because individual PDE programmes failed to reduce crash involvement in their graduates, this does not mean that training and education *per se* are incapable of producing lasting safety benefits.

Sceptical opinion was predominantly formulated on the basis of the results from systematic reviews of empirical evaluations that had been conducted over the past twenty years in relation to individual DE and DT programmes that had been designed for pre-drivers, learners and novices (e.g. Christie, 2001; Deighton & Luther, 2007; Drummond, 1989; Lonero & Mayhew, 2010; Mayhew et al., 2002; Roberts & Kwan, 2001; Vernick et al., 1999). These reviewers were generally disparaging of DE, because many of the studies

featured reported minimal and inconsistent safety-related improvements in course participants. Following their review of 9 studies of school-based PDE programmes that included two randomised controlled trials, two re-analyses of the DeKalb randomised controlled study and five ecological studies (i.e. investigations of recorded changes in crash outcomes following legislative changes to the rules for driving), Vernick et al., (1999) concluded that there was no convincing evidence to suggest that students who completed these courses had fewer car crashes or driving violations than those who did not take such a course. For instance, they showed that the proportion of high school students who take PDE courses in individual states in the U.S. was unrelated to the fatal crash involvement of 16 – 18-years-old adolescent drivers. The potential drawbacks of PDE were also noted in the conclusion of a review conducted for the Cochrane Collaboration by Roberts and Kwan (2001), which suggested that driver education may lead to a small but significant increase in teenage crash involvement due to early licensure. It has also been suggested that mere participation in such courses may induce unrealistic beliefs and expectations regarding the subsequent capabilities of PDE graduates in the students themselves (Wilde, 1994) and in their parents (Waller, 1983). This accumulation of negative appraisals of school-based PLE by well-respected researchers led seasoned analysts (e.g. Christie, 2001), to question the wisdom of spending time and money on interventions that don't work, rather than using those resources to support measures that do work, e.g. the enactment of stricter legislation and stricter enforcement of existing legislation.

Although supporters of DE (e.g. Clinton & Lonero, 2006c; McKenna, 2010a, 2010b) admit that these types of interventions have a poor track record with respect to crash reduction, they believe that it is wrong to conclude that DE does not work on the basis of this sole criterion. Instead, they propose that such conclusions are intemperate because they are based on an oversimplified conceptualisation of the driving task, of the

role and functions of the educational process, and of human nature in general. These observations serve to highlight a fundamental flaw in the rationale (i.e. the logic model) that underpins a wide range of social programming interventions which aim to prevent or ameliorate societal problems, i.e. the joint assumptions that (a) specific educational programmes encompass elements (content and processes) that are both necessary and sufficient to impart optimal levels of knowledge and skills and instil well-adjusted attitudes in all students and (b) that there is a relatively lawful, simple and direct relationship between educational inputs and long-term behavioural outputs (Donaldson, 2003).

However, the complexity of the relationship between knowledge, skills, attitudes and actual behaviour is well-documented in the psychological literature (Deighton & Luther, 2007; Durkin & Tolmie, 2010), most notably in areas of direct learning (Leslie & O'Reilly, 2003; Skinner, 1974), social learning (Bandura, 1977), the acquisition and maintenance of skills (Anderson, 1982; Ericsson, Krampe, & Tesch-Romer, 1993) and also attitudes (Ajzen, 1991) and attitude change (Prochaska & DiClemente, 1992). This means that it is harder to achieve lasting desirable and beneficial changes in driver behaviour than is generally anticipated (Lonero et al., 1995; Lonero & Mayhew, 2010). For instance, the apparent failure of DE programmes to reduce crashes has been attributed to the fact that young drivers may be either unable or unwilling to make appropriate decisions using the skills and the knowledge that they have acquired as a result of having taken these courses (Vernick et al., 1999). The true scale of this problem was summarised by Williams, Preusser and Ledingham (2009), as follows: First, PDE courses are too short and most of the time is spent teaching basic vehicle handling skill, leaving little time for teaching safety skills. Second, it is likely that the motivation to obtain a licence as soon as possible outweighs any safety concerns that PDE students may have. Finally, they noted the difficulties associated with influencing lifestyle and development factors, which represents a considerable barrier to driver education effectiveness. In this regard, research

shows that there is a positive correlation between the driving behaviours of parents and their adolescent and young adult offspring (Ferguson, Williams, Chapline, Reinfurt, & De Leonardis, 2001; Miller & Taubman - Ben-Ari, 2010). Studies also show that adolescents drive faster and take more risks when they are accompanied by peers (Arnett et al., 1997), especially males (Baxter, Manstead, Stradling, & Campbell, 1990). There is also a well-documented association between certain personality traits, such as sensation seeking (Arnett et al., 1997) and impulsiveness (Stanford, Greve, Boudreaux, Mathias, & Brumelow, 1996), and risk-taking, including risky driving. Thus, the impact of PDE can be easily superseded by such strong and persistent influences.

Discouraging as this might seem, Williams et al's analysis (2009) nevertheless identified important themes and issues that need to be addressed if DE is to play a useful role in tackling the young driver problem. Specifically, it (a) questioned the feasibility of requiring that DE programmes produce demonstrable safety outcomes in terms of a reduction in crash involvement, (b) highlighted imbalances in existing curricula that seem to favour the practical aspects of DE over safety aspects, (c) recognized the importance of motivational factors and (d) emphasised the role that antecedent lifestyle and developmental factors play in moderating the effectiveness of educational interventions. Given their relevance to the present research, these issues will now be examined in more detail.

There has been considerable debate about what should be considered as legitimate expectations and goals for PDE (Lonero & Mayhew, 2010). The requirement to produce sustainable and measurable long-term safety benefits is seen as unreasonable for a variety of reasons. For example, driving involves the balancing to two somewhat conflicting goals: the desire for mobility and the need for safety (Wickens, 1992). As a method, school-based education is geared towards achieving results in relation to well-defined topic areas that are measured over the short-term by means of continuous assessment and exams.

Thus, school-based driver training/education is well placed to cater for students' short-term mobility (instrumental) needs by focussing mainly on the 'control' aspects of driving i.e. transmitting the skills and knowledge required to pass the driving test and start a life of independent driving (Lonero et al., 1995). However, Waller believes that it is unreasonable to hold PDE responsible for the long-term safety performance of students, since that would be akin to "...holding home economics teachers responsible for whether the students prepare well-balanced meals two years later (1975, p. 2)." Taking a behaviourist perspective, Fuller (1992) noted that since the traffic system is very forgiving of errors and violations, it can inadvertently "shape" undesirable practices by intermittently but regularly reinforcing them and rarely, if ever, punishing them. Thus, even though PDE may be able to provide students with the relevant knowledge, skills and attitudes which serve as a solid foundation for safe driving, subsequent experience gained while driving tends to erode this foundation. Thus, there is clearly a need to supplement basic PDE with other forms of extended learning opportunities, such as graduated driving licencing (GDL)⁴.

Although it seems that DE is not very effective in increasing road safety by reducing the number of RTCs, McKenna (2010a) suggests that educational interventions, including DE, may actually work to increase safety in a more subtle and indirect way e.g. by promoting the 'perceived legitimacy' of actions. Countering Christie's (2001) suggestion that DE interventions should be scaled-back in order to divert existing resources into alternative road safety measures such as enforcement and engineering, McKenna argued that it is unlikely that there would be much political or public support for such measures in the absence of the type of psychological priming that educational measures currently provide. This position assumes that the value of education lies in its (supposed)

⁴ The issue of graduated driving licences is beyond the scope of this thesis. For a comprehensive review of GDL see (Williams & Shults, 2010).

ability to induce changes in attitudes at a cultural level that “facilitate, enable, or are necessary for those interventions that *do* work” (McKenna, 2010a, p. 14).

Support for this hypothesis is provided by an evidential shift in attitudes regarding driving while intoxicated (DWI) in Ireland following a series of national media campaigns that highlighted this problem. This research, which was conducted as part of the EU’s Social Attitudes to Road Traffic Risk in Europe (SARTRE) project, estimated the effectiveness of the campaigns by comparing the results from the pre-campaign study (SARTRE 2) (Fuller & Gormley, 1998) with those recorded in the SARTRE 3 study (Gormley & Fuller, 2005), which was conducted when the campaigns had been running for over 6 years. The results suggested that some progress was made in improving drivers’ attitudes with respect to DWI during this period. The number of drivers who believed that the decision about whether or not to drink and drive should not be left up to drivers themselves decreased by 14% and support for a proposal to decrease the current permitted maximum blood/alcohol limit had risen by 20% (Gormley & Fuller, 2005). These changes in attitudes most likely reflect a cultural change that was facilitated by the provision of educational interventions that aimed, among other things to, increasing awareness of the social implications of DWI.

1.2.4 Reinventing driver education

The impetus to develop better programme theories and models is evidenced in the objectives outlined in the AAA Foundation’s “Novice Driver Education Model Curriculum Outline” position paper (Lonero et al., 1995). This suggested that there was an urgent requirement to assess the needs of novice drivers comprehensively, to evaluate methods of instruction and to assess the effectiveness of DE in influencing driver behaviour (Lonero et al., 1995). In Europe, concerted efforts to improve DE culminated in the formulation of the EU’s Goals for Driver Education framework (GDE) (Siegrist, 1999), which provided detailed recommendations regarding the topics that need to be addressed by driver

education, including knowledge and skills related to vehicle handling, to operating in the traffic environment, to trip planning, and to lifestyle planning. The framework also highlights the importance of providing students with insight regarding risk increasing factors and also with metacognitive skills which allow them to assess their driving-related motivations, (e.g. peer pressure) on an ongoing basis (Hatakka et al., 2002).

Both of these approaches were informed by existing theoretical models, such as Michon's Hierarchical Control model (1985), and Fuller's Task-Capability Interface model (2000), which describe the relationship between a range of distal and proximal antecedent factors that hypothetically 'cause' driving behaviour and thus give rise to subsequent consequences in the traffic environment. They each describe the hierarchical ordering of an extensive range of driver characteristics including driving skills, personal values and motivations, self-management skills and driving behaviours which are regarded as 'educable qualities' and thus seen as legitimate targets for PDE (Lonero, 2008). By taking this new and more systematic approach to driver instruction, organizations such as the AAA Foundation and the E. U. Commission for Transport and Road Safety aim to reduce the numbers of RTCs among learner and novice drivers.

1.2.5 Theoretical models of driver behaviour

Two classes of theoretical models of driver behaviour emerged in the literature; basic descriptive models and more complex motivational models. Descriptive models, such as Dreyfus and Dreyfus's (1986) 5-stage hierarchical model of skill acquisition and Michon's Hierarchical Control Model (1985), focus on specifying the driving process itself in terms of what the driver needs to do. Michon's model subdivides the driving task into three hierarchically ordered levels that describe control (e.g. steering, braking), manoeuvring (e.g. giving right of way in traffic) and strategic (e.g. trip and route planning) operations. However, whereas descriptive models provide a solid basis for the systematic examination of driving behaviour, their usefulness is somewhat constrained because they focus solely

on the acquisition and maintenance of driving skill, without taking account of important dynamic interactions between forces that influence driver performance including motivation, capabilities and situational factors (Carsten, 2007). This view is supported by evidence presented earlier, which shows that young novice drivers are at the greatest risk of crashing just after they complete their driving test successfully (Groeger, 2006). Thus, a range of more complex motivational models were developed which attempt to provide a more comprehensive explanation of driver behaviour (Oppenheim et al., 2010). The rationale behind the motivational approach was summarised by Fuller (1984), who noted that because driving is fundamentally a self-paced task, it is the drivers actions that determine the degree of difficulty of the driving task from one moment to the next. Therefore, the driver's motivations are often more important than are their physical and perceptual capabilities in determining the safety of their performance.

1.2.5.1 The task-capability interface model

Fuller's (2005) task-capability interface model (TCI) exemplifies motivational models of driver behaviour (see Figure 1.2).

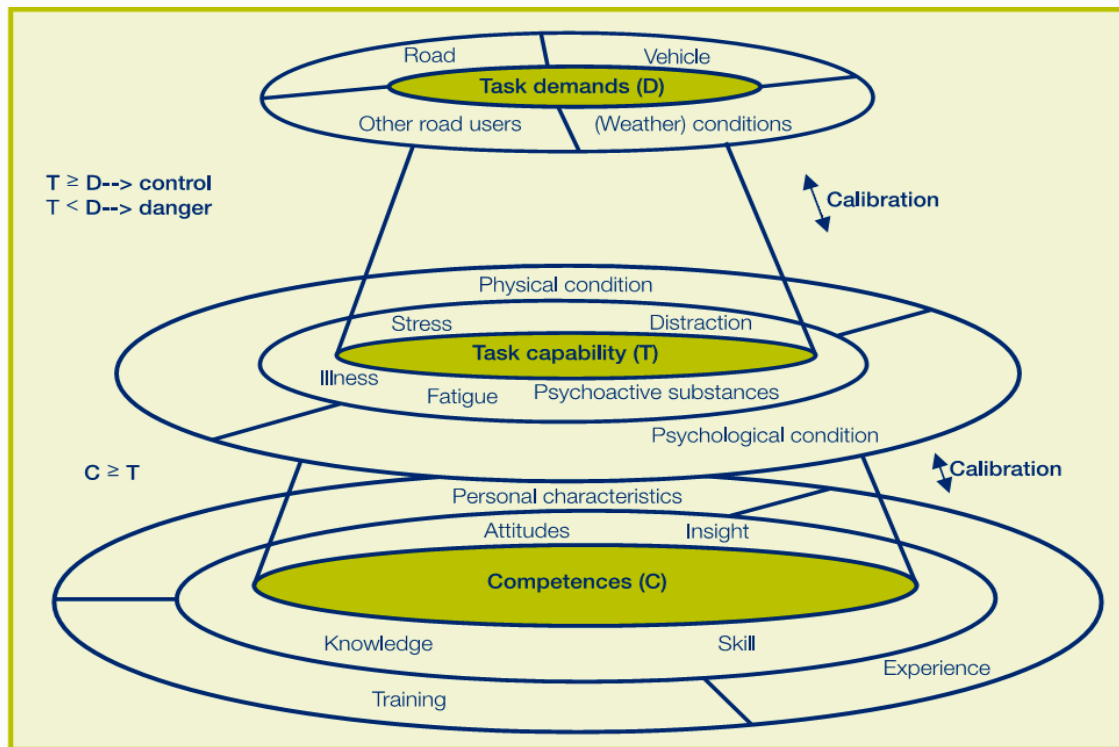


Figure 1.2. Schematic representation of the TCI model.
(Reproduced with permission from Wegman and Aarts, 2006, p. 34).

The model depicts a hierarchically structured relationship between a wide range of factors that (hypothetically) underpin driver decision making. Decision making in turn is driven primarily by a desire to keep the level of task difficulty (workload) within acceptable limits. The model posits that task difficulty represents a subjective judgement that drivers make following an assessment of their task capability (T) and the demands of the driving task (D). Moreover, when task capability is high, and task demands are low, drivers find the task is easy, whereas when capability is low and demands are high, they find the task difficult (Fuller, McHugh, & Pender, 2008). Based on evidence from previous studies that investigated mechanisms such as behavioural adaptation and compensation (e.g. Sagberg et al., 1997; Wilde, 1988), the model assumes that drivers strive continuously to optimise their performance by matching their performance to the demands of the task as part of a process termed *risk homeostasis* (Fuller, 2000). In theory, successful deployment of this

strategy depends on three things: Accurate assessment of capability and of the complexity of the task and then the correct selection of behaviours that permit drivers to balance their capabilities with the demands of the task effectively (de Craen, 2010). In psychological terms, the process of balancing capabilities and task demands is termed *calibration* (Kuiken & Twisk, 2001). The concept of calibration is also particularly interesting in the context of driver-education because evidence suggests that faulty calibration (i.e. inaccurate perception of task capability and/or task difficulties) is the root cause of the young novice driver problem (Arnett, 1996; Deery, 1999; Finn & Bragg, 1986; McKnight & McKnight, 2003). For instance, data from The U.S. National Young-Driver Survey suggests that American adolescents have relatively poor awareness of the effects of inexperience on their safety as drivers (Ginsburg et al., 2008), which suggests that they tend to overestimate their capabilities. Research also shows that young novice drivers tend to drive with smaller safety margins (e.g. headway) (Engstrom et al., 2003) and that they are more prone to engaging in secondary tasks (e.g. using mobile phones) (Sayer, Devonshire, & Flannagan, 2005) than are older, more experienced drivers. Given their inexperience, this suggests that they underestimate the demands of the driving task. Thus, there is general agreement that driver education should focus on providing students with insight into the limitations of their capabilities, and also into the actual complexity of the traffic task, thereby enabling them to assess the difficulty of the driving task with greater accuracy (de Craen, 2010; Hatakka et al., 2002; Lonero et al., 1995).

Fuller's TCI model (2005) posits that both proximal (e.g. driver fatigue) and distal factors (e.g. physical characteristics and personality characteristics) influence task capability. For instance, it suggests that task capability is contingent on a range of competences (C) which represent the sum total of what a driver is capable of doing (see Figure 1.2). Competence, in turn, is influenced by personal characteristics, e.g. biological attributes such as gender, information processing capacity (speed of reactions) and also by

learning opportunities that are afforded as a result of experience and training (trial and error learning, observational learning and the amount and type of driver instruction that an individual has received) (Wegman & Aarts, 2006). The model assumes that these factors moderate the processes that are involved in the acquisition of knowledge and skills, and the development of attitudes and insight, which, subsequently define the upper limits of an individual's competence (Fuller, 2005). Thereafter, the behavioural expression of competence is contingent on drivers' immediate physiological and/or psychological condition (e.g. alertness, motivation etc.). Thus task capability can be seen as an individual's actual capacity to perform the task on a moment-to-moment basis. Driving task demands are influenced by a range of extrinsic and intrinsic factors, including environmental conditions (e.g. road, and weather conditions and the behaviour of other road users) and also by choices that drivers make. These include strategic choices (trip planning), tactical choices (manoeuvring), and operational choices (vehicle control) which were described by Michon (1985).

The TCI model (Fuller, 2005) is useful for explaining a range of phenomena which are not only associated with the young driver problem e.g. their overrepresentation in RTCs as a result of increased vulnerability to risk (Shope, 2006), but which are also of interest from an educational perspective. For instance, the TCI model predicts that personal characteristics, including antecedent dispositional factors, moderate the learning process and thus affect competence. This is supported by evidence from studies of adolescents who have been diagnosed with attention-deficit/hyperactivity disorder (ADHD). This developmental disorder is characterized by deficits in sustained attention, persistence and poor behavioural regulation, which makes it more difficult for suffers to learn at school and also affects their behaviour as drivers (Barkley, 1998). Research shows that ADHD predisposes drivers to greater risk-taking, for instance adolescents with ADHD are four times more likely to have a crash than other teenagers (Barkley, 2004).

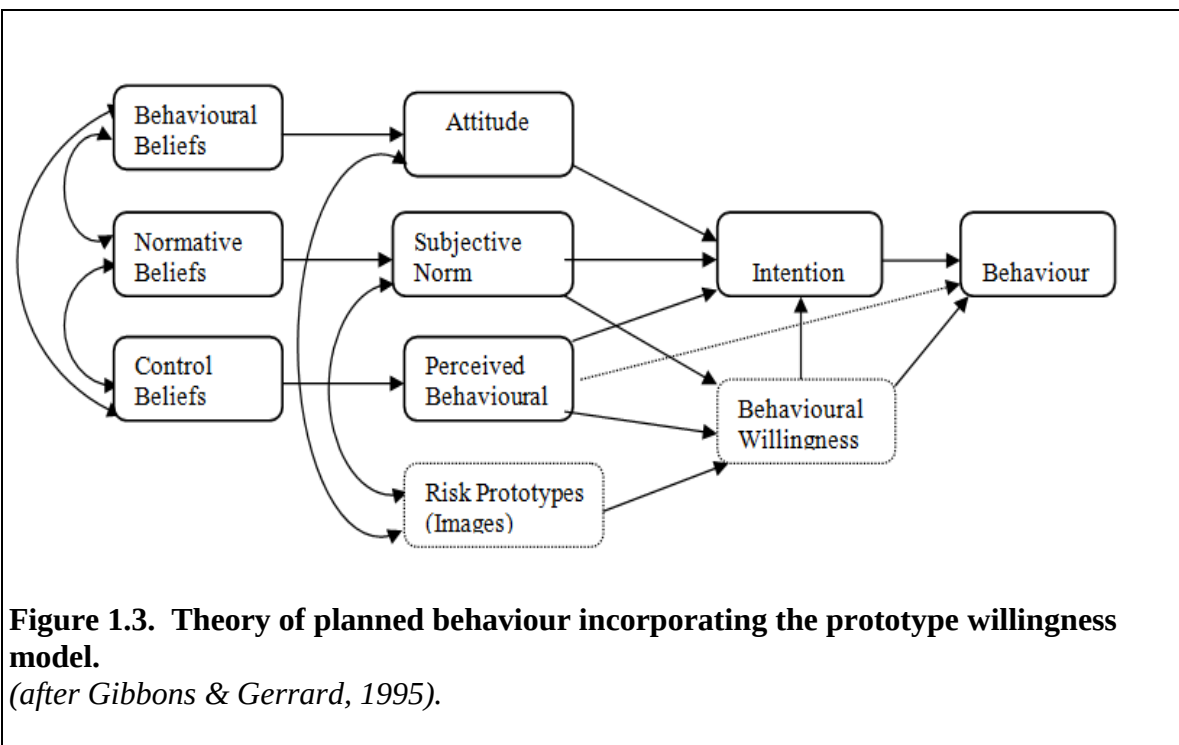
Educationalists also accept that individual differences in personality characteristics (e.g. sensation seeking, impulsiveness, conscientiousness etc.) influences the way that students interact and engage in classroom activities, and thus impact on their academic achievement (Keogh, 2003). The relationship between trait impulsiveness (Barkley, 2004; Stanford et al., 1996), sensation seeking (Arnett et al., 1997) and a number of the Big-five personality traits (W Arthur & Doverspike, 2001) and young novice drivers' risk-taking is also well-documented (Masten, 2004; Shope, 2006). However, to our knowledge, no research has been conducted yet which measures the moderating effects of these individual difference constructs on learning outcomes for students taking driver education courses. A better understanding of the potential effects of such individual differences on the acquisition and maintenance of knowledge, skills, attitudes, and insight would enable programme developers to produce content that catered specifically for individuals with certain personality traits, thereby making it more relevant to potential high-risk drivers (Ulleberg, 2001). The role of personality in driving behaviour and education is discussed in more detail in Chapter 3.

The TCI model (Fuller, 2005) also identifies a range of learning outcomes which might serve as useful intermediate criteria for assessing driving-related competencies in individuals who have not started driving yet, including knowledge, skills, attitudes and insight. Since these measures are not contingent on individuals' crash or violation records or even their driving status i.e. whether or not they actually drive, they represent feasible options for researchers who wish to measure the effects of PLDE courses. The role of knowledge, risk awareness/insight (which, in this study, will be measured in terms of risk perception), and attitudes in driver behaviour is discussed in more detail in Chapters 4, 5, and 6 respectively.

1.2.5.2 The theory of planned behaviour incorporating the prototype willingness model

model

In addition to driving-specific theories, such as Fuller's TCI model (2005), several non-domain specific theories have been used to explain and predict driver decision making and behaviour in traffic and thus are of potential interest to those who have a stake in improving road safety. The best-known of these are Ajzen's theory of planned behaviour (TPB) (1991) and Gibbons and Gerrard's prototype willingness model (PWM) (1995) (see Figure 1.3). The TPB focuses on rational decision making and models the relationship between a range of determinants of human behaviour including behavioural beliefs, normative beliefs, control beliefs and behavioural intentions.



The PWM augments the TPB by accounting for factors that influence heuristic decision making, including social images (prototypes) and behavioural willingness (Rivis, Sheeran, & Armitage, 2006).

The TPB posits that behavioural beliefs represent subjective estimates of the likely consequences of a particular behaviour, which in turn gives rise to an attitude towards that behaviour. An attitude is a dispositional evaluative response, either favourable or unfavourable, towards something or someone (Ajzen, 2005). Normative beliefs describe the normative expectations of others, which give rise to perceptions of social pressure, which is described in terms of a subjective norm. Control beliefs are derived following an evaluation of factors that may make the performance of the behaviour either more or less likely and measurements on this scale describe perceived behavioural control (Francis et al., 2009). Furthermore, these three determinants operate in tandem to form a behavioural intention, the strength of which is dictated by variations in attitude and subjective norm, combined with perceptions of control. The theory posits that behavioural intentions are the most proximal determinants of behaviour (Ajzen, 1991). In accordance with learning theory (Bandura, 1977; Pavlov & Thompson, 1902; Skinner, 1974) the TPB assumes that attitudes, subjective norms and perceptions of control are acquired directly by means of classical and/or operant conditioning and also indirectly through social learning (Ajzen, 1991; Eby & Molnar, 1998).

The TPB has been used to investigate a wide range of health-related behaviours, including exercising (Norman, Conner, & Bell, 2000), smoking and drinking (Spijkerman, van den Eijnden, Vitale, & Engels, 2004), the commission of driving violations (Forward, 2009), speeding (Conner et al., 2007; M. A. Elliott, Armitage, & Baughan, 2003, 2007) and adolescents' behaviour in traffic (M. A. Elliott, 2004). For example, the results of a study conducted by Elliott et al., (2003) showed that there was a strong relationship between self-reported intention to speed and speeding behaviour ($r = .67$), and they also reported that intentions and perceived behavioural control accounted for 32% of the variance in behaviour after controlling for demographic factors. In addition, the results of several meta-analyses support the utility of behavioural intentions as a predictor of

subsequent behaviour. For instance, Armitage and Connor (2001) reviewed 185 TPB studies and found that attitudes, subjective norms and perceived behavioural control accounted for 39% of the variation in intentions and that intentions accounted for 31% of the variation in actual behaviour. Thereafter, Armitage and Connor proposed that educational interventions might legitimately focus on TPB constructs, as a means of reducing speeding behaviour and of reducing the commission of driving violations generally. Some work has already been carried out in this regard. Hardeman et al. (2010) reviewed 30 studies of educational interventions in the areas of health and safety that were based on TPB principles and reported that 50% of these interventions were effective in changing intentions and over 65% worked to change behaviour, albeit that the reported effect sizes were small. Nevertheless, given the high risks faced by young novice drivers, any reduction in intended or actual aberrant behaviour can be seen as constituting a step in the right direction.

The path of decision-making described by the TPB assumes that this process unfolds in an entirely rational way, i.e. that individuals consider all the possible consequences of their behaviour before they decide to act (Reyna & Rivers, 2008). However, the fact that health-impairing behaviours such as substance use and risk-taking in traffic are relatively common, especially among adolescents (Bingham & Shope, 2004; McKenna & Horswill, 2006; Shope, 2006; Spijkerman et al., 2004) suggests that young people do not always act rationally. The prototype willingness model (PWM) (Gibbons & Gerrard, 1995) is dual process theory of decision making and thus describes two paths to risk-taking; one representing a reasoned route and the other depicting a heuristic route, which is contingent on reactions to social images. The social reaction path incorporates two constructs: risk prototypes, and behavioural willingness (Figure 1.3). Risk prototypes describe mental representations (images) of individuals who engage in risky behaviours, for example a typical smoker, drinker, or speeder and behavioural willingness describes

level of preparedness to engage in risky behaviour (Gerrard, Gibbons, Houlihan, Stock, & Pomery, 2008). The model proposes that adolescents both individually and collectively, possess rich mental representations of people who take risks and feel that by performing risky actions in public they will acquire aspects of that image for themselves (Gerrard et al., 2008). The model also posits that these images are predictive of adolescent's willingness to take risks and of their actual risk-taking behaviour. For instance, research conducted by Chassin, Presson, Sherman and Kim (1985) showed that the greater the match between adolescents prototypical image of drinkers and their own self-image, the stronger their intention to start drinking.

The PWM is supported by evidence from studies that investigated risky behaviours among adolescents, including smoking (Spijkerman et al., 2004), reckless driving and DWI (Gibbons & Gerrard, 1995). For example, in a study involving 628 college freshmen, Gibbons and Gerrard (1995) found that participants who engaged in reckless driving had a more favourable impression of reckless drivers than they had of safe drivers. Furthermore, reckless driving was significantly more prevalent amongst male participants, and males had a more favourable impression of the typical reckless driver than did females.

Gibbons and his colleagues believe that the PWM constitutes a valuable supplement to the TPB for explaining and predicting adolescent risk-taking behaviours (Gibbons & Gerrard, 1995; Gibbons, Gerrard, Blanton, & Russess, 1998), because their research confirms that much adolescent risk behaviour is not planned and that the related concepts of behavioural willingness and behavioural intention each explain unique proportions of the variance in risk-taking. For instance, the results of a study that focussed on the sexual behaviour of 197 undergraduates showed that when engagement in unprotected sex was intentional, participants were willing to repeat this behaviour, whereas when it was unintentional, participants were willing but not intending to repeat the behaviour (Gibbons et al., 1998). Furthermore, the results from several studies indicated

that substance use and condom use in adolescents under 19-years-old were more strongly correlated with the participants' willingness rather than with their intentions to do so (Spijkerman et al., 2004; van Empln & Kok, 2006). Thus it appears that willingness constitutes a generalised positive attitude towards behaviour, whereas intentions represent a firmer resolve to engage in that behaviour.

The accumulated evidence presented here suggests that TPB and PWM constructs constitute useful measures of attitudes, social influence, perceptions of control, behavioural willingness, intention and actual behaviour among adolescents. In addition, since these constructs can also be used as proxy measures of behaviour in order to determine the effectiveness of interventions where actual behaviour cannot be measured (Francis et al., 2009; Gibbons & Gerrard, 1995), they constitute a valuable resource when it comes to studying the effects of PLDE.

1.2.5.3 Goals for driver education framework (GDE)

The goals for driver education framework (GDE) (Hatakka et al., 2002) synthesises many of the principles incorporated in descriptive skill-based models (e.g. the Hierarchical Control Model (Michon, 1985)) and functional motivation-based models ((e.g. the TCI (Fuller, 2000), TPB (Ajzen, 1991) and PWM (Gibbons & Gerrard, 1995)) and as such represents an evolution in thinking with regard to driver behaviour and driver education (see Table 1.1 for a model description).

The GDE-framework attempts to broaden the scope of driver education and training by redefining its goals, and methods. For example, although the model retains the hierarchical framework favoured in earlier skill-based models, the GDE-framework distinguishes between four, increasingly influential, levels of skills and competencies that are seen as necessary for optimal performance including (a) vehicle manoeuvring, (b) mastering traffic situations, (c) goal and context of driving, and (d) goals for life and skills for living. The GDE-framework also outlines a second dimension, which indicates that

driver education should aim to provide students with (a) basic skills and knowledge; (b) knowledge and skills related to risk increasing factors; and (c) skills for self-evaluation, at each level of the hierarchy. In this conceptualisation, basic knowledge, and skills for manoeuvring a vehicle, and for mastering traffic situations are seen as fundamental for successful driving.

Table 1.1 Goals for Driver Education framework

	Essential curriculum		
	Knowledge and skills	Risk-increasing factors	Self-evaluation
Hierarchical levels of behaviour	Goals for life and skills for living (general) • lifestyle/life situation • peer group norms • motives • self-control, other characteristics • personal values - etc.	Risky tendencies • acceptance of risks • self-enhancement through driving • high level of sensation seeking • complying with social pressure • use of alcohol and drugs • values, attitudes towards society - etc.	Self-evaluation/awareness of • personal skills for impulse control • risky tendencies • safety-negative motives • personal risky habits - etc.
	Driving goals and context (journey-related) • effects of journey goals on driving • planning and choosing routes • evaluation of requested driving time • effects of social pressure inside the car • evaluation of necessity of the journey - etc.	Risks connected with • driver's condition (mood, BAC, etc.) • purpose of driving • driving environment (rural/urban) • social context and company • additional motives (competitive, etc.) - etc.	Self-evaluation/awareness of • personal planning skills • typical driving goals • typical risky driving motives - etc.
	Mastery of traffic situations • traffic regulations • observation/selection of signals • anticipation of the development of situations • speed adjustment • communication • driving path • driving order • distance to others/safety margins - etc.	Risks caused by • wrong expectations • risk-increasing driving style (e. g. aggressive) • unsuitable speed adjustment • vulnerable road-users • not obeying regulations/unpredictable behaviour • information overload • difficult conditions (darkness, etc.) • insufficient automatism or skills - etc.	Self-evaluation/awareness of • strong and weak points of basic traffic skills • personal driving style • personal safety margins • strong and weak points for hazard situations • realistic self-evaluation - etc.
	Vehicle manoeuvring • control of direction and position • tyre grip and friction • vehicle properties • physical phenomena - etc.	Risks connected with • insufficient automatism or skills • unsuitable speed adjustment • difficult conditions (low friction, etc.) - etc.	Awareness of • strong and weak points of basic manoeuvring skills • strong and weak points of skills for hazard situations • realistic self-evaluation - etc.

(Reproduced with permission from Hatakka, Keskinen, Glad, Gregersen, Hernetkoski, 2002)

Therefore these competencies should be acquired during driver training. In addition, the model supposes that the application of these skills is guided by higher level personal tendencies, goals and motives, which should be addressed as part of driver education and training courses. The second column in the framework describes the types of risks that arise when drivers have insufficient knowledge or skills related to the competencies described at each level of the hierarchy and thus highlights the importance of accurate risk perception for increasing safety. Risk judgements feature prominently in most theoretical models of health behaviour, including the Theory of Planned Behaviour (Ajzen, 1991). These posit that individuals' perceptions about the consequences of their behaviour and their perceptions about their personal vulnerability to those consequences play a crucial role in their decision making. For instance, studies show that whereas adolescents and adults appear to be equally capable of assessing risk accurately (Millstein & Halpern-Felsher, 2002), adolescents who take risks perceive themselves as less likely to suffer negative consequences as a result of such actions than do those who abstain from risky practices (Arnett, 2002). Furthermore, research conducted by Naatanen and Summala (1974) and Summala (1987) suggested that in addition to the official goal of the traffic system (i.e. safety), the behaviour of some young drivers is influenced by "extra motives", such as competition, sensation seeking, deliberate risk taking and a desire to conform to perceived social norms, which may be socially rewarding and satisfy their developmental needs (Jessor, 1998). For instance, it is well known that adolescence is marked by an increased desire for independence from familial influences and that this is accompanied by an increased susceptibility to (perceived) peer influence and (perceived) peer pressure (Steinberg, 2004). In response, the GDE suggests that driver education programmes should anticipate and proactively address such factors by providing students with knowledge about how both their trip-related goals and motives and also their life goals and personal tendencies affect driving behaviour and by equipping them with the necessary

skills to control these influences. Thus the GDE model provides useful guidelines for individuals or organizations who wish to develop driver education and training courses.

The third column in the GDE-framework focuses on how drivers assess their personal situations on each of the four levels and reflects an increasing awareness among theorists of the role that metacognitive processes play in the development of driver competency. Metacognition refers to the act of thinking about thinking, and involves the active monitoring and regulation of cognitive activity (A. L. Brown, 1987). The relationship between metacognition and learning was first suggested by Flavell (1979), who proposed that awareness of cognitive processes consisted of both metacognitive knowledge (self-awareness) and metacognitive skills (self-evaluation and self-regulation). For instance, the GDE-framework posits that pre-drivers and novices should be trained to examine their attitudes towards aberrant practices, such as speeding, to examine the ways in which such attitudes can potentially affect their driving behaviour and to develop strategies that enable them to change their attitudes where necessary. Research suggests that there are positive associations between increased metacognitive knowledge and increased learning, improved performance and greater achievement of educational goals (Tobias & Everson, 2003). Both the TCI model of driver behaviour (Fuller, 2005), and the GDE-framework of driver education and training (Hatakka et al., 2002) stress the importance of metacognition in establishing and maintaining safe driving practices. For instance, the concept of calibration, which features prominently in the TCI model refers to the alignment of a driver's metacognitive judgements about his/her own capabilities and the demands of the driving task, with objective reality (Kuiken & Twisk, 2001). In the context of the GDE-framework, accurate calibration describes awareness (insight) of the ways in which skills, abilities and personal tendencies affect decision making with respect to manoeuvring a vehicle in traffic and also planning trips and life in general (Peräaho, Keskinen, & Hatakka, 2003). Following a review of driver training in Europe, Lynham

and Twisk (1995) suggested that the provision of training in metacognitive aspects of driving represent the most promising approach for improving driver education. Furthermore, since metacognitive training can be provided for individuals who have not started driving yet, this type of training can be used with pre-learner as well as learner drivers. Unlike traditional approaches to teaching which focus mainly on providing students with knowledge, metacognitive training uses a constructivist approach, whereby students actively construct knowledge and increase their understanding by interacting with the topic of interest (Bransford, Brown, & Cockling, 2000). This approach necessitates a move away from lecture-based teaching in favour of more interactive methods such as discussions and role play. For example, metacognitive training might involve a group discussion that examines the possible consequences of high speed driving, or an enactment of a situation where participants are being encouraged to drive after consuming alcohol or drugs. The evidence presented above suggests that, improving driving-related metacognition constitutes a feasible objective for PLDE courses.

1.2.6 Pre-learner driver characteristics

A growing body of research indicates that risk-taking in traffic follows a developmental trajectory, which starts in early childhood (Deighton & Luther, 2007; Durkin & Tolmie, 2010; Waylen & McKenna, 2002, 2008). Empirical evidence show that that attitudes towards driving are well-established in youngsters long before they are old enough to obtain a learner permit and thus gain firsthand experience with driving⁵ (e.g. Harré, 2000; Harré & Brandt, 2000a, 2000b; Harré, Brandt, & Dawe, 2000; Parker & Stradling, 2001; Waylen & McKenna, 2002, 2008). For instance, research conducted by Harré et al. (2000) involving 277 14- and 16-year-old adolescents in New Zealand, measured their perceptions about the acceptability of a range of reckless and illegal driving

⁵ The reported prevalence of unlicensed, under aged driving among adolescents is generally quite low. Elliott, Ginsburg and Winston (2008) found that just 4.2% of the five and a half thousand 9th to 11th grade students that they surveyed indicated that they drove for at least 1 hour per week without a licence.

behaviours including; tailgating, risky overtaking, running red lights, chasing and/or racing other drivers, DWI and speeding. The results showed that over 25% of the participants, including 49% of males believed that it was safe to travel at 120km/h in a 100km/h zone. Waylen and McKenna (2002) surveyed 567 UK secondary school students aged between 11- and 16-years regarding their attitudes towards road use and their beliefs about what it would be like to drive. They found that males had riskier attitudes towards road safety and driving than did females and the former were most likely to condone driving violations such as speeding and running red lights and reported an increased tendency to enjoy travelling at fast speeds. The males in this sample also believed that driving would be easier and that they would be more influenced by their friends when they were driving than did the females. Parker and Stradling (2001) also reported that pre-driving males aged from 11-years-old onwards had a greater interest in cars, anticipated more thrill-seeking when they became drivers, rated current speed limits as 'too slow' and said that driving would provide a means for them to express themselves than did their female counterparts. Another study, by Waylen and McKenna (2008) examined the relationship between sensation seeking and positive attitudes towards speeding and driving violations among adolescents and adults. This showed that there were significant age and gender differences in trait sensation seeking among UK 11-16-year-olds, with boys reporting higher levels of sensation seeking than girls. These effects peaked in mid-adolescence for both genders after which the effects levelled-off for boys and declined for girls. The results also showed that there were significant correlations between trait sensation seeking and favourable attitudes to speeding and also driving violations. Finally, research conducted in Ireland, involving over 500 secondary-school students, with an average age of 16-years, showed that attitudes to road safety expressed by male participants were significantly riskier than were those expressed by their female counterparts. However, both sexes were equally tolerant of breaking the speed limit where doing so was perceived as safe (O'Brien,

Rooney, & Fuller, 2001). Taken as a whole, the evidence from these studies suggests that driving-related beliefs and attitudes develop in the absence of direct experience with actual driving and may instead be derived as a result of biological and/or social influences. Since these findings indicate that young males and individuals with a greater propensity for sensation seeking tend to have more aberrant attitudes towards driving, this suggests that the task of instilling appropriate attitudes towards driving in adolescents may prove more difficult in some cases than in others. As a result, there is growing support for the view that driver education should to be delivered over an extended period, beginning with pre-learner driver programmes for students aged between 14-17-years old (Christie, 2001; Lonero et al., 1995; Lonero & Mayhew, 2010; Siegrist, 1999).

1.2.7 Pre-learner driver education (PLDE)

Although PLDE programmes constitute a relatively recent addition to the driver education repertoire, the results from evaluation studies of PLDE have been mildly encouraging. These suggest that attendance at a PLDE course can result in increased knowledge, improved thinking skills and better attitudes towards safe driving. For instance, Harré and Brandt (2000a) assessed the effectiveness of a traffic safety programme designed for year 10 students (14-year-olds) in New Zealand. The programme consisted of 16 lessons which covered topics including risk perception, motivations for risk-taking and the effects of inexperience, peer pressure and impaired driving. Students were encouraged to analyse their beliefs and attitudes towards these issues using a specially designed workbook. Self-report questionnaires were used to measure changes in attitudes and behaviours in this active programme group (n = 61) and a matched control group (n = 90) on three occasions; pre- and post-intervention, and post-intervention plus 6 months. The measures included attitudes towards DWI, frequency of being a passenger of a drink-driver, intention to be a passenger of a drink-driver, frequency of seat-belt wearing and knowledge about the risk of speeding. Participants were also asked to rate the

acceptability of nine risky/illegal behaviours. The results indicated that there was a significant improvement in attitudes towards risky behaviour in the active group in comparison with the controls in four of the nine behaviours tested in the second test. However, these beneficial effects were no longer evident in the follow-up test. Unfortunately the researchers did not stipulate which specific attitudes improved (Deighton & Luther, 2007). Although this was a relatively small-scale study to begin with, and there was a 21% rate of attrition between the post-intervention and the follow-up tests, these results indicate that pre-driver education can have a positive short-term effect on driving-related attitudes.

Similar positive results were reported in an evaluation of the DRIVE pre-driver education programme in the UK (H. Simpson, Chinn, Stone, Elliott, & Knowles, 2002). This intervention consisted of a video, a teacher/student manual and a self-help booklet that was distributed to Road Safety Officers, and through them to schools and other interested groups. The evaluation was based on a pre- and post-intervention questionnaire that assessed students' knowledge of safe driving and attitudes towards driving. The sample consisted of 546 year 12 students from 19 schools that delivered the DRIVE course, and 641 matched controls and most participants were between 16-17-years old. The knowledge test was based on the course material and consisted of 28 (one mark) questions, 24 of which involved a "True", "False" or "Don't know" answer and the remaining 4 involved a multiple choice format. The results of the pre-intervention test indicated that there was very little difference in the mean pre-intervention scores for the experimental group and the controls ($M = 18.1$ and 17.8 respectively). However, the results of the post-intervention test showed that whereas the experimental group recorded significant gains in knowledge ($M = 21.2$, $p < .001$); the mean scores in the control group had decreased significantly between the two tests ($M = 16.9$, $p < .001$). Simpson et al., (2002) reported that the students who took the programme showed marked improvement in

knowledge about the fact that accidents mostly happen locally, that reducing speed can save lives and that young male passengers have a higher risk of being killed in RTCs. The risk perception measures consisted of list of 14 potentially dangerous driving activities, which the students had to rate on a four-point scale, ranging from 1 = “not at all dangerous” to 4 = “very dangerous”, thus the overall scale scores could range between 14 - 56 points. The results showed there was a small increase in the mean scores for the experimental group between the two tests, from 46.3 to 47.3 ($p < .001$), whereas there was a slight, non-significant decrease in the means for the control group, from 45.2 to 44.7 during the same period. On the basis of these results, the researchers concluded that the DRIVE programme was moderately successful in increasing the students’ knowledge about safe driving and their perception of the risks involved in risky driving activities. Clearly, however, 1 point increase in the risk-perception scores in the active group hardly constitutes a meaningful improvement. Furthermore, the information value of this study is somewhat limited because no follow up test was performed to ascertain the possible long-term effects of the programme.

More recently, a UK study evaluated a half-day PLDE intervention entitled “Safe Drive Stay Alive”, which aimed to improve pre-drivers’ attitudes by increasing their awareness of the consequences of risky driving and their vulnerability on the roads (Poulter & McKenna, 2010). The intervention involved watching a video that contained a dramatic reconstruction of a fatal car crash involving youngsters and also testimonials provided by members of the emergency services, surviving victims and bereaved parents, each describing their personal experience of a fatal collision. Students from six schools completed a questionnaire on three occasions: pre-intervention (791 students), post-intervention (422 students) and a post-intervention follow-up (258 students) five months after the presentation. As a result of listwise deletion, the overall analyses were based on the scores for just 199 students; 128 males and 71 females, with a mean age of 15.6 years.

The measures included 13 questions about speeding which were based on TPB constructs (Ajzen, 1991), including attitudes, subjective norms, perceived behavioural control, and future intentions. The results showed that the programme had a significant immediate effect on the overall scores for the items. There was a significant pre-to-post-intervention improvement in relation to four issues: students' intentions to drive within the speed limit, the inevitability that one will exceed the speed limit sometimes, sticking to the speed regardless of the fact that one is slowing down the flow of traffic and resisting peer pressure to drive faster. However, with the exception of exceeding the speed limit sometimes, these improvements were no longer evident during the five-month follow-up study, which suggests that the impact of this one-day intervention was short-lived. Furthermore, in the absence of a control group, it is difficult to judge the real effects of this intervention.

This brief review of previous evaluations of PLDE courses suggests that these types of interventions provide some short-term benefits for pre-learner drivers with respect to driving-related knowledge, risk perception skills and attitudes, which do not appear to persist over longer time periods. However, there is some evidence to suggest that PLDE interventions may function to make students more amenable to subsequent road safety messages. For instance, O'Brien, Rooney and Fuller (2001) investigated the effects of attending a drama presentation that concentrated on the negative consequences RTCs on 519 Irish pre-learner adolescents (439 in the experimental group, and 80 controls). In line with the PLDE evaluations discussed previously, they found that attendance at the drama resulted in significant short-term improvements in risk perception, but that this effect was no longer evident in the one-year follow-up test. However, as part of that test, they exposed all of the participants to a set of media messages which aimed to reinforce the central themes from the original drama and then re-tested them. Those results showed that there was a significantly greater increase in positive attitudes towards these messages

among students in the experimental group in comparison to the controls. The implications of these findings for road safety education, particularly driver preparation courses are clear. If the effects of these types of educational interventions are cumulative rather than absolute in nature, then students should be exposed to regular and timely refresher courses in order to prolong the benefits that accrued from attending the original course. The effects of reinforcement on learning are well-known in psychological circles and will be discussed in more detail in Chapter 4.

Whereas the authors of the PLDE evaluations that have been reviewed above acknowledged the various limitations of their studies, no evidence was found to suggest that they recognized the need to test for clustering effects in their data and to control for these effects where necessary. Clustering occurs when participants are grouped in some way, (e.g. within schools) or when repeated measures are used. The data derived in these cases violates the assumption of independence that underpins the rationale behind inferential statistical procedures such as analysis of variance (ANOVA) and multivariate analysis of variance (MANOVA) (Kreft, 1996). In the field of educational psychology, evaluations of school-based interventions routinely use statistical procedures, such as hierarchical linear modelling (HLM), to adjust for the effects of clustering (see for example Flannery et al., 2003; Guo, 2005; Raudenbush & Bryk, 2002). Since failure to adjust for clustering represents a significant flaw in the design of previous evaluations of driver education programmes, this study intends to make an important contribution to the literature by using HLM techniques to improve the psychometric credentials of its findings. A detailed discussion of HLM techniques is provided in Chapter 2.

To date, very few evaluations of PLDE courses have been conducted and those have contented themselves with examining a relatively small number of issues and concepts. However, this study intends to adopt a broader approach in an attempt to gain a more comprehensive understanding of the factors that influence the formation and

maintenance of knowledge, and good risk perception skills, and safe attitudes towards driving in PLDs. Not alone would this information allow programme developers to refine their courses to cater for specific target audiences, but it may also help to identify more meaningful criteria for use in future programme evaluations (Lonero et al., 1995).

1.2.8 Aim of the present study

The aim of this research is to evaluate PLDE interventions that are provided for Transition Year (year 12) students in schools in the Republic of Ireland (ROI). The main part of the project consists of a summative of assessment of student outcomes from a range of driving-related educational courses that are typically provided for TY students. These range from modular programmes that span the entire school year to one-day courses, all of which aim to provide PLDs with the types of driving-related knowledge, skills and attitudes that would assist them in becoming better drivers in the future. In addition, a formative evaluation of the curriculum which forms the basis of two of these programmes is conducted in an effort to identify programme features (content and/or processes) that might be changed in order to improve the efficiency and effectiveness of these programmes.

1.2.9 Hypotheses

The following hypotheses will be tested as part of the summative evaluation. The order in which these are presented reflects the statistical modelling strategy that was adopted in this research rather than relative importance of the predictions:

1. There will be significant variations in driving-related knowledge, risk perception skills and attitudes of participating students at intra-student, between-student and between-schools levels.
2. There will be significant short-term changes (i.e. between the pre-intervention (T1), and post-intervention (T2) tests) in driving-related knowledge, risk perception skills, and attitudes in the research sample.

3. There will be significant long-term changes (i.e. between the pre-intervention (T1), and post-intervention follow-up (T3) tests) in driving-related knowledge, risk perception skills and attitudes in this sample.
4. Students who take a PLDE course during Transition Year (the PLDE group), will acquire significantly more driving-related knowledge, better risk perception skills and better attitudes towards driving than will those in who do not take a PLDE course (the control group).
5. Students who attend specific types of PLDE courses will acquire significantly more driving-related knowledge, better risk perception skills and better attitudes towards driving than will those in the non-PLDE control group.
6. Both initial levels of, and changes in driving-related knowledge, risk perception skills and attitudes will be influenced by a range of distal and proximal between-student factors including;
 - a) Personal characteristics e.g. gender, domicile location, socio-economic status (SES) personality (i.e. sensation seeking, impulsiveness and Big-5 personality traits).
 - b) Previous experience gained through direct interactions with the traffic system or indirectly, through observational learning (see Table 2.2 for a comprehensive list.).

Chapter 2: Methodology

In the ROI, second-level education is delivered over a 5 or 6 year cycle, from year 9 onwards. In years 9-11, students prepare for the national Junior Certificate Examination, and in years 13-14, they study for the national Leaving Certificate Examination. Year 12, which is called “*Transition Year*” (TY), is an optional part in the second-level cycle. The curriculum for that year focuses on non-traditional activities with the aim of promoting “....the personal, social, vocational and educational development of students and preparing them for their role as autonomous, participative and responsible members of society” (Second Level Support Services - Department of Education and Skills, 2013, p. 1). Thus, TY students are encouraged to develop a wide range of transferable critical thinking and creative problem solving skills by engaging in a wide range of activities, such as participating in social innovation projects, forming mini companies, gaining work experience, and, of particular relevance for the current research, preparing to learn how to drive.

2.1 Design

This study used a quasi-experimental design, whereby students in TY and year 12/13⁶ in participating school were divided across six experimental groups in accordance with their PLDE status, i.e. five PLDE groups and a non-PLDE control group. This design was preferred over a randomised controlled experiment for practical reasons (see Levin, 2005), because the majority of the schools that provide PLDE in transition year have already invested considerable amount of time and effort in specific courses in terms of providing in-service teacher training, purchasing study materials etc., thus changing these arrangements would have placed excessive demands on school resources.

⁶ For the purpose of this study Transition Year (TY) is classified as “year 12” and the next school year is classified as “year 13”. However, some students skip TY and go directly from year 11 to year 13, thus some year 13 students were included as matched controls in this study.

Students in the PLDE groups took one of five different types of courses, all of which are commonly used with TY classes (see Appendix A). Students in four of these groups, (groups A - D) used PLDE programmes that were modular in design, i.e. they contained a multiple instructional units and were delivered over several weeks or months. The courses that were taken by groups A-C are used widely in the ROI. Students in group D took courses that had been developed within their own schools. Students in group E took one of two types of PLDE course that are delivered in a single day. The control group consisted of a cohort of TY and Year 13 students who did not take a PLDE course in school.

Both between-groups and repeated measures were used to ascertain the nature and levels of driving-related knowledge, cognitive skills and attitudes among students in this sample. The students were tested on three occasions in 18 months between September 2009 and March 2011. First, a pre-intervention test (T1) was administered in each group 1.5 weeks (on average) before their scheduled PLDE course was delivered. Second, a post-intervention test (T2) was conducted with each school group within 1 to 4 weeks of the completion of the individual courses. Third, a post-intervention follow-up test (T3) was administered between 9 - 12 months after each course had ended. The variability in the gaps between testing sessions occurred because there were practical limits as to when testing could take place, due to the number of schools involved, and their diverse locations and also because the PLDE courses that featured in this study differed considerably in terms of duration. The average interval between the T1 and the T2 tests was approximately 26 weeks; the average interval between the T2 and the T3 tests was approximately 51 weeks and the average interval between the T1 and the T3 tests was approximately 77 weeks (Table 2.1). The testing schedule used for classes in the control group mirrored this pattern.

Table 2.1 *Intervals between tests*

Interval between tests	Number of weeks		<i>M (SD)</i>
	Min.	Max.	
T1 - T2	4	37	25.81 (8.08)
T2 - T3	39	71	50.69 (8.41)
T1 - T3	54	85	76.51 (4.90)

The research was designed to comply with recent guidelines produced by the AAA Foundation for Traffic Safety (see Clinton & Lonero, 2006a, 2006b; Clinton & Lonero, 2006c), which encapsulate international best practice in evaluation design and methodology and was approved by the ethics committee in the School of Psychology, Trinity College, Dublin.

2.2 Participants

The population for this study consisted of all students who were enrolled as TY students during the 2009-2010 school year. During the previous year, when recruitment for this study was underway, 335,123 adolescents were enrolled in 731 secondary school in the Republic of Ireland. TY programmes were being delivered in 71% of these schools, and students in the remaining schools skipped year 12, and transferred directly into year 13 (Department of Education and Science, 2010). In order to gain access to relevant population, a list of all schools that were providing TY was obtained from the Second Level Support Services division in the Department of Education, *via* a personal communication from M. O'Leary on March 10, 2009. Thereafter, an invitation was sent, either by post or by e-mail, to the TY coordinators in these schools, inviting them to participate in this research. This letter also explained the study aims and outlined the research procedure and was accompanied by a School Consent Form (Appendix B), that they could return if they agreed to participate. Fifteen schools were recruited on foot of this initial request. Thereafter, a stratified opportunity-based approach (Shaughnessy et al., 2009) was used to recruit additional school groups, whereby successive recruitment drives increasingly targeted groups that had the potential to balance student numbers with respect

to a number of key strata, including PLDE status, gender, socio-economic status (SES), and school location. In total, 39 schools consented to host the project; however, as a result of staffing and scheduling problems, testing was conducted in only 34 of these schools. The ROI is divided into 26 counties (regions). Since the participating schools were located in 14 of these, it was concluded that they constituted a reasonably representative sample of the target population (see Appendix C). Students in 32 of these schools participated in one of the active PLDE groups. Seven of those same schools also provided a group of students, who were not taking a PLDE course, but who were otherwise of equivalent status to their counterparts, to act as matched controls. This meant that there was a minimal amount of difference between the type of students who took the PLDE courses and those who did not. For instance, in the case of the matched groups, some of these students were unable to take the PLDE course that was provided because it was over-subscribed. Where this occurred, places were typically allocated on a random basis by the TY coordinator. Two schools provided students for the control group alone: One of these did not provide PLDE as a TY option and the other did not provide a TY programme at all. Twenty-three of the participant groups came from single-sex schools (12 male, 11 female) and the remainder came from mixed sex schools.

Two thousand and three students participated in the first test (T1). However, 23 of these were removed from the study because the data that they provided in this initial survey was deemed as insufficient and/or unreliable. Thus, the actual sample consisted of 1,880 students who took the T1 test, of which 1,324 and 1,412 took the T2 and the T3 tests respectively (Table 2.2).

Table 2.2 Summary of participant demographics by programme type for the pre-intervention (T1), post-intervention (T2), and post-intervention follow-up (T3) tests

Group Characteristics

Student Characteristics

Research group	N	Students	Males	Females	Urban	Rural	SES <i>M (SD)</i>
<u>Time 1 - Pre-intervention test</u>							
A	5	244	134	110	142	102	3.81 (1.18)
B	8	429	157	272	206	223	4.00 (1.21)
C	6	265	114	151	222	43	4.46 (1.07)
D	5	269	236	33	158	111	3.70 (1.17)
E	5	161	99	62	55	106	3.64 (1.22)
Controls*	9	291	161	130	209	82	4.02 (1.19)
Withdrawals**	3	221	98	123	174	47	3.79 (1.19)
Overall	41	1880	999	881	1166	714	3.94 (1.08)
<u>Time 2 - Post-intervention test</u>							
A	5	207	113	94	127	80	3.82 (1.17)
B	8	345	122	223	154	191	3.97 (1.21)
C	6	232	102	130	195	37	4.43 (1.09)
D	5	217	193	24	130	87	3.78 (1.13)
E	5	126	77	49	48	78	3.78 (1.21)
Controls*	9	197	102	95	134	63	4.19 (1.17)
Overall	38	1324	709	615	788	535	3.96 (1.16)
<u>Time 3 - Post-intervention follow-up test</u>							
A	5	216	117	99	127	89	3.86 (1.17)
B	8	384	139	245	179	205	3.98 (1.21)
C	6	227	98	129	190	37	4.44 (1.09)
D	5	210	188	22	123	87	3.76 (1.15)
E	5	134	78	56	48	86	3.68 (1.24)
Controls*	9	241	137	104	176	65	4.27 (1.15)
Overall	38	1412	757	655	843	569	4.00 (1.17)

Note: * Seven schools provided students for both the active and the control groups.

Note** These schools had intended to deliver programme E.

The reason that there were less students present at T2 than there were at T3 was because a greater number of students were away from the classroom doing work experience (which is a feature of the TY curriculum), when the second test was being conducted. Slightly more males than females, and slightly more urban than rural dwellers were present for each test. Some gender imbalances were also evidenced. For instance there were considerably more males than females in groups D and E for every test. Urban dwellers outnumbered their rural counterparts in group C, by a ratio of 8:1 on average, in each test. Some of these imbalances arose because a number of schools were unable to deliver the PLDE course that

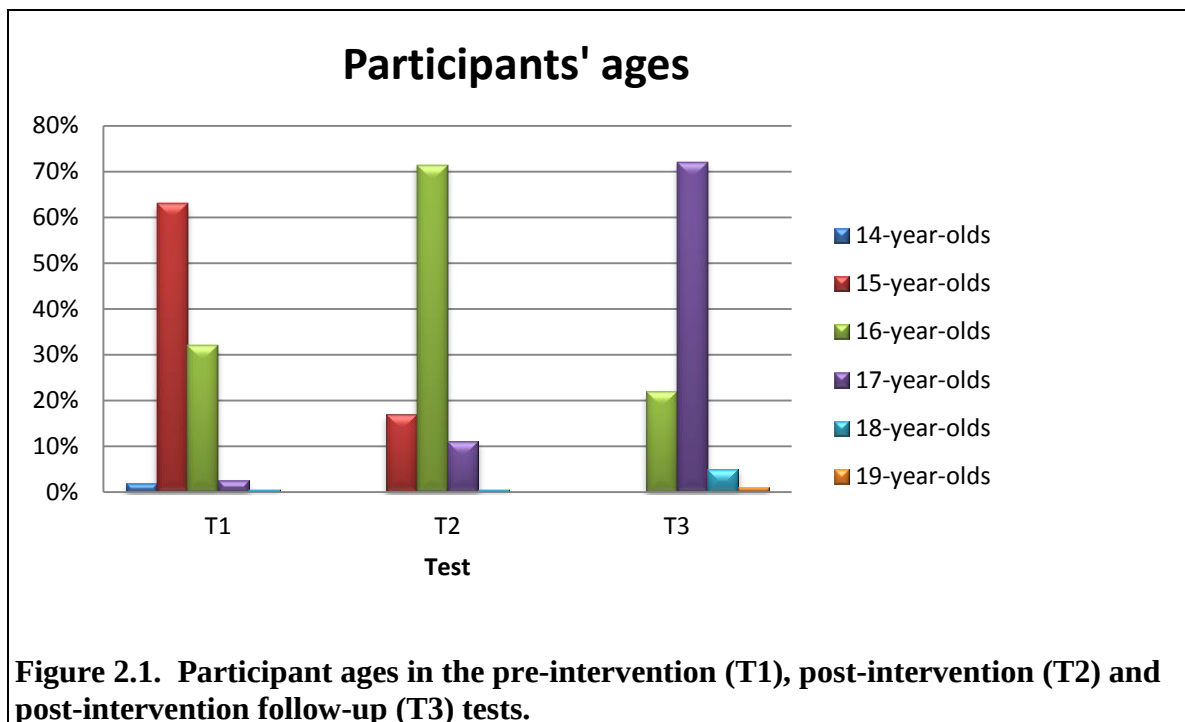
originally intended and that they noted on their consent form. For example school 23⁷ had intended to deliver programme A, however because their TY teacher was unable to attend the in-service training for this programme, she had to devise and deliver an alternative course. Two of the schools that planned to provide programme C as an option had difficulty in recruiting a sufficient number of students to make the course viable. For example, in school 19, just twenty five percent of the students actually took that course and school 33 was forced to drop the course entirely due to poor demand. Fortunately, the students in both of these groups agreed to remain in the study and thus were reassigned to the control group. Groups 30, 31 and 32, who participated in the pre-intervention test, found that they were unable to provide their scheduled PLDE courses subsequently for lack of funding. These groups declined a subsequent request to remain in the study as part of the control group. However, they allowed the data that has been collected previously to be retained as part of the study.

The participant's SES was estimated on the basis of their parent's educational status. Previous research suggests that educational status constitutes a reasonably reliable and valid indicator of SES and that there is good correspondence between adolescents' and parents' reports of SES based on that criterion ($r = .4$) (Lien, Friestad, & Klepp, 2001). In the current research, educational status was measured separately for each parent, using a 6-point scale, ranging from 1 = No recognized qualification - 6 = 4th Level degree (masters, doctorate). These scores were combined subsequently to yield a single mean SES score. Where data was provided for just one parent, that score was treated as the parental mean. The sample mean SES in the T1 test was 3.94 ($SD = 1.08$), which was above the mid-point on the 6-point scale that was used. This was in line with expectations, since from the mid-1970's onwards, the vast majority of Irish adolescents have completed 2nd level education. A means-as-outcomes hierarchical linear model was produced (this procedure is explained

⁷ A full list of schools is provided in Appendix C

in detail later in this chapter), which compared the SES of students in each of the active groups with the SES of students in the control group, with one notable result. The mean SES for students in the control group (3.81, $SE = 0.15$, $t(35) = 25.99$) was significantly lower than that for students in group C (4.5, $SE = 0.25$, $t(35) = 2.8$, $p < .01$), however this difference was quite small ($r = .25$).

The mean age in the sample at T1, the T2 and the T3 was 16.02 ($SD = 0.5$), 16.38 ($SD = 0.45$) and 17.31 ($SD = 0.41$) respectively. The modal ages are shown in Figure 2.1.



2.2.1 Attrition

Attrition is problematic in longitudinal research. Not only does it reduce the amount of data that can be used for inferential analyses, but differential attrition from individual experimental groups also constitutes a potential threat to the internal validity of a study (Levin, 2005). The overall rate of attrition in this research was low, amounting to approximately 30% between the T1 and T2 tests, and approximately 25% between the T1 and T3 tests. Furthermore, a sizeable proportion of these losses (i.e. 12%) were due to the loss of three entire school groups that withdrew from the study after taking the T1 test.

After adjusting for those losses, remaining rate of attrition was quite low, amounting to 20% between T1, and T2, and to just 15% between T1, and T3. These losses occurred mainly because students were away from their classrooms doing work experience, and other course-related activities when testing was being carried out and thus were not systematic in character. Furthermore, there were no significant differences in the rates of attrition between the groups (see Table 2.2). Also, since the main analysis was conducted using hierarchical linear modelling (HLM), the loss of individual students from within school groups did not have the same type of detrimental impact that it would have had if more traditional types of regression analyses were being used (Bryk & Raudenbush, 1992). These issues are addressed in more detail below.

2.3 Apparatus and Materials

Several software packages were used to analyze the data in this study. The descriptive analyses were conducted in PAWS (Version 18.0). The confirmatory factor analyses were performed using Amos (Arbuckle, 2009). The item response analyses of the knowledge test scores were conducted in JMP (Version 9.0.2), and jMetrik (Meyer, 2011), and the hierarchical linear models were constructed using HLM (Version7) (Raudenbush, Bryk, & Congdon, 1996-2011).

Self-report questionnaire booklets were used to collect data in the T1, T2, and T3 tests, details of which are provided in Appendices D, E, and F respectively. To help reduce survey bias, three different booklets were produced for each test, which allowed for a partial randomisation in the order in which the questions were presented. Additional questionnaire booklets were used for the supplementary knowledge tests that were used during the T2 (Appendix G) and the T3 (Appendix H) assessments.

2.4 Measures

The main function of the questionnaires was to measure the participants' driving-related knowledge, risk perception skills, and attitude towards speeding. The resulting data

were used to conduct a summative evaluation of the PLDE provision for TY students. The T2 questionnaire also contained a section where the student was asked to evaluate the PLDE course that they had taken, and these data were used as part of a formative evaluation. Table 2.3 contains a list of the predictor variables that were used to test the hypotheses that were of interest in this study and includes a description of how the scores for these variables were coded. A more detailed description of these variables, including references to the appendices where the actual questions can be viewed and which also includes the measurement schedule for these variables is contained in Appendix I.

Table 2.3 List of variables

Variable level	Coding
<u>Level-1 variable (intra-student)</u>	
- Outcome variables - Test Scores - Test time - Mean age	Details reported in the relevant chapters T1; T2: T3 Short-term effects – T1 versus T2 Long-term effects – T1 versus T3 Age at each test time (e.g. 15.25-years)
<u>Level-2 variables (Between-students)</u>	
Dummy coded variables	0 = Reference; 1 = Comparison
- Gender - Location - Experience with driving*	0 = Boys: 1 = Girls 0 = Urban: 1 = Rural 0 = No: 1 = Yes
Continuous variables	Higher mean values signify ‘more’
- Socioeconomic status (SES) - Exposure to aberrant driving - Mean level of experience with cars, motorcycles, farm/industrial machinery - Mean personal experience with RTCs - Mean indirect experience with RTCs - Mean impulsiveness - Mean sensation seeking	Scale: 1 - 6 Scale: 1 - 6 1 = Never; 2 = A few times; 3 = Driving - Once per month; 4 = Once per bicycles, week; 5 = Several times per week; 6 = Every day 1 = Never; 2 = Once; 3 = Twice; 4 = Three times or more 1 = Never; 2 = Once; 3 = Twice; 4 = Three times or more Scale: 1 - 4 Scale: 1 – 4 (cont.)

Variable level	Coding	
• Mean Big-Five personality traits ○ Extraversion ○ Agreeableness ○ Conscientiousness ○ Emotional stability ○ Intellect/Imagination ○ Emotional stability	Scale: 1 - 5	
<u>Level-3 variables (Between groups)</u>		
Dummy coded variables	0 = Reference:	1 = Comparison
• Took PLE course	0 = Yes:	1= No
• Studied the Rules of the Road (ROTR)	0 = Yes:	1 = No
• Programmes / Groups	0 = Control group:	Active groups 1 – 5
*This variable was not used as part of the modelling process. Thus the between-student models were constructed using 14 variables.		

The TY coordinators in schools that were using programmes A and B also completed a questionnaire (Appendix J), as part of the formative analysis. This addressed curriculum, teaching, course materials, and administration and evaluation standards.

2.5 Procedure

Since most of the participants were under 16-years-old at the beginning of the study, parental consent was obtained for all participants in advance of testing (Appendix K). A participant information/consent form was also provided at the start of the T1 test booklet (Appendix D) and this was completed by each participant before they took that test. This constituted blanket consent for all of the subsequent measures. Nevertheless, at the beginning of each test session the students were reminded that they could withdraw from the study at any stage if they so wished. None of the students in the classes that were tested refused to participate in the research at any time. Debriefing information was provided at the end of each test (see Appendices D, E and F).

All tests were administered during school hours in school classrooms or assembly halls by the principal researcher. Additional trained research assistants were recruited to assist with larger groups. The researcher(s) distributed the three types of survey booklets

randomly among the participants. Before the test began, the following instructions were read out:

This survey should take you about fifty minutes to complete. Please read the information at the beginning of the survey before you begin answering the questions. We are interested in your opinions, so please do not confer with your classmates while completing the survey. If you have any questions or need any help, please raise your hand and I/we will be glad to provide it. When you have finished the survey, please take a few minutes to review your answers to ensure that you have answered all of the questions fully.

Approximately ten minutes before the end of each test, the researcher(s) asked the participants to ensure that they had not inadvertently skipped a question, which helped to minimise the incidence of missing or incomplete data.

2.6 Data preparation and analysis

The data from the surveys were entered into PASW, where they were screened for errors and abnormalities. Transcription errors (e.g. out-of-range values) were corrected, by referring to the original scripts. The data were then checked for violations of the assumptions of normality that underlie the various statistical tests that were used and the results of these tests will be reported in the appropriate sections throughout this thesis. However, it is expedient to deal with some general issues such as outliers, missing data and sample size here.

2.6.1.1 Outliers

The presence of outliers (i.e. extreme values in the context of the rest of the data), can have a detrimental effect on the normality properties of a dataset and thus these values are sometimes replaced with less extreme ones. The criteria for determining whether or not a value is an outlier is quite arbitrary, and most statistical software packages, including PASW, identify values that extend beyond the 25 or the 75th percentiles as outliers (Field, 2009). However, a case can also be made for retaining outliers, on the basis that research ought to be about describing empirical reality and this cannot be achieved by removing

inconvenient values. Extreme values, especially those produced in response to Likert scale type questions are not necessarily anomalous or invalid and should not be altered solely to satisfy the assumption that data should be normally distributed (Shittu, 2008).

Furthermore, checking, and correcting for outliers can become an exercise in diminishing returns because once started the process must be continued. When outliers are deleted, researchers often find that new outliers emerge in subsequent analyses. The effect of outliers is lessened where datasets are large and where the values are destined to become part of a composite score (Langford & Toby, 1998), as was often the case in the present research. For these reasons, no action was taken to correct for outliers with respect to the scaled questions in this study. However, there were some extreme responses to question D/22, whereby students were asked to estimate the number of people killed on Irish roads in years 2008 or 2009. Preliminary analyses showed that there were 141, 128, and 107 extreme responses to this question in the T1, T2, and T3 tests respectively. Subsequently, outlying values on this question were replaced with a value that was three standard deviations away from the mean, as recommended by Field (2009).

2.6.1.2 Missing data

Missing data represents a significant challenge for psychologists and others who work in the social sciences (Zechmeister, Zechmeister, & Shaughnessy, 2001). Several options are available to alleviate this problem including; a) complete case analysis (e.g. listwise deletion) whereby data from cases that have missing values are not used at all in the analysis; b) imputation, where a plausible value is substituted for the missing one and c) full maximum likelihood analysis, which uses all the available information “to identify the parameter values that have the highest probability of producing the sample data” (Baraldi & Enders, 2010, p. 18).

According to the American Task Force on Statistical Inference, listwise deletion is one of “the worst methods available for practical applications” (1999, p. 598), since it

often results in the loss of large amounts of data. Nevertheless, the HLM software that was used to produce the hierarchical linear models in this research uses listwise deletion to deal with missing values at three levels of analysis, the intra-individual level (level-1), the between-student level (level-2) and the between groups level (level-3). Whereas listwise deletion is a prudent way of dealing with data from individuals and groups who did not participate in one or more of the tests in a longitudinal study (i.e. levels 2 and 3), the wholesale removal of responses where data was missing at the intra-individual level (for instance where a participant did not provide an answer for one item on a scale, or where he/she failed to answer individual questions), would have resulted in an unacceptable depletion of the present sample. As a case in point, the evaluation of the one-day PLDE course conducted by Poulter and McKenna (Poulter & McKenna, 2010) which was reported in the Chapter 1, involved the loss of over 67% of the participants during the course of the study. Moreover, as a result of listwise deletion, their analysis was based on the scores from just 199 of the 258 individuals who participated in all three studies, which constitutes an additional loss of almost 23% of that, already reduced sample. For these reasons, the feasibility of replacing missing values with plausible scores was examined further.

Before undertaking any form of data imputation, researchers need to know why the data are missing and what effect this is likely to have on their findings. Little and Rubin (2002) devised a classification system for missing data mechanisms to describe the relationship between measured variables and the probability of missing data and the resulting categories are widely used to decide which type of missing data technique is best in a given situation. In this system, data can be *missing completely at random* (MCAR), *missing at random* (MAR) and *missing not at random* (MNAR). These classifications apply to specific analyses and thus the same data set may feature analysis that are MCAR, MAR and/or MNAR, depending on which variables are included in the analysis.

Data are MCAR when the probability of missing data on a variable is unrelated to other measured variables or unrelated to the variable with the missing values itself (Little & Rubin, 2002). Missingness in this situation is completely unsystematic and the observed data are perceived as a random subsample of hypothetically complete data. Although assumptions for MCAR are very difficult to satisfy in practice (Baraldi & Enders, 2010) several such incidences were evident in this study: For example, since the bulk of the data was derived using Likert-type scale type questions with multiple response items, it sometimes happened that a participant either forgot to tick one of the boxes, or ticked two options for a single item by mistake. Justifiably, these types of action slips could be classified as MCAR.

Data are MAR if missingness is related to other measured variables in the dataset, but not to the underlying values of the incomplete variable (Little & Rubin, 2002). The loss in such an instance is systematic because the likelihood of missing data is associated with other variables in the analysis. However, Allison advises researchers to treat MAR, and ignorability as equivalent where the “parameters that govern the missing data process are not associated with the parameters to be estimated” (Allison, 2001, p. 5).

Data are classified as MNAR where the probability of missing data is systematically related to the hypothetical values that are missing. MNAR mechanism describes data that are missing based on the would-be values of the missing scores (Baraldi & Enders, 2010). For instance, in this study, it is likely that students who were not engaged academically, or who were not enthusiastic about PLDE did not answer the questions in the evaluation section of the questionnaire. In this situation, it would be wrong to attempt any form of substitution for these missing values, therefore no action was taken to replace missing values in such instances.

Missing data can be dealt with using some form of imputation whereby the missing data are replaced with reasonable estimations, which are then treated as if they were real

data. However, it should be noted that when imputation is used, both correlations and variability may be attenuated and mean estimates involving these data can be biased (Allison, 2001). Several techniques have been developed to impute data, ranging from relatively simple methods e.g. *single imputation*, to more complex procedures e.g. *multiple imputation*.

The simplest form of single imputation, means substitution, is seen as a crude way of dealing with missing data (Allison, 2001), therefore this option was not considered for the present analyses. The most sophisticated form of single imputation, estimation maximisation (EM), which is implemented in PAWS, uses the maximum likelihood algorithm to generate a covariance matrix and mean estimates, based on the available data. As this name suggests, EM consists of an iterative process between two steps, estimation and maximization. Using a probability function, the process first finds a value which maximizes the probability of obtaining a value for x given an observed value y , while making essential use of associated values (Dempster, Laird, & Rubin, 1977).

Multiple imputation (MI) is a Monte Carlo technique for dealing with missing data where missing values are replaced with plausible values in several simulated versions of the dataset (Rubin, 1987). This yields estimates that are less biased than are those produced by single imputation methods. Despite this, from both a theoretical and practical standpoint, MI is not the single best way to deal with missing data. Rather, decisions about how to deal with missing data need to be based on considerations about the relative costs and benefits associated specific techniques. Scheffer (2002) demonstrated that single imputation methods can work when the data are MAR but only when less than 10% of the data are missing. Alternatively, multiple imputation works well with this type of data when up to 25% are missing. However, when data are NMAR nothing short of maximum likelihood estimation will work and preferably when less than 25% of the data are missing.

In this study, individual missing value analyses were conducted on data from each test and these showed that 1.1%, 4.5% and 0.7% of the data were missing from the T1, T2 and T3 tests respectively⁸. The largest amount of missing data (8.8%) were from questions that dealt with parental driving styles and students' exposure to aberrant driving, which featured in the T1 test. There are three likely explanations for these omissions; first, since some students did not provide any data for one of their parents, this probably means they were living with a lone parent; second, it is possible that students whose parents engaged in aberrant driving were unwilling to report their behaviour and thus skipped these questions; third, a small number of students reported that their parents did not drive.

Since the current dataset was large, the cost in terms of computational resources that would have been required to produce and manipulate multiple imputations of the entire dataset was deemed prohibitive, especially since the amount of missing data was small. Having thus opted for single imputation, the EM technique was used because it has better statistical properties than other single imputation methods (Dempster et al., 1977). In this way, steps were taken to attenuate the potentially detrimental effect of HLM's automatic listwise deletion of missing values. Values were imputed only for discreet missing variables i.e. values that were either MCAR or MAR. Since accurate EM estimation requires some knowledge of scores for related items, the availability of such data was the criterion that was used to decide when a missing value should be imputed. Separate analyses were conducted to estimate values for specific items or scales. This entailed identifying items on the relevant scale or sub-scale and using the values reported there to help predict the missing score. Where such values were also missing, no imputation was performed.

When EM imputation is performed using PASW, a new data file containing the imputed scores is created. A comparison of the correlations between scores within the

⁸ Missing data from the supplementary knowledge tests will be addressed in the Chapter 5.

original file and those within the new file was conducted and the results indicated that the correlations between some variables were reduced after the replacement, probably because of the increased homogeneity of distributions. However, this reduction, which ranged from 0.01 to 0.06 was considered as extremely small (see Sümer, 2003).

2.6.2 Hierarchical linear modeling (HLM)

Longitudinal studies conducted in educational settings produce a type of datum that violates the assumption of independence that underpins most multivariate techniques. This occurs because a) observations are recorded for the same individuals on several occasions, and b) because those individuals are nested within schools. In both of these situations, the chances of committing a Type 1 error are increased (Raudenbush & Bryk, 2002). This in turn weakens the validity of any statistical conclusions that are reached on the basis of such data (Levin, 2005). Specialised data analysis techniques such as multilevel modelling (MM) and hierarchical linear modelling (HLM) have been developed to help alleviate this problem. Multilevel models have been used effectively in a range education research studies, including school effectiveness studies (Kreft, 1993; Lee & Bryk, 1989) and multisite evaluations (Pituch, 2001; Pituch & Miller, 1999), where the use of this technique allows researchers to provide a close fit to the structure of the data while also accounting for clustering.

There are other substantive reasons for conducting multilevel modelling. Researchers are often interested in exploring interactions between individual characteristics and group characteristics by testing joint effects of these characteristics on the outcome variable. For example, in educational research, it might be important to assess the joint effects of students' SES and their school's SES on their academic achievement. This type of cross-level relationship between student-level and school-level factors cannot be examined easily using conventional approaches (Guo, 2005).

Hierarchical models deal with nested data by predicting parameters using separate regression equations at each level of the model to predict parameters of variables at lower levels of the model. To illustrate how and why this is done consider the possible effects of an intervention on different types of adolescents. It is possible that the intervention may have a much greater effect on males than it does on females. The differing effects of being in the intervention group would produce different parameters for the intercept and slope of a regression equation. The intercept for the boys might be lower (lower starting values) and increase in performance (slope) is likely to be much greater. Hierarchical models take into account the fact that there are separate intercepts and slopes for different levels in a model. Therefore, information about higher levels, such as school group, can be used to predict the slopes and intercept parameters of variables in lower levels in the model (Raudenbush & Bryk, 2002). In common with more familiar types of regression techniques, HLM can be used to produce both standard and logistic models. The former is used for scaled data and the latter are used when the outcomes are categorical in nature (for an overview of the application of HLM techniques in traffic research see Dupont & Martensen, 2007).

2.6.3 HLM models in longitudinal research

Where change over time needs to be represented for students within schools, as was the case with the present research, three-level HLM models, using a full maximum likelihood estimator, are constructed (Raudenbush & Bryk, 2002). In these analyses, level-1 represents *intra-student* estimates and tests for changes in scores for variables that change over time (e.g. knowledge, skills and attitudes). Level-2 addresses *between-students* effects and tests for the influence of individual differences (e.g. gender) on the model. Level-3 represents the *between-schools* effects and tests for the effects of mean group characteristics (e.g. the type of PLDE programme that was used by individual school groups) on the model. At this level, individual difference variables are aggregated

to account for the effects of differences in the classroom environment. For example, Flannery et al., (2003) used three-level HLMs to test for the impact of a violence prevention programme (PeaceBuilders) on the aggressive behaviour of over 4,000 primary school children in the U.S. In these models, level-1 represented changes in aggression over time, level-2 represented individual differences and level-3 represented differences between schools. These analyses showed that there was a slight decrease in aggression over time for all of the participants (level-1). However, they also demonstrated that the decline in aggression was significantly larger for students who attended schools that used the PeaceBuilders programme in comparison with those who attended non-programme schools (level-3). Finally, they indicated that students who had higher baseline levels of aggression benefitted more from taking the intervention than those who were less aggressive at the outset (level-2). This study demonstrates the range of analyses that can be conducted using three-level HLM techniques.

2.6.4 Implementing HLM analysis in this study

HLM analysis for this study was implemented using HLM (Version 7) software (Raudenbush et al., 1996-2011). In order to separate the data needed for each level of analysis the required files were generated in PASW (Version 18), and these were used subsequently to create the necessary files within HLM.

As the name suggests, longitudinal hierarchical linear modeling assumes that there is a linear relationship between data obtained at a range of time points (e.g. outcomes measured at T1, at T2 and at T3). However, an accumulation of empirical evidence suggests that where studies involve some form of intervention, the rate of change over time will not be consistent across the entire period under investigation. In studies using a similar data collection schedule to the one used in this research, i.e. a pre-intervention, a post-intervention and post-intervention follow-up, substantial changes are often found in the intervention phase (i.e. between T1 and T2), which are followed by a second, post-

intervention phase (i.e. between T2 and T3) wherein the rate of change is reduced or even reversed. For instance, as part of a systematic review investigating the effectiveness of interventions in changing a range of health behaviours, including smoking, obesity, and taking physical exercise Jepson, Harris, Platt, and Tannahill (2010) noted that whereas improvements in the desired direction were often achieved while the interventions were being provided, these effects often weakened in the post-intervention period. Similar findings have been reported with respect to interventions designed to improve the behaviour and attitudes of pre-drivers and novices (Carcary, Power, & Murray, 2001; Harré & Brandt, 2000a).

Keller et al. (2000), developed a simple strategy to overcome this problem by modelling change over time using piece-wise linear models, where rates of change were allowed to differ between the different phases in the study. In the present study this was achieved by constructing separate models to map changes in scores in the *intervention phase (IP)* (i.e. between T1 and T2), in the *post-intervention phase (PIP)* (i.e. between T2 and T3), and by comparing the *initial versus final scores (IVF)* (i.e. between T1 and T3). However, since preliminary analyses of the PIP phase data indicated that there was generally very little change in scores between the T2 and the T3 tests and since these analyses were not central to addressing the study's hypotheses, only the results of the IP and the IVF comparisons will be reported in this thesis.

There were advantages and disadvantages associated with this approach. The main advantage was that since the analyses involved just two time-points, the intercept values obtained during the analyses represented the estimated mean score for the first time-point under investigation in the analysis and by adding the slope value, it was easy to calculate estimated scores for the second time point, having taken the effects of clustering into account. There were two principal drawbacks to adopting this modelling strategy. First, HLM modelling normally provides an option whereby the coefficient values for both the

intercept and the slope can be allowed to vary randomly. However, when estimating a model that is based on just two data points (i.e. T1 and T2 scores) one of these values needs to be specified as “fixed” rather than “random” so that the necessary calculations can be performed in HLM. In the current research, decisions about whether to “fix” the intercept or the slope were based on the reliability analyses produced by HLM. According to Raudenbush (2004) coefficients with low reliability (i.e. $< .1$) should be fixed because they are not useful in discriminating between the groups at that particular level. Second, since the intercepts in both the IP and the IVF models were based on the same T1 test scores, this gave rise to a considerable amount of redundant information. Although details of all of the HLM analyses, including the intercepts, slopes and random variances are provided in table form in the appendices and a full description is provided in the main thesis for the results of the IP analyses, in the interest of brevity, the intercept results for the IVF models are not described in detail in the main document.

2.6.5 Modeling strategy

The process of constructing HLMs typically begins by fitting an unconditional (null) model. In the case of the 3-level models that were used throughout this study, this unconditional model partitioned the total variability in the outcome into three components:

- σ^2 , representing the variability in the data at level-1 (intra-student)
- $\tau\pi$, representing the variability at level-2 (between-student)
- $\tau\delta$ representing the variability at level-3 (between-groups)

According to Raudenbush and Bryk “This model provides useful empirical evidence for determining a proper specification of the individual growth equation and baseline statistics for evaluating subsequent models (2002, p. 29).” This is the simplest form of HLM and is equivalent to a one-way ANOVA with random effects and the resulting output is used to calculate the intraclass correlation statistic (ICC), which quantifies variation at each of the levels and thus identifies the amount of variance

potentially to be explained at all levels (Raudenbush, Bryk, Cheong, Congdon, & du Toit, 2011). The ICCs are calculated as follows:

$$\textit{The proportion of variance over level - 1 units} = \frac{\sigma^2}{\sigma^2 + \tau\pi + \tau\theta}$$

$$\textit{The proportion of variance over level - 2 units} = \frac{\tau\pi}{\sigma^2 + \tau\pi + \tau\theta}$$

$$\textit{The proportion of variance over level - 3 units} = \frac{\tau\theta}{\sigma^2 + \tau\pi + \tau\theta}$$

In educational research with cross-sectional designs level-1 ICCs generally range between .05 and .20 (Snijders & Bosker, 1999). However, it is not unusual to find level-1 ICCs in excess of .5 in longitudinal studies (Dedrick et al., 2009; Hox & Roberts, 2010).

Opinion is divided about the best modeling strategy to use subsequently (Guo, 2005; Kreft, 1993; Pituch, 2001; Raudenbush & Bryk, 2002). Hox (2002) advocated a stepwise approach, where analysis begins with the level-one model and proceeds to both the level-two and level three models and then examines cross-level interactions. Snijders and Bosker (1999) suggested conducting a direct hypothesis test of the full model or using an inductive (data-driven) strategy or both.

In the absence of a universally-agreed strategy, data analysis for the three-level models in this research focussed on answering the research questions in the order of their importance. Step 1 involved the estimation of the unconditional model, to assess the variability in the data, thus testing hypothesis 1. In model 2, the longitudinal variable ‘time’ was added as a level-1 predictor, to test hypotheses 2 and 3 (i.e. that there would be significant short-term and long-term improvements in scores). Model 3 tested for the effects of exposure to PLDE generally, addressing hypothesis 4. Model 4 tested for the effects of taking specific PLDE programmes, addressing hypothesis 5. Model 5 involved testing for the effects of between-student predictor variables at the intercept and at the slope. These models were trimmed subsequently in accordance with recommendations provided by Raudenbush & Bryk’s (2002):

1. Variables where both the fixed effects coefficients⁹ and corresponding random effects were not significant were excluded from the model.
2. Variables with non-significant coefficients but significant random effects were retained where there were substantive reasons for keeping those predictors.
3. Where there were remaining random slopes with significant variance, additional cross-level interactions were included to try to explain that variance. Where this resulted in the random slope becoming non-significant, that slope was estimated as a non-randomly varying slope.

Since the majority of these tests produced non-significant results, in the interest of clarity and brevity, the model 5 tables that are reproduced in appendices provide details of only those between-student predictors that had a significant effect on the outcomes in question. Finally, in cases where there were significant predictors at all three levels, a sixth model was constructed to explore cross-level interaction effects.

According to Snijders and Bosker (1999) model specification should then progress to the testing of the significance of random effects. Two techniques can be used to distinguish between alternative models with significant random effects and to decide which one best represented the pattern of variability seen in the data; the loglikelihood ratio test and the Akaike Information Criterion test. The log likelihood test is used to compare the goodness-of-fit of alternative nested models (i.e. where one model consists of a subset of the variables contained in a larger model). This uses the deviance ($-2 \log \text{likelihood}$) of the two models by subtracting the smaller deviance from the larger one. The difference is expressed as a chi-square statistic with the number of degrees of freedom equal to the number of different parameters in the two models and is accompanied by a significance test. When the difference is statistically significant, this indicates that the less restrictive model (the one with the highest number of variables) fits the data significantly better than

⁹ The fixed effects reported as part of this research did not include adjustments for robust standard errors due to the small size of the sample (see Maas & Hox, 2004).

does the simpler model. Alternatively, the Akaike Information Criterion (AIC) (Akaike, 1987) can be used to distinguish between non-nested models. For instance one model might contain a combination of time and gender, whereas another might contain a combination of time and SES. The AIC also measures goodness of fit and offers a relative measure of the information lost when a model is used to represent reality, by describing the trade-off between accuracy and complexity. The AIC is calculated by doubling the number of parameters in the model and adding this to the deviance statistic produced by HLM. The model with the lower AIC is seen as the better of the two, although there is currently no way to test the significance of this result.

2.6.6 Effect size calculations

Effect sizes provide important supplementary information to complement null hypothesis significance testing because they provide a practical measure of the magnitude of an effect, which is independent of sample size (Selya, Rose, Dierker, Hedeker, & Mermelstein, 2012). In ordinary least squares (OLS) regression, the R^2 statistic represents the proportion of the variance explained by the predictors, however there is no direct equivalent of this in hierarchical linear regression. Instead, a pseudo- R^2 can be calculated, which compares the log-likelihood from the empty (unconditional) model to the log-likelihood from fuller models in order to measure the proportional reduction in residual variance between two nested models using this formula:

$$Pseudo - R^2 = \frac{(\text{null model variance}) - (\text{fuller model variance})}{(\text{null model variance})}$$

This can also be done for random variation at each of the three levels in the model (Raudenbush & Bryk, 2002). Since this explained variance is analogous to the R^2 change in OLS regression, Cohen's (1988) guidelines can be applied i.e. *pseudo- R^2* values of .02, .13, and .26 in *pseudo- R^2* change represent small, medium and large effects respectively. However, this method can sometimes produce negative values, because the inclusion of some predictors can increase the magnitude of the variance component, rendering the

result uninteruptable (Peugh, 2010). For instance, in the present research, a series of three-level models were constructed to test for the effects of change over time (level-1), between-student factors (level-2) and between group factors (level-3), on a range of outcome variables. The null model in the series accounted for the variance at each of these three levels. However, the next model, which tested for the effects of time, contained an additional level of variance (i.e. for the time slope), thus this model is not directly comparable to the null model using the formula described above. For this reason, researchers using longitudinal designs commonly calculate the *pseudo- R^2* with reference to a basic model which has already accounted for the effects of time, rather than to the null model itself (Schreiber & Griffin, 2004). Thus in the present research the *pseudo- R^2* calculations were based on Model 2, which included a time slope.

The calculation of *pseudo- R^2* values also becomes more complicated in cases where level-2 predictors are allowed to vary randomly in the model, because this increases the number of variance coefficients at that level, thus increasing the overall variance in the model, as indicated by Peugh (2010). This situation renders the *pseudo- R^2* uninterperatable. In order to avert this problem in the current research, it was decided to ‘fix’ all level-2 coefficients, rather than allow them to vary randomly, because the variance thus produced is functionally equivalent to that produced by a basic model. This decision was taken on pragmatic grounds, since the advantages of being able to report effect sizes for the models concerned outweighed the disadvantages associated with restricting the variation in the between-student predictors.

The magnitude of the differences in scores between groups and between scores on different test occasions was assessed as a function of the standardised mean difference between the relevant scores (i.e. Cohen’s *d*), using this formula:

$$Cohen's\ d = \frac{(\text{Mean of experimental group}) - (\text{Mean of control group})}{(\text{Pooled standard deviation of both groups})}$$

The resulting value is equivalent to a z-score of a standard normal distribution. For example, an effect size of 0.7 means that the score of the average person in the experimental group is 0.7 standard deviations above the average person in the control group and hence exceeds the score of 76% of the control group. Using Cohen's (1988) guidelines, effect sizes of 0.2, 0.5 and 0.8 were considered as small, medium and large respectively.

2.6.7 Sample size

The initial sample size calculations for this study were based on the assumption that mainstream statistical techniques such as multiple regression would be used to analyze the data. In these circumstances, the present sample would have been more than adequate to detect statistically significant outcomes. However, when it was recognized that the effects of clustering in the data needed to be offset by using hierarchical multilevel modeling the issues of sample size and statistical power had to be re-examined.

Studies involving HLM techniques face two problems in relation to sample size: Establishing the minimum number of cases needed to use this method and attaining sufficient statistical power to reach significance. Although Hox and Roberts, (2010) showed that the estimation of the elements in the fixed part of multilevel models are unbiased under most conditions, there is general agreement that having more groups is more important than having more cases per group (Kreft, 1996; Peugh, 2010; Raudenbush, 2008; Snijders & Bosker, 1999). Hox and Roberts (2010) also suggested that the random variations are best estimated using at least 100 groups, although they highlighted the need for more work to clarify this issue.

Power requirements vary depending on the particular hypothesis of interest. In general, fixed effects require fewer cases and main effects require fewer cases than cross-level interactions. Kreft (1996) found that when using HLM a sample size consisting of at least 30 groups with 30 participants per group were required to have sufficient power to

test fixed effects. However, Hox and Roberts (2010) indicated that when estimating random variances and cross-level interactions, in excess of 100 groups with ten participants are needed to power these tests sufficiently. In the context of longitudinal growth curves, one needs more than 5 groups and the greater the interval between tests the better (Raudenbush, 2008). In the present study only 25 of the 41 groups had more than 30 participants, and although a further 8 groups had between 20 – 30 participants, there were still some concerns that the study might be underpowered. However these considerations had to be balanced against the greater threat to validity that would have been posed had clustering effects not been taken into consideration.

2.6.8 Analysis of knowledge test scores

Several options were considered when calculating the scores on the knowledge tests in this study. The simplest option would have been to calculate the total number of correct answers provided by each student, with the further option of introducing a formula for negative marking. However, since the knowledge tests that were used as part of this research had not been used previously and since there was considerable heterogeneity in the sample neither of these solutions was deemed wholly adequate in terms of reliability and validity. Therefore an alternative method, based on item response theory testing was used to calculate the knowledge test scores in an effort to improve the psychometric properties of these tests.

2.6.8.1 Item response theory

The aim of many educational and psychological tests is to measure an underlying ‘latent’ variable, which is often regarded as an *ability* or a *proficiency*. Item response theory (IRT) constitutes a probabilistic model which attempts to explain the response of an individual to an item on a test (DeMars, 2010; Hambleton, Swaminathan, & Rogers, 1991; Lord, 1980) in terms of this proficiency. Unlike classical test theory, where examinees’ scores are determined by summing their test scores, IRT examines the quality of items by

calculating whether or not an examinee provided the correct answer to individual items.

Lord and Novick (1968) suggested that obtaining the maximum amount of information from a given set of items depends on three major factors:

- The measurement procedure – the manner in which the examinees respond to the items
- The specification of an item scoring rule or formula that is used for each item
- The combination of the item scores into a total score by an item weighting formula

IRT assumes that the probability of a random person j with proficiency θ_j correctly answering a random item i with a difficulty b_i is a function of the interaction between his/her proficiency and the difficulty of the item. Thus individuals with high proficiency are more likely to get easy items right, whereas individuals with low proficiency are more likely to get difficult questions wrong.

The proficiency parameter θ signifies the magnitude of the latent trait (e.g. knowledge proficiency) for each person who took the test. This score is computed and interpreted in a way that is very different from traditional scoring methods (e.g. total number or percentage of correct answers). The examinees' total number-correct score is not the actual score, rather the score is based on the item response functions (IRF), leading to a weighted score when the model contains item discrimination parameters. Thus the scores generated through an item-response-theory analysis are represented in a logit metric, which references a person's proficiency to the log of the odds of a correct response to items. Proficiency θ is measured on a scale that has a midpoint of zero and a unit of measurement of one and thus can be classified as an interval level of measurement, where a value of zero represents an average level of proficiency, positive values indicate levels of performance that is above average and negative values signify below average proficiency (Hambleton et al., 1991).

The item difficulty index b_i shows the proficiency at which a correct response to an item can be expected from approximately 50% of examinees. Thus, if $b = 0.3$, then about 50% of examinees with a proficiency of 0.3 would get the item right, whereas a larger proportion of examinees with a proficiency of 0.6 would do so.

Items can be calibrated using a range of models including Rasch or one-parameter logistic (1PL) models; two-parameter (2PL) or three-parameter (3PL) models. A discussion of the psychometric properties of each of these models is beyond the scope of this thesis (see DeMars, 2010 for more details) therefore from this point onwards sole reference will be made to the 2PL model which was deemed most suitable for the purposes of this research. The 2PL model is specified by the following equation, where θ signifies the examinee's proficiency, a is the discrimination parameter and b is the difficulty parameter:

$$P(\text{correct response} / a, b, \theta) = \frac{1}{1 + \exp(-a(\theta - b))}$$

This equation yields an Item Correlation Curve, which describes the relationship between the examinee's performance and the traits/proficiencies that underpin that performance. Variables a , b and c are the parameters of the curve and these vary from item to item (Hambleton et al., 1991). Tests for reliability and validity in 2PL models that use marginal maximum likelihood estimation, showed that item discrimination (the a -parameter) appears to be well estimated for samples of 500 regardless of item difficulty or distribution of proficiency (Drasgow, 1989; Harwell & Janosky, 1991). Although the 3PL model provides an additional c -parameter that adjusts for guessing, such a model was rejected in this research for two reasons. First, estimation of the c -parameter can distort the estimation of the a and b parameters, thus accurate estimation of the c -parameter requires very large samples. Secondly, calculation of the c -parameter is very demanding computationally where the penalty for guessing is not common across all of the test items

as was the case with the knowledge tests used in this study. IRT models do not require the data to be normally distributed, however estimation of IRT parameters requires large samples and longer tests provide more accurate θ estimates (C. M. Woods, 2008).

Item response analysis uses mathematical models that specify that the probability that an examinee will supply the correct answer to a given item depends on the examinee's proficiency and the characteristics of the item (Hambleton et al., 1991). One major advantage of using IRT is that when an IRT model fits the test data, the proficiency estimates for the examinees are not test-dependent, which means that proficiency estimates derived using different sets of items will be invariant across the tests (except for measurement error) (Hambleton et al., 1991). However, before proceeding with IRT analysis, several assumptions need to be satisfied about the data used in these models, the most important of which are unidimensionality and local independence. A test that measures a single proficiency is deemed unidimensional. Although the outcomes on knowledge tests are affected by other factors, such as cognition, personality and motivation, the assumption of unidimensionality is satisfied where there is a single “dominant” element that influences test performance (Hambleton et al., 1991). This is established by looking at the scree plot. The assumption of local independence is established when examinees' responses to any pair of items are statistically independent when their abilities are held constant. This is established using Yen's Q_3 Test (1984). These assumptions were tested in relation to the data produced on each of the knowledge tests in this research and the outcomes are reported at the beginning of the relevant sections.

Chapter 3: Personal Characteristics

3.1 Introduction

The field of personality research encapsulates two fundamental views of human nature; an ideographic perspective, which focuses on the uniqueness of individuals and a nomothetic view, which concerns itself with the human tendency to exhibit consistent patterns of thinking, feeling and acting in terms of personality traits (McCrae et al., 2000). In the latter part of the 20th century, the well-publicised person-situation debate between proponents of the nomothetic, trait-based approach, most notably Costa and McCrae, and advocates of the ideographic approach, including Mischel and Bandura, highlighted the strengths and weaknesses of these approaches in explaining and predicting human behaviour. On the one hand, Mischel condemned, what he saw as an over-reliance on trait-based explanations, by demonstrating that behaviour varies across situations and that the correlations reported in studies that used both self-reported trait measures and also assessed actual behaviour were typically less than .30 (Mischel, 1968). On the other hand, a range of studies using the five-factor trait model of personality showed that there is substantial consistency in personality traits across the adult lifespan and that trait scores were predictive of life-course outcomes (McCrae & Costa, 1989; McCrae et al., 2000). One such example involved a longitudinal study of Harvard graduates, which showed that trait measurements taken at the end of their college careers were significantly related to those taken 45 years later and that higher levels of traits such as conscientiousness, extraversion and openness to experience were associated with more positive outcomes, such as career success and general adjustment to variations in life circumstances (Soldz & Vaillant, 1999).

As a result of the insight gained during the person-situation debate, it is now generally accepted among theorists that personality constitutes a stable, generalised, distal influence on behaviour (Beirness, 1993; McCrae & Costa, 2004; Mischel & Shoda, 1995;

Ulleberg & Rundmo, 2003), which is mediated through more proximal socio-cognitive factors such as beliefs, attitudes and intentions (Ajzen, 1991). This view is also enshrined in TCI model of driving behaviour (Fuller, 2005).

Numerous studies have shown that individual differences in personality traits, including sensation seeking, impulsiveness and Big-Five markers, are predictive of a range of behaviours, including academic performance, risk taking, the development and maintenance of driving styles and crash involvement (Arnett et al., 1997; Winfred Arthur & Graziano, 1996; Chamorro-Permuzic & Furnham, 2003; Jonah, 1997; Stanford et al., 2009; Sümer, 2003). These findings have substantive implications for driver education. First, whereas cognitive ability is clearly an important factor in academic achievement, ability alone does not provide a sufficient explanation for individual differences in either the ability to learn or academic achievement. For instance, research conducted by Chamorro-Permuzic and Furnham, (2003; 2009) indicated that the Big-Five traits (Costa & McCrae, 1992) accounted for over 10% of the unique variance in exam grades achieved by university undergraduates over a three-year period. Furthermore, following their longitudinal study of New Zealanders aged from 3 – to 21-years-old, which assessed health risk behaviours, Caspi et al. (1997) noted that since the personality correlates of risk taking are evident early in life, knowledge of these characteristics would help programme developers build courses that can adapt to characteristic motivations, attitudes and feelings of specific audiences. Thus, knowledge about personality could be used to inform the content of educational interventions and also to customise interventions in order to make them more efficient and effective (Shope & Bingham, 2008). Whereas it is acknowledged that it is difficult to change personal dispositions, it also appears that the behavioural expression of these tendencies is amenable to modification through metacognitive practices (Flavell, 1979). These ideals are firmly enshrined in the GDE-framework (Hatakka et al., 2002), which posits that driver education programmes should incorporate metacognitive

exercises, for example to encourage students to identify their own personal tendencies, to understand the effects that these tendencies might have on their driving behaviour and to provide them with robust strategies to control maladaptive tendencies, thereby increasing safety.

3.1.1 Big-Five personality traits

In recent years the Big-Five model has come to dominate trait-based research into individual differences (McAdams & Pals, 2006), because evidence suggests that this model, encompassing five super traits (extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience) represents personality at its broadest level of abstraction (Costa & McCrae, 1992; Goldberg, 2011). As described by the International Personality Item Pool (Goldberg, 2011), five-factor domains subsume hundreds of traits. For instance, agreeableness incorporates facets such as trust, compliance and straight-forwardness. Conscientiousness includes goal-orientation, competence, deliberation and orderliness. Extraversion is marked by positive affect, excitement seeking and gregariousness. Neuroticism, which is labelled ‘emotional stability’ is characterised by anxiety, anger/hostility, impulsiveness and vulnerability. Openness to experience, which is labelled ‘intellect/imagination’, incorporates intellectual curiosity, fantasy and openness to aesthetics, feelings and values (Gullone & Moore, 2000).

Links between Big-Five traits and engagement in risky behaviour have been investigated empirically. For example, Nicholson, Fenton-O’Creevy, Soane, and Willman (2005) devised an index of risk taking across six life domains (career, health, finance, recreation, social and safety), which they used subsequently to examine the relationship between Big-Five traits and risk-taking. Their results showed that high levels of extraversion and openness, and that low levels of neuroticism, agreeableness and conscientiousness predicted risk-taking tendencies. However, the associations between Big-Five traits and risky driving are less clear. Whereas Booth-Kewley and Vickers

(1994) found that both low agreeableness and low conscientiousness were strong predictors of risky driving, neither neuroticism, openness, nor extraversion predicted this behaviour.

A number of Big-Five traits have also been linked with accident involvement. A meta-analytic study by Clarke and Robertson (2005) found that low conscientiousness and low agreeableness were valid and generalizable antecedents of accident involvement generally, with correlations of .27 and .26 respectively. They also showed that high extraversion was predictive of RTC involvement. Winifred Arthur and her colleagues (W Arthur & Doverspike, 2001; Winfred Arthur & Graziano, 1996) have demonstrated links between low conscientiousness and crash involvement repeatedly. For instance, one study involving 477 drivers, showed that individuals who rated themselves as more conscientious (i.e. more dependable, responsible and self-disciplined) were less likely to have been involved in an RTC than were those with lower scores for that trait (Winfred Arthur & Graziano, 1996).

Research also suggests that personality traits can influence risk judgements in adolescents. A study by Gullone and Moore (2000), involving 459 secondary school pupils aged from 11- to 18-years-old found that those who were more extraverted and/or more agreeable were also less likely to rate behaviours listed in the Adolescent Risk-Taking Questionnaire (Gullone, Moore, Moss, & Boyd, 2000) as risky. In addition, those who were more conscientiousness judged all types of risk, except thrill seeking, as riskier than did their less conscientious counterparts. The relationship between Big-Five traits and academic success has also been studied extensively (for a review, see de Raad & Schouwenburg, 1996). The bulk of this research involves college students, where consistent positive relations have been found between performance and both conscientiousness and openness, and negative relations with extraversion, and neuroticism (Busato, Prins, Elshout, & Hamaker, 1998, 2000; Chamorro-Permuzic & Furnham, 2003; de Raad & Schouwenburg, 1996). It is also worth noting that conscientiousness is regarded

as the most reliable predictor of performance at work (Barrick & Mount, 1991). Among children and adolescents, it seems that both extraversion and neuroticism act as positive predictors of achievement (de Raad & Schouwenburg, 1996). Since individual differences with respect to Big-Five traits appear to influence risk-taking behaviour, accident involvement, risk judgements and academic performance, then clearly these influences need to be acknowledged by course developers and suitably addressed as part of a good PLDE course.

3.1.2 Sensation seeking

Sensation seeking (SS) is a personality disposition that is characterised by a need to seek novelty and intensity of sensory experience (Arnett, 1994). Tendencies towards sensation seeking have been identified in the general population, using a variety of instruments, including the Arnett Inventory of Sensation Seeking (AISS) (Arnett, 1994). Elevated levels of SS have been associated with greater participation in a variety risky activities including extreme sports (Ruedl, Abart, Ledochowski, Burtscher, & Kopp, 2012), substance abuse (Wagner, 2001), risky sexual activities (Donohew et al., 2000) and risk taking in traffic (Arnett, 1994; Arnett et al., 1997). Both age and sex differences have been identified in AISS scores (Arnett, 1996; Donohew et al., 2000). For instance, the results from a German study involving almost 2,000 people aged between 16 - and 79-years, showed that age was inversely related to SS and that the scores for males were higher than those for females across all age categories (Roth, Schumacher, & Brähler, 2005). The same study also found that sociodemographic factors, such as socioeconomic status and place of residence, only explained a small amount of the variance in SS. Since consistently higher levels of SS have been found in adolescents when compared to adults (Hoyle, Stephenson, Palmgreen, Lorch, & Donohew, 2002; Jonah, 1997; Zuckerman, 1996), it has been proposed that SS might be partly responsible for the disproportionately high rates of road traffic crashes and fatalities among young drivers (Arnett et al., 1997). Jonah (1997)

reviewed 40 studies that investigated the relationship between SS and risky driving, and found moderate correlations between these factors ($r = 0.3$ to 0.4). Similarly, Rimmö and Åberg (1999) found that SS explained 27% of the variance in driving violations, which was 10 times more than the variation accounted for by driving errors. Beirness, and Simpson (1988) also identified SS as a contributing factor in accident involvement among American high school students in grades 9 – 11. Since, SS represents a risk-increasing factor for adolescent drivers, there is an obvious need to provide youngsters with knowledge about SS and insight into their own SS tendencies and the ways in which SS can have a negative impact on their safety and well-being.

3.1.3 Impulsiveness

Impulsiveness is characterised as “a predisposition towards, rapid, unplanned reactions to internal or external stimuli without regard to the negative consequences of these reactions” (Moeller, Barratt, Dougherty, Schmitz, & Swann, 2001, p. 1783). Research has shown that individuals who exhibit elevated levels of trait impulsiveness are prone to a variety of behaviours that have a negative impact on their own health and well-being, and on society generally. For instance, impulsiveness has been linked with sub-optimal levels of emotional and behavioural control in areas of educational performance (Fink & McCown, 1993; Stanford et al., 1996), mental health (Castellani & Rugle, 1995) criminal justice (Ireland & Archer, 2008) and general risk-taking (Haase & Silbereisen, 2011). This suggests that individual differences with respect to trait impulsiveness may also constitute useful predictors of pre-existing levels of knowledge, skills and attitudes and also of educational outcomes with respect to PLDE.

The Barratt Impulsiveness Scale (BIS), is the most widely used measure of trait impulsiveness (Stanford et al., 2009). The original BIS scale consisted of 30-items designed to measure three sub-traits: cognitive impulsiveness (making quick decisions), motor impulsiveness (acting without thinking) and non-planning impulsiveness (lack of

foresight) (Barratt, 1959). Furthermore, Patton, Stanford and Barratt (1995) believe that the overall item pool constitutes a “homogenous measure of impulsiveness”, which indicates that a total scale score can also be used to assess overall impulsiveness. The BIS-30 was designed to clearly differentiate impulsiveness from other action-based personality characteristics such as extraversion, sensation seeking and risk taking (Stanford et al., 2009). Using the updated BIS-II, Stanford et al. (1996) found that impulsiveness was positively correlated with a number of risk taking behaviours including aggression, drug use, drink driving and not wearing seatbelts. The same study also showed that levels of impulsiveness were higher in males than females and was higher in high school students than in college students. Thus, it is possible that excessive impulsiveness may partly explain the overrepresentation of young male drivers RTCs.

Research also suggests that impulsiveness acts as a moderator between intelligence and academic success; students with high impulsiveness and high academic ability tend to have lower grades than do those with low impulsiveness and high ability (Zeidner, 1995). For example, in a study of 241 Spanish secondary school students aged between 12 – 17-years, using the BIS-10, Vigil-Colet and Morales-Vives (2005) found significant positive correlations between academic failure and non-planning (.29), cognitive (.27), and overall impulsiveness (.31). One likely explanation for these findings is that children and adolescents with an impulsive problem-solving style do not persist with learning tasks (Fink & MCCown, 1993). Another explanation focuses on the cognitive aspect of impulsiveness, suggesting that impulsive individuals tend to respond quickly, with little analysis or reflection (Vigil-Colet & Morales-Vives, 2005), which may indicate that they might not apply themselves adequately when responding to surveys. The BIS 15 was developed by Spinella (2007) to provide a short version of the BIS that would be suitable for use in larger surveys, such as the present study.

Thus, an accumulation of evidence suggests that individual differences in personality traits constitute a significant antecedent influence on cognition, affect, and behaviour. In addition, the TCI model (Fuller, 2005) predicts that personality represents a significant antecedent influence on driver capability and thereby on driving behaviour.

3.2 Aim

This part of the study aims to calculate scores for sensation seeking, impulsiveness and the Big-Five-personality traits. These scores will be used subsequently to investigate the impact that these traits might have on driving-related knowledge, skills and attitudes of PLDs before taking a PLDE course, immediately after taking a course and again 9 months later. The results of these tests will be reported in chapters 5, 6 and 7 as part of the summative evaluation. Method

3.2.1 Design

See Chapter 2, subsection 2.3

3.2.2 Participants

See Chapter 2, subsection 2.2.

3.2.3 Procedure

See Chapter 2, subsection 2.5

3.3 Measures

Three well-known inventories were used to measure personality characteristics in this research:

1. Arnett Inventory of Sensation Seeking (AISS) (Arnett, 1994).
2. Barrett Impulsiveness Scale-15 (BIS-15) (Spinella, 2007).
3. International Personality Item Pool-50 item set of Big-Five traits (IPIP-50) (Goldberg, 2011).

3.3.1 AISS

The 20-item AISS (Arnett, 1994) incorporates 2 sub-scales; Novelty (10 items) and Intensity (10 items). Responses were given on a 4-point Likert scale (1 = Describes me very well – 4 = Does not describe me at all), (Appendix D, Question 14) and these scores were reversed subsequently such that higher scores suggested a greater tendency towards sensation seeking. The AISS is used widely to measure sensation seeking, however, although some studies showed that Arnett's two-factor model of sensation seeking provided a reasonably good fit for the data (Ferrando & Chico, 2001), others found that the internal consistency of the model was low (Arnett, 1994; Haynes, Miles, & Clements, 2000; Roth & Hertzberg, 2004). For example Arnett himself (1994) reported poor Cronbach's α values for both the intensity (.64) and the novelty sub-scales (.5), and the value of the overall scale was barely adequate (.7). Furthermore, the results from studies conducted by Haynes et al. (2000), and Roth and Hertzberg (2004)¹⁰, who used confirmatory factor analysis (CFA) to test the factor structure of the AISS, highlighted problems with respect to some of the AISS items because they failed to load onto their designated sub-scales, which suggests that the current test may need some revision.

3.3.2 BIS-15

The BIS-15 (Spinella, 2007) consists of a 15-item scale comprising 3 sub-scales, i.e. motor and attentional impulsiveness and non-planning (5 items for each). Responses were measured on a 4-point Likert scale (1 = Rarely/never – 4 = Almost always) (see Appendix D, Question 34). Although there are six positively valenced items in this scale, scores for these items are reversed prior to data analysis, thus a higher score on this scale indicates a stronger tendency towards impulsiveness. Although Spinella reported good internal consistency for the entire scale ($\alpha = .81$), no alpha values were provided for the three sub-scales. However he also reported that scores on the BIS 15 correlated highly

¹⁰ Note the mean participant ages in these studies were 24.8 and 14.9 years respectively.

with those on the BIS-30 ($r = .94, p < .001$). In addition, scores on the BIS 15 were inversely related to age and the instrument related to other measures that assess executive functions and impulsiveness. Thus, Spinella concluded this shorter scale serves as a useful alternative to the BIS-II, while retaining good psychometric properties. In their review of 50 years of research using the 30-item BIS, Stanford et al., (2009), reported alpha values of .74, .59 and .72 respectively for the Attentional, Motor and Non-planning subscales and .83 for the overall scale.

3.3.3 IPIP-50

The IPIP-50 test (Goldberg, 2011) provides a public-domain alternative for measuring Big-Five personality constructs which feature in major commercial inventories (e.g. Costa and McCrae's Neo-Pi-R(1992)). The inventory uses 10 items to measure each of the 5 personality factors: Extraversion, Agreeableness, Conscientiousness, Emotional Stability and Intellect/Imagination. Responses were recorded using a 5-point Likert scale (1 = Very Inaccurate – 5 = Very Accurate), (Appendix E, Question 46). Scores for negatively valenced items were reversed subsequently, thus higher scores indicate a stronger tendency towards these dispositions

The IPIP-50 scale has good internal consistency, with a reported Cronbach's alpha coefficient of .84 for the 50-item scale and alphas of .87 for extraversion, .82 for agreeableness, .79 for conscientiousness, .86 for emotional stability and .84 for intellect/imagination (Goldberg, 2011).

In the current research, both the AISS and the BIS-15 tests were conducted at T1, and the IPIP test was conducted at T2. This was done in order to balance the sizes of the questionnaires that were used in both tests and to avoid overtaxing the participants in any one test.

3.4 Results

3.4.1 Confirmatory factor analysis

The data from each inventory was subjected to separate confirmatory factor analyses (CFA) using Amos (Version 18.0) (Arbuckle, 2009), to ascertain the psychometric properties of these tests. Preliminary analyses revealed excessive kurtosis in some of the data, thus further analysis was conducted using *asymptotic distribution free* estimation, which makes no distributional assumptions and can be used where sample sizes exceed 1,000 (Muth  n, 1993). The following well-established criteria were used to judge the acceptability of each model in this research:

- The Goodness of Fit Index (*GFI*) exceeds .90 (Byrne, 2010)
- The Comparative Fit Index (*CFI*) exceeds .93 (Byrne, 2010)
- The Root Mean Square of Approximation (*RMSA*) is less than .08 (M. W. Brown & Cudeck, 1993) and ideally less than .05 (Steiger, 1990).
- The Expected Cross Validation Index (*ECVI*) should be less than 2 or 3 (Kline, 2011).

Attempts to fit unidimensional models and a range of multi-dimensional models for each of the three inventories were unsuccessful (see Appendix L for full details). The following results from the final attempt to fit unidimensional models for each instrument show that *ECVI* and the *CFI* indices were outside of acceptable levels.

- AISS: (χ^2 (1880) = 605.65 [$p < .001$]; *RMSEA* = .06 [.05-.06]; *GFI* = .95; *CFI* = .67; *ECVI* = .36 [.32-.40])
- BIS: (χ^2 (1880) = 551.75 [$p < .001$]; *RMSEA* = .05 [.049-.058]; *GFI* = .94; *CFI* = .61; *ECVI* = .33 [.291-.370])
- IPIP: (χ^2 (1880) = 10196.26 [$p < .001$]; *RMSEA* = .06 [.06-.06]; *GFI* = .79; *CFI* = .60; *ECVI* = 5.54 [5.37-5.72].

3.4.2 Exploratory factor analysis

As an alternative, the scores on these tests were subjected to separate exploratory factor analyses (EFA) using principal component analysis (PCA). The suitability of the data for factor analysis was assessed independently for each test. Inspection of the correlation matrices for each test revealed the presence of many coefficients of .3 and above, the Kaiser-Meyer-Olkin (Kaiser, 1974) values exceeded .80 and Bartlett's Tests of Sphericity (Bartlett, 1954) reached statistical significance ($p < .05$), supporting the factorability of the correlation matrices. To aid the interpretation the resulting components, oblique (promax) rotations were performed in an attempt to achieve the most parsimonious simple structure, while permitting the factors to correlate, since the results of the CFAs had established that there was some overlap between the latent constructs in each test (see Appendix L). Having identified the relevant factors in each test, the Cronbach's alpha (α) (Cronbach, 1990) was computed to assess the internal consistency of the individual scales and sub-scales. The following rule-of-thumb outlined by Nunally (1978) was used to categorise α ; $> .9$ – Excellent, $> .8$ – Good, $> .7$ – Acceptable, $> .6$ – Questionable, $> .5$ – Poor, and $< .5$ – Unacceptable. Then mean score were calculated for each scale. According to Tabachnick, and Fidell (2001), this method preserves the variation in the original data and is generally acceptable for most exploratory research designs.

3.4.2.1 AISS

The CFA of the 20-item AISS inventory showed that 4 of the observed variables that Arnett (1994) proposed should load on to the Novelty factor (items 3, 5, 13, and 15) and 1 observed variable that should load on to the Intensity scale (item 4) failed to load significantly on to these factors. Similar problems with these items have been reported in previous studies (e.g. Haynes et al., 2000; Roth & Hertzberg, 2004). In order to improve the validity of this scale in the present study, the PCA was conducted using only the

remaining 15 items: Items 1, 7, 9, 11, 17 and 19 from the Novelty scale, and items 2, 6, 8, 10, 12, 14, 16, 18 and 20 from the Intensity scale. The unrotated solution revealed the presence of five components with eigenvalues exceeding 1, explaining 51.95% of the variance. Although Kaiser (Kaiser, 1974) recommends that all factors with an eigenvalue above 1 should be retained, because they represent a sizeable amount of variation, Cattell, and Vogelmann (1977) demonstrated that the scree test represents a reasonably reliable criterion for factor selection, while offering a more parsimonious solution. An inspection of the scree plot revealed a clear break before the 3rd component (Figure 10.1¹¹); two components, which explained 42.4% of the variance, were retained for further investigation. Inspection of the Factor Pattern Matrix (Table 10.1) showed that three items related to Intensity (2, 8 and 14) failed to load significantly on to any of the components, therefore another PCA was performed using the remaining 12 items. This revealed the presence of 4 components with eigenvalues exceeding 1, explaining 52.25% of the variance. However, since the scree plot revealed a clear break after the second component (Figure 10.2), two factors were retained for further investigation. The internal consistency of these factors was tested using Cronbach's alpha criterion (Cronbach, 1990) and since the alpha values for these sub-scales were low (.5 for Novelty and .58 for Intensity), neither of these sub-scales were considered suitable for further use. However, the alpha value for a single factor comprising the 12 remaining items was acceptable (.70), therefore a mean score for this general scale was calculated for each participant, which was used during subsequent analyses. The sample mean on this scale was 2.54 ($SD = .46$). An independent samples t-test was conducted to compare the AISS scores for males and females and the results showed that the scores for males ($M = 2.68, SD = 0.41$) were significantly higher than those for females ($M = 2.38, SD = 0.45$); $t(1878) = 15.06, p < .001$, two tailed, $d = .69$).

¹¹ Note: Tables and Figures which are labelled as "10. " are presented as part of the appendices.

3.4.2.2 BIS-15

The PCA of the items from the BIS-15 inventory (Spinella, 2007) revealed the presence of three components with eigenvalues exceeding 1, explaining 46.27% of the variance. Since this was consistent with previous finding using this test (e.g. Spinella, 2007), and those based on the BIS-30 (e.g. Patton et al., 1995), these components were retained for further analysis. The Factor Pattern Matrix (Table 10.3) revealed a number of strong item loadings onto all three factors. Factor 1, consisting of 5 items (1, 5, 7, 11 and 13) was labelled “Behavioural Impulsiveness” (BI), and accounted for 26.96% of the variance. Factor 2, consisting of 6 items (2, 4, 8, 9, 12 and 15) was labelled “Poor Cognitive Planning Skills” (PCP) and accounted for 12.34% of the variance, and Factor 3, consisting of 4 items (3, 6, 10 and 14) was labelled “Distractibility (D), and accounted for 6.97% of the variance. This factor structure broadly replicated the one produced by Spinella (2007) during the development of the BIS-15, however in the present study item 4 “I concentrate easily” was associated with PCP rather than with D. This may be due to a method effect (i.e. a confound that arises as a result of the way that items are worded (see Cordery & Sevatos, 1993), since all 6 positively valenced items loaded onto the same factor (PCP).

Cronbach’s alpha reliability coefficients were calculated for the BI (.69), the PCP (.67) and the D (.67) scales. Since alpha values between .6 and .7 are considered questionable and since the alpha reliability for the full 15-item scale (.79) was more acceptable (see Nunally, 1978), a sample mean score was calculated for this scale ($M = 2.28$, $SD = .45$). An independent samples t-test was conducted to compare the BIS-15 scores for males and females. Although the score for the females ($M = 2.33$, $SD = 0.48$) was significantly higher than that for males ($M = 2.24$, $SD = 0.42$), $t(1878) = -4.11$, $p < .001$ (two tailed, $d = 0.2$) this difference was small.

3.4.2.3 IPIP-50

The PCA of the IPIP-50 inventory (Goldberg, 2011) revealed the presence of 11 components with eigenvalues exceeding 1, explaining 51.57% of the variance. Since the scree plot did not suggest a clear solution (Figure 10.3), a five-factor solution was imposed on the data in correspondence with previous findings based on the IPIP (e.g. Goldberg et al., 2006) and the NEO-Pi-R (e.g. McCrae & Costa, 2004; O'Connor & Paunonen, 2007), both of which measure Big-Five personality traits. Reflecting the nomenclature used by Goldberg (2011), these factors were labelled “Extraversion”, “Emotional Stability”, “Agreeableness”, “Intellect/Imagination” and “Conscientiousness”, and accounted for 35.4% of the overall variance in the model. The factor pattern (Table 10.4) showed that, with the exception of item 2 “Feel little concern for others” and item 19 “Seldom feel blue”, which were removed subsequently, the remaining 48 items loaded strongly on to the expected factors, which supports the reliability of the five-factor solution. A sample mean was computed for each factor, summary properties of which are provided in (Table 3.1) which shows that the factor means were all above the scale mean, suggesting slightly elevated levels of these traits in the present sample. The internal consistency of the scales was adequate.

Table 3.1 IPIP factors, including variance explained, alpha reliabilities and mean scores

Factor No.	Factor Name	Factor items	Variance explained	α	Mean (SD)
1	Extraversion	1, 6, 11, 16, 21, 26, 31, 36, 41, 46	10.92%	.79	3.38 (0.61)
2	Emotional Stability	4, 9, 14, 24, 29, 34, 39, 44, 49	8.01%	.76	3.16 (0.61)
3	Agreeableness	7, 12, 17, 22, 27, 32, 37, 42, 47	7.08%	.74	3.71 (0.53)
4	Intellect/Imagination	5, 10, 15, 20, 25, 30, 35, 40, 45, 50	4.83%	.74	3.43 (0.56)
5	Conscientiousness	3, 8, 13, 18, 23, 28, 33, 38, 43, 48	4.54%	.72	3.12 (0.55)

Gender differences for each of the traits were examined using independent sample t-tests and the results revealed small significant differences on all the traits except conscientiousness. The mean score for conscientiousness for males was 3.15 ($SD = 0.51$) and for females it was 3.09 ($SD = 0.59$), $t(1321) = .13, p > .05$. The mean score for emotional stability was significantly higher for males ($M = 3.28, SD = 0.59$) than females ($M = 3.02, SD = 0.6$), $t(1321) = .34, p < .00, d = 0.45$. Similarly, the mean score for intellect/imagination was significantly higher for males ($M = 3.47, SD = 0.55$) than females ($M = 3.38, SD = 0.57$), $t(1321) = 3.04, p < .00, d = 0.16$. The mean score for extraversion was significantly higher for females ($M = 3.43, SD = .65$) than males ($M = 3.34, SD = 0.58$), $t(1321) = 2.76, p < .00, d = 0.15$. Also the mean for agreeableness was significantly higher for females ($M = 3.88, SD = 0.54$) than males ($M = 3.57, SD = 0.49$), $t(1321) = 10.68, p < .001, d = 0.6$.

3.5 Discussion

The results of this study highlighted some problems with the psychometric properties of the AISS (Arnett, 1994), the BIS-15 (Spinella, 2007) and the IPIP-50 (Goldberg, 2011) which suggests that, in their current form, none of these tests were wholly adequate when it came to describing the personality attributes of the adolescents in the current sample. The CFA analyses showed that neither unidimensional nor multidimensional factor models for any of the tests represented a good fit for the data. However, it should be noted that it is more difficult to satisfy the various criteria used for judging model fit when one is obliged to use asymptotic distribution free estimation than it is when the data are more normally distributed (Byrne, 2010). It is unlikely that the excessive kurtosis in the data was due to an actual lack of variability, given the large sample size. However, it is also acknowledged that some of the problems occurred relation

to factor analyses in this study might have arisen because the scales that were used were developed for adults rather than for adolescents.

Nevertheless, the results for the PCAs for the IPIP and the BIS-15 showed that, with minor exceptions, all of the items loaded onto the expected factors and that the resulting scales had good internal consistency, which accords with findings from research with adult samples (Goldberg et al., 2006; Spinella, 2007). This suggests that both the IPIP-50 and the BIS-15 instruments are capable of measuring Big-Five personality traits and impulsiveness in adolescents, which may be of some interest to the research community, given that both of these tests are short and are available free of charge.

However, the various difficulties outlined above with respect to the original 20-item AISS scale suggest that this test did not constitute a valid measure of sensation seeking in the current sample. The combined results of the CFA and the EFA showed that over 40% of the items failed to load properly on to the correct sub-scales and the internal consistency reliability of these sub-scales was poor also. Similar results have been reported in previous studies that examined the factor structure of the AISS using CFA. For example, in a study involving 822 US undergraduates, with a mean age of < 25-years ($SD = 8.3$), Haynes et al, (2000) needed to remove 7 items due to low factor loadings (items 3, 13, 15 and 17 from the Novelty sub- scale, and items 10, 14, and 16 from the Intensity sub-scale) to derive a version of the AISS which fitted the data adequately. Similarly, research conducted by Roth, and Hertzberg (2004) with a sample of 1,949 German adolescents aged between 14 – 16-years, also produced low factor loadings with respect to 8 AISS items (items 3,5,13, 15 and 17 from the Novelty sub-scale, and items 2, 10 and 14 from the Intensity sub-scale), prompting their removal. It is interesting to note that 4 items, that proved problematic in those studies were also problematic in the present study; item 3 “If I have to wait a long time, I am usually patient about it”, item 13 “I do not like extremely hot and spicy food”, item 14 “In general, I work better when I am under pressure” and item

15 “I often like to have the TV on while I am doing something”. Given that all three studies were conducted in different countries, with different aged samples and also that Roth and Hertzberg used a German translation of the AISS, it is clear that these particular items do not constitute valid generalized measures of their respective sub-scales and should perhaps be removed from the AISS inventory. For instance, it is likely that item 3 assesses patience as opposed to a low desire for novelty. Younger adolescents may have limited experience with making the decisions described in items 13 and 15, depending on their families’ lifestyles. Given that 7 further items (2, 4, 5, 8, 10, 16 and 17) have proved problematic in the U.S, the German and/or the present study, this suggests that over 50% of the items on the AISS do not measure the construct that they were designed to measure on a consistent basis and thus warrant further investigation.

The poor performance of the AISS is generally attributed to Arnett’s failure to establish the psychometric properties of the test at the outset, devising the test instead on the basis of the face validity of the constituent items (Haynes et al., 2000; Roth & Hertzberg, 2004). The best-studied alternative, Zuckerman’s Sensation Seeking Scale, Form V (Zuckerman 1996), appeared unsuitable for the current research, since it requires that participants adjudicate on activities such as flying an airplane, homosexuality and sexual experiences, which not only describe behavioural willingness rather than sensation seeking (Mallet & Vignoli, 2007), but are also plainly unsuitable for measuring of sensation seeking in younger adolescents. Thus, further research is warranted to investigate the underlying structure of sensation seeking as a personality trait and to formulate a test that can measure that construct more accurately than can the present formulation of the AISS, especially in young adolescents.

3.5.1.1 Gender effects

Gender differences in the scales on the IPIP=50 were broadly in line with expectations. Differences in agreeableness and emotional stability (opp. neuroticism)

evidenced in this study were consistent with those reported in previous studies of adults and adolescents (Costa & McCrae, 2001; Gullone & Moore, 2000). Females had significantly higher levels of agreeableness and significantly lower levels of emotional stability than males. Also in accord with Gullone and Moore's findings, males reported higher levels of conscientiousness than females, albeit that these differences were non-significant. Moreover, whereas males scored higher on intellect/imagination (openness to experience), the females in this study appeared to be more extraverted than the males. It is notable however, that the magnitude of gender differences that were found was quite small.

Males also recorded significantly higher levels of sensation seeking and gender differences accounted for 11% of the variation in the scores on that scale. Although Arnett (Arnett, 1994) did not provide effect size calculations for his research, the present results accord with findings from the Roth and Hertzberg study reported earlier (2004) which recorded a medium sized gender effect in favour of males using Cohen's *d* test. Although significant gender differences were also evident for impulsiveness in this research, these effects were very small. Moreover, whereas significant gender differences were found with respect to several of the traits that feature in this study, the magnitude of most of these differences was so small as to render them negligible. Similar outcomes are common in studies featuring large sample sizes. In sum, the results of this study indicate that there were meaningful gender differences in the levels of sensation seeking, emotional stability, and agreeableness in the current sample, where males exhibited higher levels of the former two traits and females reported higher levels of the latter trait.

The principal aim of this part of the study was to measure personality traits that (theoretically) constitute antecedent influences on behaviour (i.e. the Big-Five) and also on risk-taking (i.e. sensation seeking and impulsiveness). Despite the large sample size, a number of problems were identified regarding the validity of these tests, most notably with the AISS (Arnett, 1994). Nevertheless, scores on these scales were calculated for each

participant and these were used during the remainder of this study to test for the possible effects of these traits on driving-related knowledge, risk perception skills and attitudes. However, since the TCI model (Fuller, 2005) also posits that prior learning represents a significant influence on knowledge, skills and attitudes and thereby on driver capability, the next chapter will examine that issue in some detail.

Chapter 4: Learning and experience

4.1 Introduction

An understanding of the phenomena and principles of learning is an essential prerequisite in any study of human behaviour (Levin, 2005). This is especially true when that behaviour occurs in an educational setting as is the case with the present research. There is general agreement among practitioners and researchers across a wide range of disciplines, including educationalists, psychologists and neuropsychologists, that learning is a process whereby experience produces a relatively enduring change in an organism's behaviour or capabilities (Bandura, 1977; Bransford et al., 2000; Brunner, 1966; E. R. Kandel, Schwartz, & Thomas, 2000; Piaget, 1971; Skinner, 1974). The scientific literature on human learning, development, cognition, brain functioning and culture is colossal, thus a detailed explication of these principles is beyond the scope of this study. Instead, there follows a brief review of theories and research that are pertinent to driver behaviour on the one hand and that have specific implications for the design, implementation and assessment of school-based educational interventions on the other.

Learning entails the acquisition of some type of knowledge, which is then stored in the form of memory (Reber & Reber, 2001). Schacter, Wagner and Buckner (2000) identified four long-term memory systems; episodic memory, semantic memory, perceptual-representation system and procedural memory. One of the main ways in which memory systems differ is in their reliance on explicit or implicit memory processes; the former involves conscious recollection of previous experience whereas the latter is evidenced when performance on a memory task relies mainly on unconscious mental processes. Much of the evidence supporting the existence of separate memory systems was derived from studying patients with memory deficits. For example, Vargha-Khadem

et al. (1997) studied children who sustained bilateral hippocampal damage before they had the opportunity to develop semantic memories. Although these children had poor recall of the day's events, e.g. television programmes that they watched, their speech and language development, literacy and factual knowledge were all within the normal range.

Episodic and semantic memories involve explicit memory processes, and as such, are often subsumed under the heading of declarative memory. Episodic memory involves the conscious recall of personal events from the past and semantic memory refers to knowledge about the world (Eysenck & Keane, 2010). The cognitive processes that occur during explicit learning have a substantial influence on subsequent long-term memory. Craik and Lockhart's levels-of-processing theory (1972) posited that the depth of processing of a stimulus has a sizeable impact on its memorability and that deeper levels of analysis produce stronger memory traces than do superficial levels of processing. Craik and Tulving (1975) demonstrated that the elaboration of processing is important for encoding memories. Over a number of trials they presented participants with a word and a sentence where a word was missing, and the task was to decide whether or not the word fitted into the blank space. Elaboration was varied by the complexity of the sentences, for example, "She cooked the....." and "The great bird swooped down, and carried off the struggling....." Cued recall in a subsequent test was twice as high for words accompanying more complex sentences, indicating that elaboration facilitates long-term memory.

The distinctiveness of a stimulus also affects memorability and two interesting phenomena have been studied in this regard; the self-reference effect, and flashbulb memories. The self-reference effect is tested by comparing participants' self-judgements with those that they make about others and tests the hypothesis that stimuli involving the former will be better recalled than those involving the latter. In a meta-analysis of 60 self-reference studies, Symons and Johnson (1997) found clear evidence supporting the

existence of this effect. They also showed that self-references worked best to facilitate memory when the stimuli used are commonly organized and elaborated through self-reference. For instance there was a stronger self-reference effect for personality traits than for nouns describing parts of the body. Flashbulb memory (R. Brown & Kulik, 1977) describes long lasting vivid memories that people have for dramatic events, for instance, the assassination of President Kennedy, or being involved in a car crash. Research shows that flashbulb memories depend on three main factors; (a) prior knowledge, which helps to relate the event to existing memory structures, (b) personal importance, as predicted by self-reference theory and (c) a feeling of surprise and an emotional reaction (Conway et al., 1994). Evidence supporting the memory enhancing effects of levels of processing, self-reference and flashbulb phenomena supports the assumption that individuals who have been directly or indirectly involved in a RTC should remember that event and thus their crash histories may have some bearing on their subsequent knowledge, risk perceptions and attitudes, and thereby on their amenability to the road safety messages delivered as part of a PLDE course.

Learning also involves implicit memory processes such as the acquisition of procedural memory and perceptual representations. Procedural memory is used in acquiring cognitive and motor skills (Schacter et al., 2000), such as learning to drive. The perceptual representation system is best described in terms of the repetition priming effect. For example, evidence shows that stimulus processing occurs faster and/or more easily on successive presentations of a stimulus (Schacter et al., 2000). Some of the theories presented above have implications for the development and refinement of driver education courses. They show that learning is enhanced by repetition and elaboration and when the material is distinctive and/or has personal relevance to the students.

4.1.1 Learning theories

Psychologists distinguish between two modes of learning: Direct learning, which happens as a result of trial-and error, and indirect learning, which is based on observation or instruction (Fuller, 2002). In practice, learning can, and often does, entail both of these processes. The behaviourist movement focused almost exclusively on explaining direct learning, the social learning and constructivists paradigms mainly concerned with indirect learning and the cognitivist approach addressed both of these types of learning.

4.1.1.1 Behavioural theories

Modern-day theorising about how people learn began in earnest with the advent of the behaviourist movement (Bransford et al., 2000). Behaviourism is an empirical approach to learning that focuses on observable behaviour and on the stimuli that elicit it, without reference to the mind or mental processes (Skinner, 1974). The central tenet of behaviourism is that almost all behaviours are learned by means of conditioning, which occurs as a result of interacting with the environment. During the learning process, associations are formed between environmental stimuli and behavioural responses, which are fuelled by primal drives, such as hunger and also the presence of external forces, such as rewards and punishments (Leslie & O'Reilly, 2003; Skinner, 1974). Mainstream behaviourism focuses on two types of learning: classical and operant conditioning. Classical conditioning, describes a type of incidental learning that occurs automatically when a stimulus (unconditioned) that elicits a response becomes associated with another stimulus (conditioned) which subsequently acquires the capacity to evoke the same response (Leslie & O'Reilly, 2003). Operant conditioning describes the modification of voluntary behaviour on the basis of consequences, most notably through a process of trial-and-error (Thorndike, 1966). Skinner (1974) viewed operant conditioning in terms of relations between antecedents, behaviours and consequences (ABC) and this so-called

“three-term-contingency” provides a reasonably comprehensive account of the acquisition and maintenance of a wide range of behaviours (Leslie & O'Reilly, 2003).

4.1.1.2 Cognitive theories

Alternatively, cognitive theories focus on the changes that occur in thinking in response to learning. Cognitive scientists specialise in describing and explaining the mental structures and processes that underlie the acquisition, adaptation and regulation of behaviour, including attention (Treisman & Gelade, 1980), perception (Gibson, 1979; Milner & Goodale, 1995), memory (Atkinson & Shiffrin, 1968; Baddeley, 1982) and general information processing (Shiffrin & Schneider, 1977a). They also address more complex cognitive processes which are involved in using or transforming previously acquired knowledge and skills, for example, adapting existing concepts (Piaget, 1978), problem solving (Newell & Simon, 1972), the development of expertise (Anderson, 1996; Ericsson et al., 1993), transfer of training (Barnett & Ceci, 2002) and metacognition (Flavell, 1979).

4.1.1.3 Social cognitive theory

The social cognitive approach to learning attempts to synthesise ideas from the behaviourist, cognitive and social paradigms within psychology (Bandura, 1989). The theory was built around the concept of the *triadic reciprocal determinism*, whereby behaviour, personal factors (including cognition) and environmental influences “all operate as interacting determinants that influence each other bi-directionally” (Bandura, 1989, p. 2). As part of this project, Bandura pioneered the study of indirect, observational learning, which he termed *modelling*, and this concept has made a significant contribution to current thinking about learning processes. According to Bandura (1989) almost all learning which occurs as a result of direct experience can also occur vicariously by observing people’s behaviour and noting the consequences. Furthermore, Bandura’s research on vicarious learning showed that whereas children acquire the knowledge and the

capability to emulate the behaviour of a role model quite easily, they are selective in the way that they express this learning behaviourally. For example, studies on the acquisition of gender-role learning, showed although children learned from observing both male and female role models, they did not ordinarily express all of these behaviours because they judged that some of them are inappropriate for their sex (Bandura, 1965). Observational learning also exerts a distal influence on behaviour. For example Bandura and Walters' Bobo doll experiments (1963) suggested that acquired knowledge and behavioural capabilities may not be translated into action until an suitable opportunity presents itself. This suggests, for example, that children and young adolescents begin learning to drive by observing their parents actions and emulate this behaviour when they themselves start to drive.

The social cognitive perspective also provides some insight into the differential effects of parental socioeconomic status on outcomes for their children. An abundance of evidence suggests that there is a strong relationship between parental socioeconomic status and a range of adolescent outcomes, including educational attainment (Zwick & Greif Green, 2007), lower levels of health-related knowledge (La Torre, Perna, De Vitto, Langiano, & Ricciard, 2002), crash involvement when driving (Hasselberg & Laflamme, 2003, 2008, 2009). In the field of education, for example, the association between standardised test scores and socioeconomic status (SES) is well-established (Zwick & Greif Green, 2007). In the U.S., prospective college entrants are required to take the Scholastic Assessment Test (SAT), which tests their capacity for mathematics, critical reading and writing and test results show that there is a consistent, positive relationship between SES and SAT test scores. For instance, data from the 2005 test, indicated that test scores for students whose family income exceeded \$100,000 per annum were approximately 1 standard deviation unit above those for students whose family income was less than €10,000 (College Entrance Examination Board, 2005). Similarly, the results from

a study investigating the relationship between health-related knowledge and socio-economic status of Italian adolescents, found that youngsters from lower socioeconomic backgrounds knew significantly less about proper dietary requirements, sexually transmitted diseases and the effects of psychoactive drugs on perception and consciousness (La Torre et al., 2002). Finally, the relationship between parental SES and the crash involvement of their young novice driver offspring was examined in a series of Swedish studies (Hasselberg & Laflamme, 2003, 2008, 2009), which reported that there was a negative relationship between these factors: The higher the SES of the parents, the lower the crash involvement of their children. It is generally supposed that the detrimental effects of being brought up in a low-SES family are due to the combination of relative deprivation within the family and within the low-SES neighbourhoods. Adolescents from such backgrounds usually have more limited exposure to positive role models and more limited access to material resources than their better-off counterparts (Gordon et al., 2000). Thus SES constitutes a significant environmental influence on adolescent learning and behaviour, which suggests that the existence of individual differences in SES should be considered by PLDE course developers and evaluators.

4.1.1.4 Constructivist theories

Constructivism expands on the social cognition model by describing and explaining the various ways that individuals actively construct their knowledge as a result of interacting with other people and the environment (G. Simpson, 2001). Early constructive approaches viewed learning as a process of organising, assimilating, and accommodating new information into their existing cognitive structures (schemas) (Piaget, Inhelder, & Weaver, 1969). Constructivism also emphasises the role of social context in the formulation of knowledge and mutual understanding. For example Vygotsky's zone of proximal development theory, posits that individuals can, with help from someone who has

more advanced knowledge, master concepts and ideas that they would not be able to understand on their own (Vygotsky, 1978).

4.1.2 Implications of learning theories for educational practice

Behaviourist, cognitivists, social cognitivists and constructivist theories have contributed to increasing understanding about the processes that are involved in learning and in teaching. Historically, the main goal of primary and post-primary school education was to provide students with knowledge, thus success was demonstrated through being able to remember, and repeat information (Bransford et al., 2000). Today, however, as a result of advanced understanding of learning and memory processes, ‘knowing’ is construed in terms of being able to find and use information (Simon, 1996). To illustrate, when driving, it is one thing to know the physical laws that dictate the braking distance of a vehicle under any given condition, but it is quite another thing to access and use this information to establish and maintain a safe distance from the vehicle in front. This change in educational focus reflects the growing influence of cognitivist and constructivist ideas (Moreno, 2010). Today’s educationalists concentrate on helping students to develop the necessary tools and strategies that will enable them to acquire knowledge and that allow them to think productively about subject matter ranging from mathematics to social, personal and health education (Bransford et al., 2000). These latter would encompass road safety education and PLDE. Such developments have implications for educational practice. The recent overhaul of the mathematics syllabus in Irish secondary school represents a good example of this change in emphasis from rote learning to insight learning. Whereas the old syllabus focussed almost entirely on memorising theorems and formulae, the new “Project Maths” syllabus requires that students actively apply these principles to solving mathematics problems in a real-world context (Lubienski, 2011).

Following a detailed examination of the accumulated literature on learning and teaching, the American National Research Council’s Committee on Developments in the

Science of Learning (Bransford et al., 2000) arrived at three main conclusions about the conditions under which formal learning takes place.

- (1) Students come to the classroom with preconceptions about how the world works. If their initial understanding is not engaged, they may fail to grasp the new concepts and information that they are taught or they may learn them for the purposes of a test but revert to their preconceptions outside the classroom.
- (2) To develop competence in an area of inquiry, students must: (a) have a deep foundation of factual knowledge, (b) understand facts and ideas in the context of a conceptual framework and (c) organize knowledge in ways that facilitate retrieval and application.
- (3) A metacognitive approach to instruction can help students learn to take control of their learning by defining learning goals and monitoring their progress in achieving them.

Current theorising in the driver education field has also kept abreast of these developments. For instance, the GDE-framework (Hatakka et al., 2002), recognizes that whereas declarative knowledge and procedural skill are necessary for driving, metacognitive processes play a vital role in the acquisition and maintenance of safe driving habits.

Bransford et al's (2000) findings also have important implications for both the development and evaluation of driver education programmes. For example, evidence presented in Chapter 1 suggests that young road users, including children, adolescent pre-learners and pre-drivers have a range of well-established attitudes towards driving before they have had any direct experience with driving (M. A. Elliott, 2004; Harré et al., 2000; Lonero, 2008; Waylen & McKenna, 2002). The learning theories reviewed in this chapter suggest that these attitudes have most likely been acquired as a result of exposure to differential learning opportunities. Thus it is almost certain that students embarking on PLDE courses constitute a heterogeneous group. It follows therefore that a one-size-fits-

all approach to driver education does not constitute an efficient strategy when it comes to increasing knowledge and improving cognitive skills and attitudes towards driving. The constructivist approach to learning suggests that in order to be effective, social programmes need to identify and take account of, the knowledge and cognitive structures (schemas) that students possess when they embark on an educational intervention. Only then can they provide the types of mildly challenging experiences which promote assimilation and accommodation which supports increased understanding (Piaget, 1978; Vygotsky, 1978) and metacognition (Siegrist, 1999). This implies that the efficiency and effectiveness of educational interventions would be improved were they to incorporate features (e.g. tests and/or exercises) that would allow both teachers and pupils to explore the range of pre-existing driving-related knowledge, risk perception skills and attitudes within a class and use this as a basis for further learning.

Behaviourism also provides prescriptive advice for programme developers and evaluators. According to Skinner (1974), learning proceeds most effectively when

- The information to be learned is presented in small steps
- The learners are given rapid feedback concerning the accuracy of their learning
- The learners are able to learn at their own pace

Interestingly, the most commonly used teaching technique in secondary schools, i.e. the teacher lead approach, often violates all three of these principles.

4.1.3 Application of learning theories to driver behaviour

The behaviourist approach provides a relatively simple model for explaining driver behaviour and the motivations that underlie that behaviour in terms of stimulus-response mechanisms. For instance, Fuller and Bonney (2004) outlined the problems that novice drivers face when it comes to learning the vast array of A-B-C contingencies which prevail in traffic, and which might explain their over-representation in crashes. These include;

- “Inadequate exposure to the contingences of safe driving

- Discrepancies between experienced contingencies and contingencies represented in the ‘Rules of the Road’
- Few opportunities to learn directly the relationship between low probability events
- The reinforcement of unsafe driving behaviour and the punishment or at the least non-reinforcement of safe-driving behaviour” (p.26)

Since many of these problems are not specific to learner and novice drivers, it is obvious that learning through direct experience can have detrimental as well as beneficial effects on driving behaviour. For example, many experienced drivers persist with driving at inappropriately high speeds, disregarding the accumulated evidence showing that this behaviour seriously increases the risk of crashing (see Aarts & Van Schagen, 2006; SWOV, 2007; Wallén Warner & Aberg, 2008). From a behaviourist perspective, speeding can be construed as reinforcing: On the one hand it reduces the perceived cost of driving (e.g. the expenditure of effort), and on the other hand it confers apparent benefits (e.g. saving time) especially in the short-term (Fuller, 2002).

Cognitive science focused on explaining changes in mental representations (thinking) that occur as a result of learning, and Dreyfus and Dreyfuss’ (1986) 5-stage hierarchical model of general skill acquisition is an interesting example of this approach. The model describes changes in the perception of the task environment that were reported by performers as they acquired complex skills by means of instruction and experience. This model outlines progress through five developmental stages: Novice, advanced beginner, competent, proficient and expert (Tronsmoen, 2010). During the initial stage novices learn the relevant abstract *rules* (e.g. the Rules of the Road) and stick to them rigidly. In time and given some experience in coping with real situations, advanced beginners begin to formulate *guidelines* for action based on specific aspects of a situation (e.g. in wet conditions, drive more slowly). The development of competency is marked by an increasing ability to see actions in terms of longer-term goals and to read traffic

intuitively. Behaviour is increasingly based on emotional responses, both positive and negative, to situations derived from past experience. During this stage, learners develop *maxims*, which take account of situational aspects and also their salience to determine the appropriate action (e.g. when pressured for time and at low risk of official sanction, exceed the speed limit). Experts have an intuitive grasp of situations based on deep tacit understanding and only revert to using rules, guidelines or maxims to guide behaviour when problems arise or in novel situations. Dreyfus and Defuses' (1986) ethnographic research provides additional evidence supporting the existence of a number of cognitive sub-processes that contribute to the development of skilled performance: including the gradual change from controlled to automatic processing (Shiffrin & Schneider, 1977a, 1977b), the development of expertise (Erickson et al., 2007) and transfer of training (Barnett & Ceci, 2002). Such findings can be used to inform the content of driver education courses and to improve the processes whereby they are delivered.

4.1.4 The role of social influence in the development of risky driving styles

Socioenvironmental perspectives, including social learning theory (Akers, 1973; Bandura, 1989) and primary socialization theory (Oetting & Donnermeyer, 1998; Taubman - Ben-Ari, Mikulincer, & Gillath, 2005) highlight the effect that familial and peer influences have on the development of problem behaviour in adolescence (D. B. Kandel & Andrews, 1987). Aker's social learning theory (Akers, 1973) proposes that parental, and peer influences operate by means of differential association with "groups which control (their) major sources of reinforcement and punishment, and expose them to behavioural models and normative definitions" (Akers, Krohn, Lanza-Kaduce, & Radosevich, 1979, p. 638). Aker's theory was used to investigate the influence of peers and parents on the risky behaviour of young drivers aged from 17 to 24-years (Scott-Parker, Watson, & King, 2009). The results showed that peer norms, and anticipated peer and parent rewards significantly predicted self-reported risky driving behaviour. Green, and Dorn (2008),

investigated the pre-driving experiences of British 17-19-year-old pre-drivers and novice drivers using focus groups, and reported that two main themes emerged: one concerned modelling people's behaviour and the other was 'distancing from other's driving behaviour'. Parental driving was carefully monitored by many of the participants. Fathers were admired because they were confident, made driving seem like fun and liked speeding, whereas mothers were perceived as less competent, and less assured as drivers. Some adolescent, whose parents regularly combined drinking and driving, believed that they themselves would be likely to emulate this practice. This study shows that pre-drivers do, in fact, critically assess the skills and behaviours of their parents.

Parental influence on driving operates through the family socialization process, both in terms of how they themselves drive (Taubman - Ben-Ari et al., 2005) and how they supervise their offspring in the learner and novice stages of driving (Simons-Morton & Ouimet, 2006). Since a discussion of this latter aspect of driver socialisation is beyond the scope of this present research, this thesis will focus on the influence of parental driving habits on driving behaviour of their offspring. It is also worth noting here that associations between parents and offsprings' behaviours, attitudes and beliefs are most likely due to the combined influences of shared genetics, parental role modelling and parental socializing practices (Maccoby, 2000). Mindful of this caveat, research has demonstrated some degree of correspondence between the driving practices of parents and their offspring. Findings from a study that examined the official driving records of over 140,000 families in the US suggested that during the first few years of licensure, the driving records of adolescents were related to those of their parents: Youngsters whose parents had three or more recorded crashes were 22% more likely to have had a crash themselves. Those whose parents had three or more violations were 38% more likely to have had a violation when compared to those whose parents had a clean driving record (Ferguson et al.,

2001)¹². Further research on the inter-generational transmission of driving styles within families showed that there was some correspondence between the self-reported driving styles (habits) of parents and those of their recently licenced offspring (Miller & Taubman - Ben-Ari, 2010). This study indicated that parental anxious and angry driving styles were mirrored in the driving styles of their children. Maternal anxious driving style predicted a similar driving style in their daughters and paternal recklessness was also associated with reckless driving styles in their daughters. However, maternal careful driving styles were reflected in the styles of both their sons and daughters. Earlier research conducted by Taubman-Ben-Ari, Mikulincer, and Gallath (2005) also found a high correspondence between maternal driving styles, adaptive and maladaptive, and the corresponding styles in their offspring. Thus, it appears that whereas maternal driving styles predicted a wide range of driving behaviours in their offspring, paternal driving styles were mainly associated with the aberrant driving habits of their children. Since children inherit genetic characteristics from both of their parents, this evidence supports the view that driving habits are mainly acquired through social learning processes.

Similarly, evidence suggests that driving behaviours and attitudes can be transmitted horizontally within families. A French study featuring over 1,200, 27- to 30-year-olds and their parents found that although parental behaviours and attitudes predicted those of their adult children, these influences were attenuated in the presence of siblings who drove (Lahatte & Le Pape, 2008). When the young driver was an only child, or when they were the only driver in a sibship, they were significantly more likely to be influenced by parents than a young person with siblings, or with siblings who held a full driving licence. The study also compared the results for young inexperienced drivers with those of drivers with 4 or more years of driving experience and found that parental influence on

¹² Whereas no attempt was made in this study to control for the amount of driving or type of driving that either the parents or their offspring did, given the large sample size such factors were unlikely to influence these results significantly.

driving behaviours and attitudes decreased gradually over time, which provides support for primacy of direct experience over indirect learning in affecting behaviour and attitudes.

Peers effects with respect to adolescents' risk-taking behaviours, and attitudes are well- documented (Allen & Brown, 2008; Steinberg & Monahan, 2007). The tendency for individuals to take more risks in groups than when alone is termed '*the risky shift*' (Vinokur, 1971). Gardner and Steinberg (2005) investigated this phenomenon in three groups: 13 – 16-year-old adolescents, 18 – 20-year-old youths and adults over 24-years-old. Participants completed questionnaires that measured risk preference, risky decision making and risk taking when alone, or in the company of 2 same-aged peers. The results showed participants took more risks, focussed less on the costs of risky behaviour and more on the benefits, and made riskier decisions when accompanied by peers than when they were alone, and also that peer influence decreased with age. Peer influence on adolescents driving behaviour and attitudes towards driving has been studied extensively. Reflecting on the ways in which peers influence adolescent driving behaviour Allen and Bown (2008) proposed that developmental, driving-specific and social factors often combine to create a "perfect storm" of risks for adolescent drivers. Adolescence is associated with an increased tendency towards risk-taking (Arnett, 2002), some of which is associated with a need to achieve autonomy from parents and gain social acceptance from peers (Allen, Aber, & Leadbetter, 1990). Research shows that adolescents driving behaviour changes depending on whom they are carrying as passengers. Teenages drive faster and take more risks when accompanied by peers as opposed to adult passengers (Arnett et al., 1997), especially if the peers are young males (Baxter et al., 1990). Evidence also suggests that adolescents who believe that risky driving and DWI is acceptable and who have friends who engage in these deviant behaviours, are more likely to engage in these practices than those who do not (e.g. Jessor, Turbin, & Costa, 1997).

Although relatively few studies have examined peer influences on the perceptions and attitudes of pre-drivers, there is some evidence to suggest that adolescents perceive peer norms as being quite tolerant of risk. In a study involving over 5,000 American 12 – 17-year-olds, the participants were asked to judge how much people of a similar age cared about a range of behaviours, including avoiding drugs, cigarettes, heavy drinking, physical fitness, DWI and seatbelt use (N. Evans, Gilpin, Farkas, Shenassa, & Pierce, 1995). The results showed that whereas almost 85% of the sample believed that their peers cared a lot about weight control, just 40% thought that their peers were concerned about DWI. Furthermore, just 15% perceived seatbelt use as a major concern for their peers. However, Green, and Dorn (2008) showed that adolescents believed that certain undesirable driving practices that they had observed in young drivers, including aggressive, careless and reckless behaviour, should be avoided. Thus, it seems that although adolescents perceive the peer norm in relation to driving as risky, these norms do not always influence their attitudes towards risky driving practices.

4.1.4.1 Experience with road traffic crashes

The relationship between experience with driving and crash involvement was established in Chapter 1, and the pervasive nature of this relationship was outlined earlier in this chapter. In Ajzen's Theory of Planned Behaviour (1991) previous experience is regarded as a general antecedent, influencing beliefs, attitudes, norms, perceived behavioural control, and thence actual behaviour. Research conducted by Fazio and his collaborators found that attitudes formed through direct experience were better predictors of behaviour than those formed through indirect experience (Fazio, Powell, & Williams, 1989; Fazio, Zanna, & Cooper, 1978). Direct experience produces attitudes that are based on affective appraisals of the attitude object, whereas indirect experience gives rise to cognitive evaluations of that object (Millar & Millar, 1996). It is therefore reasonable to predict that experience (direct or indirect) with crucial events, such as car crashes, would

leave a strong impression on peoples' thinking, feelings and actions. Lucas (2003) investigated the psychological effects of crash involvement on a group of 124 American drivers, 42 of whom had been involved in at least one crash. The results showed that drivers who were involved in a collision in the five years preceding the study had greater concerns for their personal safety, worried more about driving and reported higher levels of driving-related stress and negative physiological symptoms than those who were not crash-involved. A study conducted by McKenna and Albery (2001) revealed that drivers who had been hospitalised as a result of a RTC judged their driving skills more negatively and expressed less intentions to speed in the future than did those who were accident free. However, the same study indicated that involvement in a minor accident or an accident where someone else was injured had no significant effect on skill evaluations or intentions. Furthermore, longitudinal research based on the driving records of over 13,000 US young novice drivers showed that those who had been involved in an at-fault crash were just as likely to be involved in another collision as they were before they had the first one (Waller, Elliott, Shope, Raghunathan, & Little, 2001). A recent meta-analysis of drivers' crash records also showed that the frequency of crash involvement for individuals is remarkably stable over time (A. E. af Wåhlberg, 2009). This seems to suggest that if crash experience has any influence on the way that drivers feel and act, these effects are short-lived. However, very little is known currently about how either direct or indirect involvement in crashes affects the beliefs and attitudes of PLDs.

In addition, there is a dearth of research investigating the possible effects that direct experience with traffic, exposure to the driving behaviour of parents or other influential role models might have on knowledge, risk perception skills, and attitudes in PLDs. Given the well-established links between direct and indirect experience, and the acquisition and maintenance of knowledge, skills, attitudes and behaviour generally, and also with respect to driving behaviour, this constitutes a significant gap in the literature. Increased

understanding about the effects that prior learning might have on driving-related knowledge, skills and attitudes would contribute towards the future development and evaluation of PLDE programmes. Current thinking in educational circles suggests that generic types of educational interventions, which do not address pre-existing levels of knowledge, cognitive skills and attitudes are unlikely to contribute substantially to increasing road safety (Bransford et al., 2000). Evaluators also need to account for the effects of moderating influences that are extrinsic to the programmes themselves in order to increase the validity of their findings.

4.2 Aim

The aims of this part of the study were to measure:

1. Interest in driving in this PLD sample.
2. Direct experience with using vehicles, including bicycles, motorcycles, cars and farm/industrial machinery.
3. Direct and indirect experience with crash involvement
4. Exposure to aberrant driving practices.

The results of these tests will then be used to ascertain whether or not these factors influences driving related knowledge, risk perception skills and attitudes towards speeding as part of the summative evaluation which is reported in Chapters 5, 6 and 7. It is predicted that:

1. Students who have a greater amount of direct experience with using vehicles will have demonstrably better knowledge and risk perception skills than will those with little or no direct experience with vehicle use.
2. Students with greater exposure to aberrant driving practices, will be less knowledgeable and have poorer risk perception skills and have a more positive attitude towards speeding than will those with less exposure to maladaptive driving habits.

4.3 Methodology

4.3.1 Measures

A list of the measures that were used to assess interest in driving, experience with driving and RTCs and exposure to aberrant driving practices is contained in Table 4.1.

Table 4.1 Measures of direct and indirect experience with traffic and driving

Appendix/ Question	Description of variables	No. of items	Response Scale
<u>Interest in driving</u>			
D/10	Intention to obtain a learner driver permit	1	1 = When I am 17 to 5 = Have an LP already*
F/13	Has taken the driver theory test	1	1 = No, 2 = Yes and passed, 3 = Yes and failed
F/8	Number of months holding a learner permit	3	1 = Less than 1 month, to 6 = Over 12 months
F/15	Has taken the practical driving test	1	1 = No, 2 = Yes and passed, 3 = Yes and failed
<u>Experience with using vehicles</u>			
D/11	Recent experience with bicycles/motorcycles /cars/machinery	4	1 = Never - 6 = Every day
F/10	Frequency of driving	1***	1 = Every day - 6 = Less than once a month
D/13	If driving, who supervised driving practice and how often	6	1 = Always - 3 = Never
F/12	Amount of professional driver training received	1	1 = None - 6 = over 12 hours
F/18	Cautioned/penalised for aberrant driving	1	1 = Speeding - 8 = Failed to yield
<u>Experience with RTCs</u>			
D/12	Personal involvement in crashes	3**	1 = Never - 4 = 3 times or more
D/13	Significant other(s) involvement in crashes	3**	1 = Never - 4 = 3 times or more
F/16	Crash involvement while driving	3	1 = Never - 4 = 3 times or more
F/17	If crashed while driving, who was at fault	1	1 = Mine - 6 = Don't know (cont.)

Appendix/ Question	Description of variables	No. of items	Response Scale
	<u>Exposure to aberrant driving</u>		
D/15-19	Parents'/guardians' driving behaviour	5 2****	1 = Never - 6 = Always
D/20	Frequency of exposure to aberrant driving practices as measured by the Driver Behaviour Questionnaire	6	1 = Never - 6 = Most of the time

Note: * Scores on this item were reversed; consequently, higher scores indicated greater eagerness to drive.
 **Due to low frequencies of crash involvement at each of these levels, scores on this scale were collapsed to yield a single value for crash involvement.
 ***Scores on this item were reversed; consequently, higher scores indicated more experience.
 ****Scores for all positively valenced items were reversed; consequently, higher scale scores indicated a higher frequency of aberrant behaviour.

4.4 Result

4.4.1 Interest in driving

Eagerness to start driving was measured as a function of when the students intended to apply for a learner driver permit (LDP) (D/10). The results indicated that a high proportion of student in this sample intended to apply for a LDP and the majority of these intended to do so when they reached 17-years-old (Table 4.2). A series of HLM means-as-outcomes models were constructed to explore differences in the immediacy with which students intended to apply for a LDP. The results indicated that there were no significant effects of age ($\beta = -0.02$, $t(39) = -0.63$, $p > .05$), gender ($\beta = 0.03$, $t(39) = .67$, $p > .05$), SES ($\beta = 0.02$, $t(39) = 1.06$, $p > .05$), location ($\beta = 0.08$, $t(39) = 1.93$, $p > .05$) or exposure to pre-learner driver education ($\beta = -0.06$, $t(39) = -0.62$, $p < .01$) on immediacy.

Table 4.2 Intention to obtain a learner driver permit

When	<u>Test time</u>		
	T1	T2	T3
At 17-years-old	81%	76%	42%
At 18-years-old	10%	8%	12%
At 19-years-old	1%	2%	1%
Has a learner driver permit	-	2%	35%
No current plans	8%	12%	11%

Note: The numbers of students who had obtained a learner driver permit increased during the course of this study.

Individuals need to pass a driver theory test before they can apply for a LDP.

Experience with taking this test was measured in the T3 test in this study (F/13). The results showed that of the 1,412 students who were present at that time, 54.3% had not taken the theory test, 43.3% had passed the test and 2.4% had failed the test. Forty percent of those who took the test were males and 30% were females. A series of 2-level binomial logistic regressions were conducted to explore differences in success rates in the theory test for various groups of participants. These showed that males ($\beta = 3.25$, $t(36) = 11.86$, $OR = 25.89$) were twice as likely to pass the test as were females ($\beta = -0.71$, $t(36) = -1.95$, $OR = 0.49$, $p = .05$). However, there was no real difference between the pass rate for the controls ($\beta = 2.85$) and that for students who had taken a PLDE course ($\beta = 0.06$, $t(36) = 0.11$, $OR = 1.06$, $p > .05$). Neither were there any significant differences between the success rate for the controls ($\beta = -2.88$), and that for students in the experimental groups; A ($\beta = 0.21$, $t(31) = 0.34$, $OR = 1.23$, $p > .05$); B ($\beta = 0.03$, $t(31) = 0.06$, $OR = 1.03$, $p > .05$); C ($\beta = 0.52$, $t(31) = 0.87$, $OR = 1.68$, $p > .05$); D ($\beta = -1.19$, $t(31) = -1.40$, $OR = 0.30$, $p > .05$), and E ($\beta = -0.27$, $t(31) = -0.32$, $OR = 0.76$, $p > .05$).

Obtaining a LDP constitutes a clear expression of intent to start driving in the near future. As shown in (Table 4.2), approximately 35% of the students (males 40%, females 30%) who took the T3 test reported that they had obtained a LDP by the end of this study. HLM logistic regressions were used to examine between-groups differences in the likelihood of obtaining a LDP and the results showed that males ($\beta = -0.52$, $t(36) = -3.93$, $p < .001$, $OR = 0.6$) were significantly more likely to have obtained a permit than were females ($\beta = -0.32$, $t(36) = -2.1$, $OR = 0.72$, $p < .05$). Whereas students who took a PLDE course were less likely to hold a LDP ($\beta = -0.7$, $t(35) = 5.43$, $OR = 0.5$) than were those in the control group, ($\beta = 0.21$, $t(35) = 0.71$, $OR = 1.23$, $p > 0.48$), this difference was not statistically significant. Furthermore, there were no statistical differences in the likelihood

of holding a LDP between students in the control group¹³ ($\beta = -0.49$, $t(31) = -1.85$, $OR = 0.61$) and those in the individual experimental groups; A ($\beta = -0.28$, $t(31) = -0.69$, $OR = 0.76$); B ($\beta = -0.21$, $t(31) = -0.6$, $OR = 0.81$); C ($\beta = -0.47$, $t(31) = -0.39$, $OR = 0.63$); D ($\beta = 0.25$, $t(31) = 0.61$, $OR = 1.28$); E ($\beta = -0.33$, $t(31) = -0.74$, $OR = 0.72$), all p 's < .05.

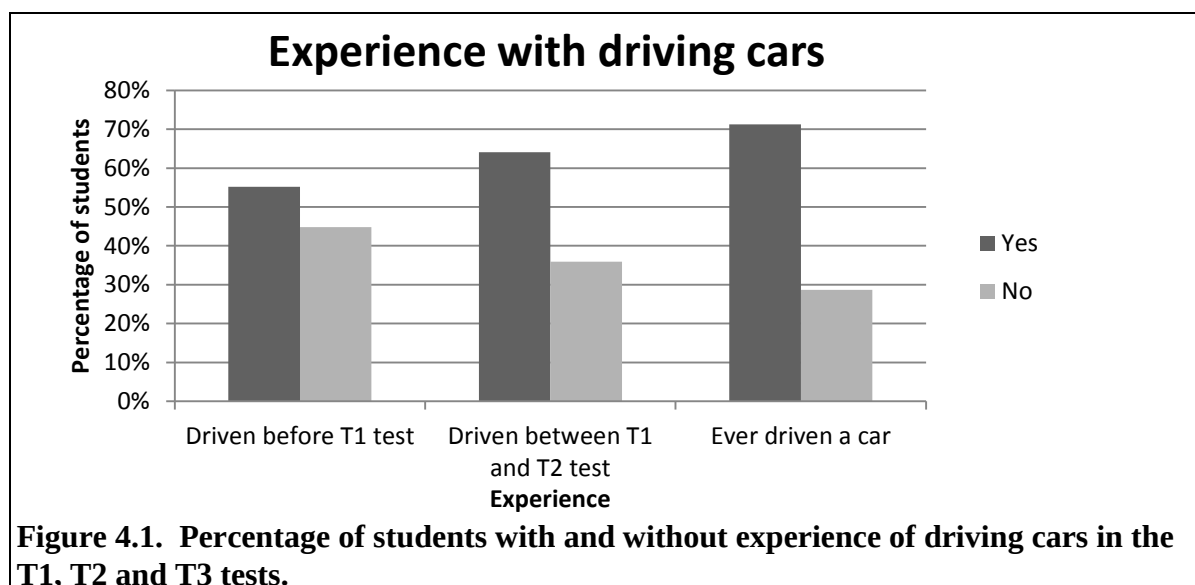
However, these results indicate that the odds for obtaining a licence were higher for the control group than they were for four of the five experimental groups.

Since relatively few students had obtained a licence for a motorcycle or a tractor, (5% and 13%, respectively) and only 32 students had taken the practical driving test (50% passed) by the end of this research, no further analysis was conducted on this data.

4.4.2 Experience with traffic

4.4.2.1 Recent experience with using vehicles

Many of the students had some previous experience with driving a car (Appendix D, Question10): Results from the T1 test showed that over 55% of the sample had driven a car before they commenced TY/year 13 in school, and the numbers students with car-driving experience rose to 64% and 71% in the T2 and T3 tests respectively (Figure 4.1).



¹³ The percentages of students who had obtained an LDP in each of the groups were as follows: Group A = 32%, group B = 34%, group C = 27%, group D = 46%, group E = 31% and controls = 33%

A binomial regression was conducted in HLM which showed that there was a small, non-significant decrease in the odds in favour of starting to drive during the study ($\beta = -0.08$, $t(37) = -1.38$, $p > .05$). The relationship between the onset of car driving and programme group membership, gender, age, place of residence, and a range of personality variables including sensation seeking, impulsiveness and the Five-factor trait markers are depicted in Table 4.3.

Table 4.3 Effects of gender, age, location, and personality on the onset of car driving

Predictor variables	β (SE)	t	df	Odds Ratio	95% CI
<u>Pre-learner education</u>					
Intercept (non-PLDE)	0.32 (0.19)	1.69	39	1.38	(0.94, 2.0)
Slope (Did PLDE)	0.1 (0.03)	0.44	39	1.1	(0.69, 0.78)
<u>Intervention group</u>					
Intercept (Controls)	0.33 (0.2)	1.61	34	1.39	(0.92, 2.1)
Slope (Group A)	0.08 (0.35)	0.22	34	1.08	(0.53, 2.21)
Slope (Group B)	-0.01 (0.31)	-0.01	34	0.99	(0.53, 1.86)
Slope (Group C)	-0.32 (0.00)	-0.96	34	0.73	(0.37, 1.43)
Slope (Group D)	0.51 (0.36)	1.41	34	1.65	(0.8, 3.4)
Slope (Group E)	0.46 (1.58)	1.58	34	1.17	(0.71, 3.49)
<u>Gender</u>					
Intercept (Male)	0.73*** (0.11)	6.4	39	2.07	(1.64, 2.6)
Slope (Female)	-0.72*** (0.13)	-5.85	39	0.48	(0.38, 0.62)
<u>Age^a</u>					
Intercept	0.4** (0.11)	3.55	39	1.49	(1.19, 1.87)
Slope	0.33** (0.09)	3.91	39	1.39	(1.18, 1.67)
<u>Location</u>					
Intercept	0.37** (0.11)	3.62	39	1.45	(1.18, 1.79)
Slope (Rural)	0.49*** (0.1)	4.63	39	1.63	(1.32, 2.01)
<u>SES^a</u>					
Intercept	0.4** (1.5)	3.52	39	1.5	(1.19, 1.88)
Slope	-0.05 (0.04)	-1.18	39	0.95	(0.88, 1.04)
<u>Impulsiveness^a</u>					
Intercept	0.4** (0.11)	3.49	39	1.49	(1.18, 1.88)
Slope	0.12 (0.11)	1.18	39	1.13	(0.92, 1.4)
<u>Sensation Seeking^a</u>					
Intercept	0.4** (0.11)	3.52	39	1.49	(1.18, 1.87)
Slope	0.37** (0.13)	2.98	39	1.45	(1.13, 1.88)

(cont.)

Predictor variables	β (SE)	<i>t</i>	df	Odds Ratio	95% CI
<u>Emotional stability^s</u>					
Intercept	0.41** (0.12)	3.28	36	1.5	(1.17, 1.93)
Slope	0.32** (0.09)	3.4	36	1.37	(1.14, 1.66)
<u>Agreeableness^s</u>					
Intercept	0.41** (0.12)	3.35	36	1.51	(1.18, 1.93)
Slope	-0.37** (0.12)	-3.1	36	0.69	(0.54, 0.88)
<u>Intellect/imagination^s</u>					
Intercept	0.41** (0.13)	3.29	36	1.51	(1.17, 1.94)
Slope	-0.21 (0.1)	-2.11	36	0.81	(0.67, 0.99)
<u>Conscientiousness^a</u>					
Intercept	0.41** (0.13)	3.3	36	1.51	(1.17, 1.95)
Slope	-0.04 (0.08)	-0.54	36	0.96	(0.81, 1.27)

Note: ^a Variables centred around the grand mean

* $p < .05$, ** $p < .001$, *** $p < .001$.

The results of these analyses suggested that neither taking a PLE course in general nor taking any of the specific types of PLE course that featured in this study had any effect on the likelihood that students had ever driven a car. However, there was a significant effect of gender on the onset of car driving; males were twice as likely as females to have driven a car. Significant age effects were also found; older students were 39% more likely to have driven than younger ones. Rural students were 63% more likely to have driven than urban ones. Students' SES did not predict the onset of driving. Several personality traits also significantly predicted the onset of driving; students with higher levels of trait sensation seeking, extraversion, emotional stability and lower levels of agreeableness were all more likely to have started driving than were their counterparts.

Students were asked about their recent experience with using vehicles, including bicycles, motorcycles, farm/industrial machinery and cars in each test¹⁴. Ninety percent of students reported that they had ridden a bicycle previously, and over 65% had driven a car

¹⁴ These frequencies were measured as follows: T1 = any time previously, T2 = in the interval since the T1 test and T3 = since the T2 test.

in the preceding 5 – 6 years. A relatively small percentage had driven a motorcycle, or farm/industrial machinery (Table 4.4).

Table 4.4 Percentage of students with experience in using vehicles for each test

	<u>Bike</u>			<u>Car</u>			<u>Motorcycle</u>			<u>Machinery</u>		
Frequency	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3
Never	10%	10%	22%	43%	35%	34%	80%	81%	88%	81%	82%	84%
A few times	42%	41%	50%	44%	54%	20%	16%	16%	20%	13%	12%	11%
Once a month	11%	12%	9%	3%	2%	14%	1%	1%	9%	1%	1%	1%
Once a week	11%	11%	6%	4%	3%	11%	2%	1%	1%	1%	1%	2%
Several times a week	19%	20%	9%	4%	5%	11%	1%	1%	1%	2%	2%	2%
Every day	7%	7%	4%	2%	1%	10%	1%	1%	1%	2%	1%	1%

The results also suggested that there was a high incidence of under-age driving in the sample¹⁵. For instance, during the T1 test, 64% of 14-year-old, 51% of 15-year-olds and 63% of 16-year-olds had already driven a car, albeit that approximately 80% of these said that they had only driven ‘a few times’. Similarly, the T2 test showed that 85% of under-aged drivers had driven ‘a few times’. However, incidence and frequency of under-age driving increased in the T3 test (when all of the participants were over 16-years-old). Over 90% of the 16-year-olds had driven a car previously: Of these, 35% had driven ‘a few times’, 24% had driven ‘once per month’, 16% had driven ‘once per week’, 15% had driven ‘several times per week’ and almost 10% had driven ‘every day’. The scores for the individual categories of vehicles were aggregated to produce a single mean for vehicle use, which indicated that levels of recent experience with using vehicles remained relatively static during this study; T1 ($M = 1.42$, $SD = 0.73$), T2 ($M = 1.45$, $SD = 0.62$), and T3 ($M = 1.53$, $SD = 0.8$).

HLM regressions conducted to assess the effects of time, PLE, demographic and personality factors on vehicle use (Table 4.5). The results showed that there were no significant differences in the frequency of vehicle use between students who didn’t take a

¹⁵ It should be noted however that the students were not asked whether or not they drove on or off the roads. The lack of such differentiation represents a flaw in the research design, which should be remedied in future research.

PLE course ($\beta = 1.49$) and those who in the active groups ($\beta = -0.01$, $t(36) = -0.11$, $p > .05$). Furthermore, there were no significant differences between the control group and any of the active groups; group A ($\beta = 0.1$, $t(36) = 0.71$, $p > .05$), group B ($\beta = -0.03$, $t(36) = -0.21$, $p > .05$), group C ($\beta = -.02$, $t(36) = -1.64$, $p > .05$), group D ($\beta = 0.18$, $t(36) = 1.24$, $p > .05$) and group E ($\beta = 0.03$, $t(36) = 0.19$), $p > .05$). There were significant gender effects in the frequency of vehicle use, which was higher for males ($\beta = 1.5$) than it was for females ($\beta = -0.41$, $t(36) = 8.41$, $p < .001$). Students from urban backgrounds ($\beta = 0.4$) used vehicles less frequently than did their rural counterparts ($\beta = 0.33$, $t(36) = 3.91$, $p < .001$). Older students used vehicles significantly more often than did younger ones ($\beta = 0.08$, $t(36) = 2.25$, $p < .05$). Those with higher levels of trait sensation seeking ($\beta = 0.21$, $t(36) = 4.52$, $p < .001$), extraversion ($\beta = 0.1$, $t(36) = 3.88$, $p < .001$), and emotional stability ($\beta = 0.08$, $t(36) = 2.72$, $p < .001$) all used vehicles significantly more frequently than did their counterparts.

Table 4.5 Experience with using vehicles

Predictor variables	β (SE)	t^b	95% CI
<u>PLE</u>			
Intercept (non-PLDE)	1.49*** (0.13)	11.74	(1.45, 1.53)
Slope (Did PLDE)	-0.01 (0.14)	-0.11	(-.06, 0.04)
<u>Intervention group</u>			
Intercept (controls)	1.49*** (0.08)	18.09	(1.46, 1.52)
Slope (Group A)	0.1 (0.15)	0.71	(0.05, 0.16)
Slope (Group B)	-0.03 (0.15)	-0.21	(-0.08, 0.02)
Slope (Group C)	-.02 (0.14)	-1.64	(-0.07, 0.02)
Slope (Group D)	0.18 (0.15)	1.24	(0.13, 0.23)
Slope (Group E)	0.03 (0.16)	0.19	(-0.02, 0.08)
<u>Gender</u>			
Intercept (male)	1.5*** (0.04)	37.07	(1.49, 1.51)
Slope (female)	-0.41*** (0.05)	-8.41	(-.42, -.39)
<u>Age^a</u>			
Intercept	1.48*** (0.05)	32.29	(1.46, 1.5)
Slope	0.08* (0.03)	2.25	(0.7, .09)

(cont.)

Predictor variables	β (SE)	t^b	95% CI
<u>Location</u>			
Intercept (urban)	0.4** (0.11)	3.55	(0.38, 0.42)
Slope (rural)	0.33** (0.09)	3.91	(0.3, 0.36)
<u>SES^a</u>			
Intercept	1.47*** (0.04)	32.09	(1.46, 1.48)
Slope	-0.02 (0.02)	-1.12	
<u>Impulsiveness^a</u>			
Intercept	1.48*** (0.05)	32.65	(1.46, 1.5)
Slope	-0.06 (0.04)	-1.29	(-0.07, -0.05)
<u>Sensation Seeking^a</u>			
Intercept	1.48*** (0.05)	32.61	(1.46, 1.51)
Slope	0.21*** (0.05)	4.52	(0.19, .023)
<u>Extraversion^a</u>			
Intercept	1.48*** (0.05)	30.91	(1.46, 1.51)
Slope	0.1** (0.03)	3.88	(0.09, 0.11)
<u>Emotional stability^s</u>			
Intercept	1.48*** (0.05)	32.75	(1.46, 1.51)
Slope	0.08** (0.03)	2.72	(0.07, 0.09)
<u>Agreeableness^s</u>			
Intercept	1.48*** (0.05)	32.22	(1.46, 1.51)
Slope	-0.05 (0.03)	-1.75	(-0.52, -0.49)
<u>Intellect/imagination^s</u>			
Intercept	1.48*** (0.05)	31.76	(1.46, 1.51)
Slope	-0.01 (0.03)	-0.55	(-0.01, 0.02)
<u>Conscientiousness^a</u>			
Intercept	1.48*** (0.05)	31.83	(1.46, 1.51)
Slope	0.05 (0.03)	1.56	(0.04, 0.06)

Note: ^a Variables centred around the grand mean; ^bdf = 36

* $p < .05$, ** $p < .001$, *** $p < .001$.

4.4.2.2 Driving supervision

The type of supervision that students received while they were driving was measured in each test. In Ireland, people who hold a learner driver permit “must be accompanied and supervised by a person who has a current and valid full licence for the same category of vehicle” (RSA, 2010b, p. 22). The percentage of students who reported that they were always accompanied by an adult with a full licence remained fairly static during the study, ranging between 72.5%, 70% and 71% in the T1, T2 and T3 tests

respectively. The remainder of the sample reported that they were sometimes accompanied by friends who held either a LDP or had no licence at all and a small percentage (2.3% on average across all of the tests) reported that they sometimes drove alone. However, the results of a binomial regression showed that the overall likelihood for driving under legal supervision was significantly greater than it was for driving illegally ($\beta = 0.95$, $t(40) = 12.77$, $p < .001$, $OR = 2.58$). There was also a significant effect of gender on driving with appropriate (legal) supervision in each of the three tests. The odds ratios reported in (Table 4.6) show that females were twice as likely as males to be accompanied always by a suitably qualified adult in the initial test and 1.5 times more likely to do so in the subsequent tests. No significant effects of PLDE, age, SES, location or personality variables were found on the likelihood of driving with proper supervision.

Table 4.6 Gender effects on driving with proper supervision

Test Time	Predictor variable	β (SE)	Odds Ratio	95% CI
	<u>Gender</u>			
T1	Intercept ^a	0.86 (0.14)	2.37	(1.8, 3.11)
	Slope (female)	0.70** (0.22)	2.02	(1.29, 3.17)
T2	Intercept ^a	-0.65 (0.14)	0.52	(0.4, .069)
	Slope (female)	0.26* (0.23)	1.52	(1.01, 2.1)
T3	Intercept ^a	-0.39 (0.11)	0.7	(0.54, 0.85)
	Slope (female)	0.41* (0.2)	1.51	(1.01, 2.74)

Note: df = 39. ^a Reference group = male.

* $p < .05$, ** $p < .01$, *** $p < .001$.

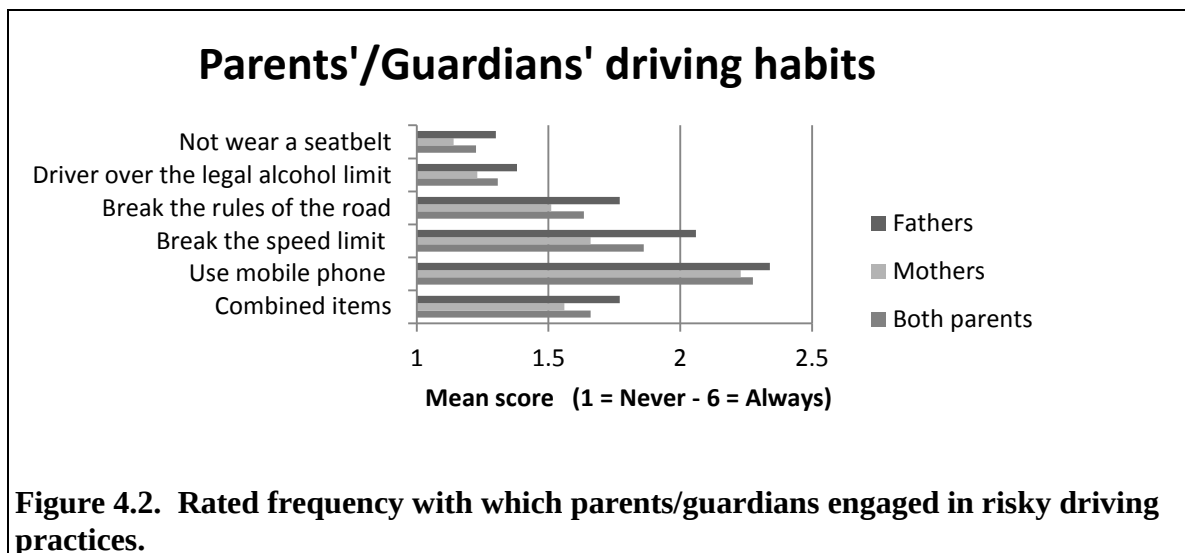
4.4.2.3 Experience with road traffic crashes

Although experience with road traffic crashes was measured at three levels of seriousness in each question (i.e. property damage, moderate damage/minor injury and serious injury/death), these scores were aggregated subsequently to produce a single score. The results for personal experience with crashes showed that at the beginning of this study 28% of the sample had been personally involved in some type of an RTC in the previous 5-year period and personal crash involvement increased to 33% and 44% respectively in the subsequent tests. Crash involvement with respect to close friends/relatives rose from 62% at T1, to 71% at T2 and reached 79% during the final test. The percentage of students,

who had no RTC experience, either direct or indirect, fell from an initial high of 32%, to 24% at T2 and stood at just 17% by the end of the study. However, the frequency of both direct and indirect involvement with crashing was generally low, between 75% and 80% of students with experience of crashes indicated that they had experienced just one crash in the preceding 5 years. The mean frequencies of both direct and indirect involvement in RTCs in all 3 tests were calculated for each student¹⁶. The means for direct involvement in the T1, T2 and T3 tests were 1.28 ($SD = 0.45$), 1.05 ($SD = 0.2$) and 1.14 ($SD = 0.34$), respectively. The corresponding values for close friend/relative were 1.38 ($SD = 0.45$), 1.19 ($SD = 0.35$) and 1.25 ($SD = 0.38$). The overall frequencies for both direct ($M = 1.12$, $SD = 0.21$) and indirect ($M = 1.8$, $SD = 0.41$) crash involvement were quite low.

4.4.3 Exposure to aberrant driving practices – Parents driving style

The responses to the questions about parental driving habits (Appendix D, Questions 15 – 19) showed that 97% of the fathers, and 95% of the mothers of the students in the study, were drivers. Mean scores were calculated for all 5 questions for each parent (Figure 4.2).



¹⁶ ¹⁶ Note that the percentage figures quoted above represent cumulative estimates, whereas the mean scores in the T1 test cover the previous 5 years, the means in T2 cover the period between the T1 and the T2 tests and the T3 means cover the period between the T1 and the T3 tests.

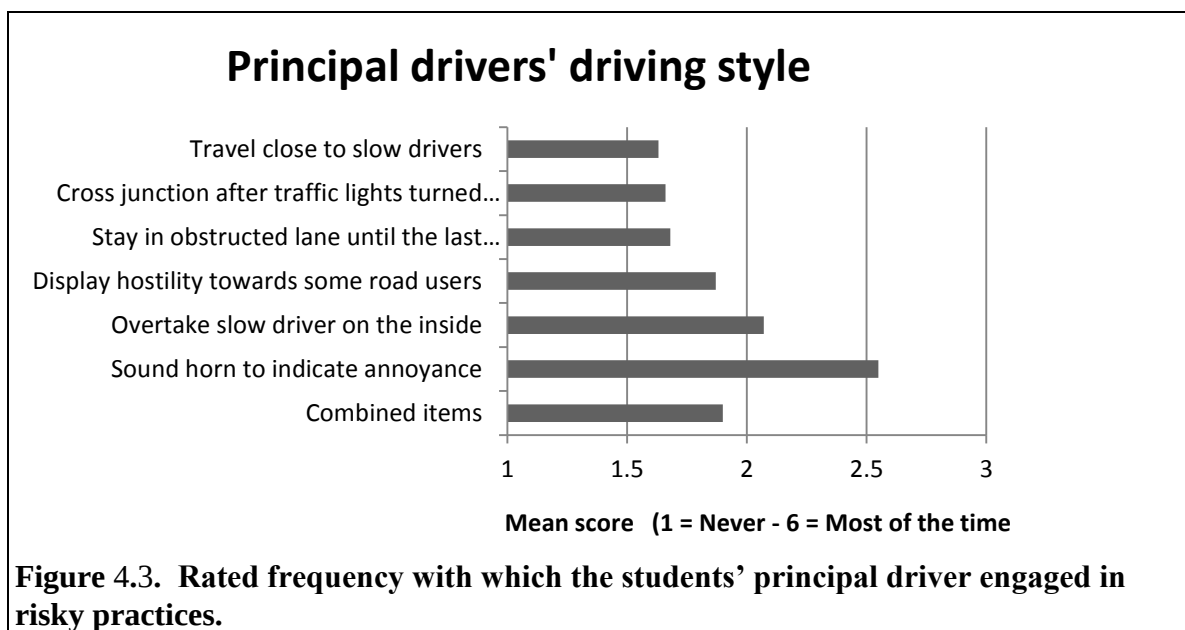
A series of Bonferroni corrected paired sample t-tests were conducted to compare the mean item scores for each parent. There was a small statistically significant difference in the frequency with which fathers ($M = 2.07$, $SD = 1.08$) exceeded the speed limit when compared to mothers ($M = 1.66$, $SD = 0.92$, $t(1698) = 16.03$, $p < 0.001$, $d = 0.41$). Similarly, there was a small statistically significant difference in the frequency with which fathers broke the rules of the road ($M = 1.78$, $SD = 0.9$), when compared to mothers ($M = 1.51$, $SD = 0.75$), $t(1698) = 13.61$, $p < .001$, $d = 0.33$). A similar pattern prevailed with regard to the non-wearing of seatbelts, fathers ($M = 1.3$, $SD = 0.85$), mothers ($M = 1.14$, $SD = .61$), $t(1699) = 7.88$, $p < .001$, $d = 0.22$); and drink-driving, fathers ($M = 1.37$, $SD = .81$), mothers ($M = 1.23$, $SD = .61$), $t(1699) = 8.53$, $p < .001$, $d = 0.2$), and using mobile phones, fathers ($M = 2.35$, $SD = 1.34$), mothers ($M = 2.23$, $SD = 1.3$), $t(1699) = 3.73$, $p < .001$, $d = 0.09$). The scores for all of the items were then combined to produce a mean scale score for each parent and the results of a further paired-sample t-test showed that there was a large difference in the overall score on this scale between the parents: the fathers ($M = 1.77$; $SD = 0.67$) were reported as engaging in aberrant driving practices significantly more often than were mothers ($M = 1.56$; $SD = 0.56$), $t(1698) = 15.7$, $p < .001$, $d = 0.34$).

The scores for the fathers and mothers were then combined to produce a parental mean score. Where scores were available for just one parent, that value was treated as the parental mean. The most prevalent aberrant driving behaviour on this overall scale was using a mobile phone ($M = 2.28$, $SD = 1.16$), which was followed by speeding ($M = 1.86$, $SD = .089$), breaking the rules of the road ($M = 1.63$, $SD = 0.73$). The parental mean for high-risk practices such as DWI ($M = 1.31$, $SD = 0.71$), and not wearing a seatbelt ($M = 1.23$, $SD = 0.66$) were gratifyingly low. Scores for this scale were then combined to produce a single score for parental aberrant behaviour and the internal consistency of this scale was satisfactory ($\alpha = .8$). The sample mean for this scale ($M = 1.66$, $SD = 0.62$) was

low. Given that a score of 1 on this scale represented “Never” and a score of 2 represented “Hardly ever” this indicated that the students in the sample were not exposed to aberrant driving behaviour by their parents to any great extent.

4.4.3.1 Exposure to aberrant driving practices – principal driver’s driving style

The levels of student exposure to the aberrant driving practices of the driver that they travel with most often (i.e. their principal driver, who may or may not have been a parent) were measured using 6 items (D/20). The reported prevalence of aberrant driving practices among principal drivers was generally quite low (Figure 4.3).



The most prevalent behaviour was sounding the car horn to indicate annoyance with another road user ($M = 2.55$, $SD = 1.37$). The mean score for overtaking slow drivers on the inside was surprisingly high ($M = 2.07$, $SD = 1.4$) in relative terms. The least prevalent behaviours were crowding slow drivers ($M = 1.6$, $SD = 1.07$), crossing against traffic lights ($M = 1.66$, $SD = 0.93$) and lane hogging ($M = 1.68$, $SD = 1.03$). The scores for these 6 items were combined to form a single scale representing exposure to driving violations, and the internal consistency of the scale was adequate ($\alpha = .71$). The mean scale score was relatively low ($M = 1.9$, $SD = 0.77$), given that a score of 1 represented “Never” and a score of 2 represented “Hardly ever”.

The HLM regression analyses of this scale revealed some interesting associations between reported exposure to driving violations and gender and some personality variables. The males in the sample reported that their principal driver committed significantly more driving violations than did their female counterparts. Furthermore, students with higher trait sensation seeking or impulsiveness or lower levels of agreeableness reported significantly more exposure to driving violations than did those with low to average levels of these traits. There were no significant effects of either programme group, age, SES, location or the remaining personality traits on scores for this scale (Table 4.7).

Table 4.7 Exposure to driving violations

Predictor variables	β (SE)	<i>t</i>	95% CI
<u>Gender</u> ^a			
Intercept (Male)	1.96 (0.04)	51.7	(1.94, 1.97)
Slope (Female)	-0.15** (0.05)	-3.07	(-0.17, -.013)
<u>Sensation seeking</u> ^a			
Intercept	1.37 (0.13)	10.46	(1.33, 1.41)
Slope	0.2*** (0.05)	3.86	1.8, 0.22)
<u>Impulsiveness</u> ^a			
Intercept	1.18 (0.11)	10.95	(1.14, 1.22)
Slope	0.31*** (0.05)	6.84	(0.29, 0.33)
<u>Agreeableness</u> ^b			
Intercept	2.46 (0.22)	11.15	(.39, 2.53)
Slope	-0.16** (0.06)	-2.9	(-0.18, -0.14)

Note: ^a df = 39. ^b df = 36. ** $p < .01$, *** $p < .001$.

Finally, the scores for all of the items relating to parents'/guardians' and also principal drivers' driving styles were combined to produce a single score representing the students overall exposure to aberrant driving. The sample mean for this combined scale was 1.75 ($SD = 0.54$), which suggested that exposure to aberrant driving was low for the sample. The internal consistency reliability for this scale was good ($\alpha = .80$). This score was used to test for the effects of exposure to aberrant driving on the knowledge, risk perception skills and attitudes as part of the summative analyses. Similar to the results from the HLM analysis on the driving violations scale, there were significant effects of

gender on exposure to aberrant driving, females reported slightly less exposure than did males, $\beta = -0.07, p < .05$ (Table 4.8). Students with higher levels of sensation seeking ($\beta = 0.13, p < .001$), impulsiveness ($\beta = 0.28, p < .001$) and lower levels of agreeableness ($\beta = -0.09, p < .05$) reported significantly higher levels of exposure to aberrant driving than did their counterparts

Table 4.8 Overall exposure to aberrant driving practices

Predictor variables	β (SE)	<i>t</i>	95% CI
<u>Gender^a</u>			
Intercept (Male)	1.78 (0.02)	82.43	(1.77, 1.79)
Slope (Female)	-0.07* (0.03)	-2.17	(-0.08, -0.06)
<u>Sensation seeking^a</u>			
Intercept	1.41 (0.09)	16.45	(1.38, 1.44)
Slope	0.13*** (0.03)	3.88	(0.12, 0.14)
<u>Impulsiveness^a</u>			
Intercept	1.12 (0.08)	13.6	(1.04, 1.15)
Slope	0.28*** (0.04)	7.6	(0.27, 0.29)
<u>Agreeableness^b</u>			
Intercept	2.08 (0.14)	15.11	(0.03, 2.13)
Slope	-0.09* (0.04)	-2.49	(-1.39, -1.21)

Note: ^a df = 39. ^b df = 36. * $p < .05$, *** $p < .001$.

4.5 Discussion

The results from this section of the study showed that the adolescent PLDs sampled were very interested in learning to drive. They also had some direct and indirect experience with using vehicles in traffic and with crash involvement before they reached year 12¹⁷ in secondary school.

Levels of interest in driving provided contextual information about the sample. They are also important because it is reasonable to suppose that students who are interested in a topic are more likely to benefit from attending courses related to that topic. For instance, a review of studies that examined the effects of interest and motivation in learning concluded that interest had a significant, positive effect on comprehension, the use

¹⁷ In this study, the mean age of students when they began year 12 was 16.02 years.

of learning strategies and the quality of the emotional experience while learning (Schiefele, 1991). Eagerness to start driving remained fairly constant during this research: Most of the students intended to apply for a LDP as soon as they possibly could and only a small percentage had no plans to obtain a permit at each stage. Furthermore, data from the end of the study showed that over 45% of the students had taken their driver theory test and that 35% had obtained a LDP by then. Males in the sample were significantly more likely to have passed a driver theory test and to have obtained a LDP than were females, suggesting that males were more eager to start driving than were females. This supports findings in previous studies which showed that males start driving earlier than females (e.g. Ferguson, Leaf, Preusser, & Williams, 1994). However, recent Irish data shows that there was very little difference between the percentages of males (52.5%) and females (49%) taking the driver theory test between January and October 2011 (personal communication from Catriona McLaughlin, Prometric Ireland, May 24th, 2012). There were no significant effects of taking a PLDE course generally, or of taking one of the specific PLDE courses that featured in this research, on success with the driver theory test. However this is not surprising, given the large percentage of students who reported that they had passed the test. It is worth noting however that the 5.5% failure rate reported in this study was much lower than the estimated failure rate on the actual theory test, which was approximately, 30% during the first 6 months of 2011 (personal communication with Catriona McLaughlin, Prometric Ireland, May 24th. 2012). There are two possible explanations for this discrepancy; either people who failed the test indicated that they had in fact passed, or those who didn't pass didn't admit to taking the test in the first place. Given that participants had been given repeated assurances of their anonymity, the latter explanation seems somewhat more plausible than the former. Either way this inconsistency highlights the drawbacks of measuring behaviour and attitudes through self-report. Nevertheless, Jonah, and Dawson (1987) noted that although people tend to

overreport positive behaviour and underreport negative behaviour, the self-report method is nevertheless useful for making comparisons between groups. Furthermore several studies indicate that people, including school students tend to provide accurate reports of their behaviours and attitudes (Killen & Robinson, 1988; Lajunen & Summala, 2003). However for a contrarian view on self-report methodology in traffic research see af Wählberg (2009).

The majority of the students in the current sample had operated a vehicle in the 12-month period prior to each test. However, since mean score for vehicle use ranged between 1 and 2 on a scale where 1 represented “never” and 2 denoted “a few times”, it appears that overall levels of experience with using vehicles was generally quite low. Nevertheless, over half of the participants indicated that they had driven a car at least once before they reached year 12 in secondary school and experience with using vehicles rose to 75% by the end of the study. The results for the post-intervention tests (i.e. T2 and T3) showed that students who had taken a PLDE course were not more likely to have driven a car than were those in the control group. One of the major criticisms of PDE is that it encourages students to start driving at an early age, thus increasing their exposure to risk (Mayhew et al., 2002; Mayhew, Simpson, Williams, & Ferguson, 1998; Roberts & Kwan, 2001). However, the results of the present study do not support this contention, because they show that participation in PLDE did not lead to earlier licencing, nor did it precipitate the early onset of car driving in pre-learners. Furthermore, participation in PLDE did not affect the frequency with which the students used other vehicles, including cars.

Several demographic factors, such as gender, age, rural domicile and personality traits, including sensation seeking, extraversion, emotional stability and agreeableness, were associated with an earlier onset of driving. The finding that rural students were significantly more likely to have driven a car than their urban counterparts was unsurprising. Youngsters in rural areas with poor access to public transport are likely to be

more strongly motivated to start driving than are those who have regular access to these services. However, it is well known that driving on rural roads poses particular challenges for all drivers. For instance data from the U.S. shows that whereas just 23% of the population lives in rural areas, 56% of crashes occur in rural areas (NHTSA, 2010). Furthermore, researchers agree that teens in rural areas are five to six times more likely to be involved in a fatal or severe injury crash than teens in urban areas (H. Y. Chen et al., 2009; Peek-Asa, Britton, Young, Pawlovich, & Falb, 2010). Given that the combination of youthfulness and rural driving represents a significant threat to safety, and since this study shows that rural youngsters are more likely to start driving at an early age than their urban counterparts, there is a clear need to ensure that all teenagers in rural areas are made aware of the increased risk that they face as learner and novice drivers. This should be addressed as part of a good PLDE course.

The early onset of driving was also predicted by a range of personality factors including high sensation seeking, extraversion and emotional stability, and low agreeableness. Most of the scientific literature examining the relationship between personality traits and driving focuses on aberrant behaviours, such as deliberate risk taking (Arnett, 2002; Arnett et al., 1997). However, given that driving clearly represents a somewhat novel, challenging, and in some instances illegal activity for students in their mid-teens it is not surprising that students with a stronger tendency towards sensation seeking, extraversion, emotional stability, and/or lower levels of agreeableness would start driving sooner than do their counterparts. The GDE-framework (Hatakka et al., 2002) recommends that driver education should aim to make students aware of risk-increasing factors and provide them with insight into how personal tendencies might influence their perceptions of risk and their actual risk-taking behaviour. Thus, these issues should be addressed in PLDE courses.

The reported prevalence of illegal underage driving in the sample was high¹⁸.

Over half of the 15-year-olds and more than 60% of the 16-year-olds reported that they had driven a car, albeit that most under aged students had only driven “a few times”. However, the results from the final test indicated that 90% of 16-year-olds had driven a car previously and over 40% of the 16-year-olds were driving at least once a week. On the basis of the well-documented links between youthfulness, inexperience and increased crash risk, which were outlined in Chapter 1, these findings are a cause for concern. Thus, it is recommended that PLDE courses should pay particular attention to the problem of underage driving and to explaining why these factors constitute such a high risk for learner and novice drivers.

The results with respect to driving supervision were also disquieting. In Ireland, it is illegal for a learner to drive a vehicle unless he/she is under the supervision of a person who has had a full licence for a minimum of two years. It is expected that this form of extended supervision will not only help novices to avoid unnecessary risk-taking in the short-term, but will also help them to acquire good driving habits over the longer-term (RSA, 2007). In this regard, the results from a new German scheme whereby newly qualified adolescent drivers agreed to be accompanied by a designated qualified driver, who does nothing to actively influence their behaviour, showed that participants in this scheme had fewer crashes than did their counterparts in a control group (Funk, 2010). In the current research, over a quarter of the drivers surveyed during the initial test, one third of those who took the post-intervention test and over half of those who completed the final survey reported that they had driven without proper supervision at some time. Furthermore, given that the incidence of inadequate supervision appeared to increase over time and the apparent absence of any significant programme effects relative to the control

¹⁸ Although it is acknowledged that the students were not asked to differentiate between off-road and on-road driving, it is clear nonetheless that underage driving in either setting is problematic and should be discouraged

group, it seems reasonable to conclude that the PLDE courses that featured in this study were not effective in discouraging this practice. Thus it is recommended that that PLDE courses should pay more attention to the outlining the problems associated with inadequate supervision, and the attendant risks in order to discourage this practice.

Although over half of the students had been involved directly in some kind of RTC in the preceding 5 years and 80% had indirect experience of crashing through a close friend or relative, the actual frequency of crash involvement was gratifyingly low. In both instances, over three quarters of those with experience of crashing had only been involved in one crash in the preceding 5 years. This indicated that it would be difficult to assess the moderating effects that experience with road traffic crashes might have on knowledge, risk perception skills and attitudes in the remainder of this research.

The participants reported that their parents generally refrained from engaging in aberrant driving practices. Since the mean scores for four of the five items in this scale was below 2.1, this suggests that the parents either “never” or “hardly ever” refrained from wearing seatbelts, drove while over the legal alcohol limit, broke the speed limit or contravened the rules of the road. The means for driving while using a mobile phone were slightly higher; however, it should be noted that the test made no distinction between hand-held and hands-free instruments. Whereas the use of hands-free mobile phones while driving does not contravene current traffic legislation in Ireland, it does increase the risk of crashing (WHO, 2011). Since this fact has been well publicised by the RSA, it is reasonable to assume that parents who were using hands-free mobile phones had chosen to do so despite the risks involved. However, when the findings from this part of the study were examined in terms of the percentage of parents who always complied with driving regulations it was notable that just 33% of fathers and 53% of mothers always observed the speed limit, 44% of fathers and 59% of mothers always observed the rules of the road and 84% of fathers and 93% of mothers always wore their seatbelts. In addition, only 76% of

fathers and 86% of mothers never drove after drinking alcohol and amazingly only 35% of fathers and 93% of mothers never used a mobile phone whilst driving. This suggests that more work needs to be done to improve the driving habits of Irish parents. The finding that fathers engaged in aberrant driving practices more often than mothers was not surprising, since an accumulation of evidence in the literature indicates that males have riskier driving styles than females (de Winter & Dodou, 2010; Miller & Taubman - Ben-Ari, 2010; Wells et al., 2008).

The current results indicated that students' general exposure to driving violations while being driven by their principal driver was also low. This reflects the fact that many of these drivers either "never" or "hardly ever" crossed an intersection against the traffic lights, hogged driving lanes, displayed hostility towards, crowded other drivers or overtook slow drivers on the inside. Although sounding the horn to indicate annoyance with another road user was the most prevalent type of violation reported by the students, their exposure to this practice was also moderately low. Since the scores from this test are very similar to those found in studies featuring drivers' own self-reported behaviour (Åberg & Rimmö, 1998; Lajunen, Parker, & Summala, 2004), it seems that the commission of driving violations in Ireland reflects the international average. More importantly in the present context, these results indicate that pre-learner drivers both notice and are capable of reporting on the frequency with which their principal drivers commit driving violations with a reasonable degree of accuracy. In hindsight however, it is regrettable that the identity of these "principal drivers" was not ascertained, since this would have provided a clearer picture of the various influences on adolescent passengers. Since male students and those with higher levels of sensation seeking, and impulsiveness, and lower levels of agreeableness reported higher levels of exposure to driving violations than did their counterparts, it seems likely that those former individuals chose to associate with people who engaged in aberrant driving practices. This assumption is given credence by the fact

that no such differences were found in the reporting of parental driving practices.

Furthermore, it is well-known that male drivers and those who are more inclined towards sensation seeking, impulsiveness and low agreeableness are more likely to commit driving violations than are their counterparts (Lajunen et al., 2004; Olstedal & Rundmo, 2006; Owsley, McGwin, & McNeal, 2003; Rimmö & Åberg, 1999).

Having established that, in accordance with the TCI model of driver behaviour (Fuller, 2005), personal characteristics and previous learning represent important antecedent influences on personal competence, and having produced personality and experience indices for each of the participants, these predictors were used to investigate individual differences in initial levels of knowledge, risk perception skills and attitudes, and also changes in these outcomes as a function of time and of participating in a PLDE course in the chapters that follow.

Chapter 5: Knowledge

5.1 Introduction

Knowledge about how the traffic system works is an essential precursor of safe behaviour in the roadway. In Ireland, the traffic system is governed by The Rules of the Road (ROTR), which enshrines current legislation and describes best practice in road user behaviour. Compliance with these rules is essential for ensuring the safety and security of all road users (RSA, 2010b). Moreover, the behavioural psychologist Skinner once suggested that rules are society's way of demonstrating to its citizens how to learn from the mistakes of others (Bonnie, 1985). In cognitive terms, knowledge about the ROTR is classified as declarative knowledge, since it entails knowing that something is the case (Eysenck & Keane, 2010). This type of knowledge is generally acquired either directly as a result of experience or indirectly by means of formal education (Dong et al., 2011). Research conducted within the educational sector shows that classroom-based instruction is a particularly effective way of providing students with declarative knowledge in a systematic way (Moreno, 2010). For instance, the results from the Irish State Junior Certificate Examinations in 2011 indicate that less than 2% of the examinees failed the English section of this test and that the failure rates for History (6%) and Science (3%) were also very low (Irish State Examinations Commission, 2012). This suggests that the vast majority of Irish students gain a substantial amount of knowledge during the first three years in secondary school as a result of education.

As part of their educational strategy, the RSA has developed a range of material to educate child and adolescent school goers about road safety. Three programmes are currently in use for primary school students; the "Be Safe" programme, which targets 5 – 12-year-olds and the "Seatbelt Sheriff", and the "Hi Glo Silver" programme which is aimed at 7 – 12-year-olds. At secondary school level, the "Streetwise" programme is designed for 12 – 15-year-olds. Because of this concerted effort to provide road safety education in

Irish schools, the vast majority of youngsters who have completed their primary school and/or post-primary education in Ireland will have received some type of instruction about how to stay safe in traffic and about the ROTR before they reached year 12 in secondary school (RSA, 2012).

The current edition of the “Rules of the Road” (RSA, 2010b) uses three methods to guide behaviour: It draws attention to behaviour that the law requires or forbids; it tells road users how to act where no legal rule is in place and it describes and illustrates road signs and markings, traffic lights etc. which serve to regulate traffic. Although the ROTR apply to all road users, aspiring drivers must demonstrate a satisfactory level of knowledge of these rules by taking a learner driver theory test (TT) before they can apply for a learner driver permit (LDP). Since formal study of the ROTR constitutes a recognisable move towards obtaining a licence and thus becoming a driver, it is expected that this element would be included as part of a good PLDE course.

In addition to the type of knowledge contained in the ROTR, many driver preparation courses draw students’ attention to evidence related to statistical risk in traffic. This typically includes information about the number of people killed each year, the age groups who are most at risk, the amount of practice that is needed to become a competent driver and the types of manoeuvres that constitute the highest statistical risk of crashing for learner and novice drivers. This information is useful for increasing awareness about the objective risks that are associated with a range of demographic and behavioural factors, because people’s perceptions of risk are generally quite low since they don’t usually experience these risks at first hand (Fuller, 2002).

Since the concept of PLDE is relatively new and since those evaluations that have been carried out to date have mainly focussed on the effects of these courses on driving-related cognition e.g. beliefs, attitudes and risk perception (e.g. Harré & Brandt, 2000a; Poulter & McKenna, 2010), very little is known about the effect of PLDE on declarative

knowledge i.e. knowledge about the ROTR and statistical risk. However, an evaluation the 1-day Rotary Youth Driver Awareness programme, involving over 1,200 Australian PLDs in school year 11, showed that this course lead to significant gains in short-term knowledge with respect to the consequences of risky driving behaviour and drink-driving regulations for new drivers (Elkington, 2005). However, most of this knowledge was lost over the subsequent 3-month period.

The aims of this part of the study were to:

1. Devise tests to measure knowledge about the ROTR and statistical risk in PLD adolescents, and establish their psychometric properties.
2. Use the results of those tests to investigate the 6 hypotheses that form the centrepiece of this research.

5.2 Method

5.2.1 Design

See Chapter 2, subsection 2.3

5.2.2 Participants

See Chapter 2, subsection 2.2.

5.2.3 Procedure

See Chapter 2, subsection 2.5

5.2.4 Measures

Two different tests were devised and used to measure student knowledge about the rules of the road and statistical risk in the present study. The first short test was included as part of the main questionnaires and thus recorded knowledge proficiency in the T1, T2 and T3 tests. A supplementary knowledge test was devised and used during the T2 (see Appendix G) and T3 (see Appendix H) tests, in an attempt to address the knowledge construct more adequately.

5.2.4.1 Short knowledge test

The short knowledge test was presented as part of the ‘Attitudes and Knowledge’ section of the questionnaire, whereby the knowledge questions were interspersed among the attitude questions. This test contained eight questions, which were designed to measure the students’ knowledge about the ROTR and statistical risk (see Appendix D, questions 22, 23, 25, 26, 28, 29, 31 and 35). Questions about statistical risk were included because they represent the type of information that should be provided as part of a good PLDE course, and the inclusion of such measures was required to cater for school groups that did not study the ROTR formally as part of their PLDE course.

Seven of the questions were presented in multiple-choice formats. Five of the multiple-choice questions featured response options that included one key (correct) response and at least three distractor items. Two questions involved multiple key response items, with several distractors. There was also one free-response question. Thus, each of the short knowledge tests contained 13 key items. In the following examples, key responses are denoted by the symbol ‘*’;

Question 22: “How many people were killed on the roads in the Republic of Ireland in 2008? We are merely interested in your best estimate as opposed to the correct answer. Please enter your estimate in this box”. One mark was awarded for estimates that were within 20% of the correct figure. In the T1 and T2 tests, this question specified the year 2008, when 279 people were killed, therefore answers between 223 and 335 inclusive were awarded one point. In T3 the specified year was changed to 2010, when 213 people were killed, therefore one mark was awarded to values between 170 and 257 inclusive.

Question 26: “How much driving experience do you think you will need to have, before your chances of having a crash are the same as those of the average mature driver?” Six options were presented: (a) Less than 1 year; (b) Between 1 & 3 years; (c) Between 3 & 5 years; (d) Between 5 & 7 years*; (e) Between 7 & 9 years; (f) More than 9 years.

Question 28: “What should you do if you become drowsy while driving?” The 4 response options were; (a) Increase your speed to shorten the journey, (b) Stop and take a break*, (c) Play some loud music and (d) Open a window or turn on the air conditioning. A binary code was used to grade the responses, where 1 represented a correct answer and 0 denoted an incorrect answer. Since it was assumed that missing values in these tests indicated of a deficit in knowledge, these were also awarded a score of 0. The maximum score for the short knowledge test was 13 points.

5.2.4.2 Supplementary knowledge test

A supplementary knowledge test, consisting of 26 multiple-choice questions was administered during the T2 (Appendix G), and the T3 (Appendix H) tests. In order to control for practice effects, the content of 50% of the questions was changed between the T2 and T3. However, as can be seen in Table 5.1, both the old and the new question covered the same general categories of knowledge.

Table 5.1 Descriptions of items that were altered between the T2 and T3 supplementary knowledge quizzes

Question Number	T2 Description	T3 Description
02	Picture – Hazard perception	Picture – Hazard perception
05	Rules for drivers	Rules for Pedestrians
06	Rules for drivers	Rules for drivers
08	Road signs	Road signs
10	Road markings	Road markings
12	Stopping distances	Stopping distances
13	Road markings	Road markings
14	Rules for learner drivers	Rules for learner drivers
15	Road signs	Road signs
18	Hand signals	Hand signals
22	Picture – Hazard perception	Picture – Hazard perception
24	Rules for drivers	Rules for drivers
25	Picture – Hazard perception	Picture – Hazard perception

Note: Questions 02 and 25 contained 2 key items, question 05 contained 3 key items, and the rest of the questions listed above contained 1 key item.

The supplementary tests consisted of 18 questions where the students were required to pick one key answer from four possible responses, and eight questions where they were required to choose 2 or more key responses from a list of possible responses. Thus, each

test contained 43 key responses, and since the responses from this test were graded in a similar manner to those on the short knowledge test, the maximum score for this test was 43 points.

5.2.5 Data analysis

Data from the knowledge tests were analysed in two stages: First, an item response analysis was conducted to establish the reliability and validity of the knowledge tests and thereafter to calculate a proficiency score for each participant. Second, the resulting scores were used to build multilevel hierarchical linear models (HLMs), which examined the effects of a range of predictor variables on the knowledge proficiency scores.

Item response theory represents an important technical development in the field of measurement (Linn, 1989). The main advantage of IRT over traditional methods for scoring tests lies in the promise of invariance, which Wright (1968) described as “person-free item calibration and item-free person measurement”, the basis for which was described in Chapter 2, sub-section 6.9.1. Because it is able to identify items that do not differentiate between and/or which discriminate against candidates, IRT is preferred over classical item analysis when it comes to producing valid achievement proficiencies on the basis of tests that have not been validated previously (Hambleton et al., 1991), as was the case for the knowledge tests that were used in this study. IRT has the further advantage of being able to adjust for changes in the item composition between tests, which allows researchers to substitute some of the items on a test with items that are similar in terms of difficulty and discriminatory properties (DeMars, 2010). In the present study, this property of item invariance allowed us to replace almost 50% of the items from the T2 test in the T3 test. This was done to reduce possible practice effects and thus to improve the validity of the test further. Previous research with respect to student learning suggest that IRT provides more stable estimates of item difficulty across samples and across different forms of the same test, and produces less measurement error than do analyses that are based on

classical test theory (CTT) (Magno, 2009; Sharkenss & DeAngelo, 2011). For instance, Magno (2009) studied the psychometric properties of two different forms of a 60-item multiple-choice chemistry test that was taken by 219 junior high school students. He found that the correlations of item difficulty using CTT (form A, $r = .82$; form B, $r = .84$) were smaller than those produced from IRT approach (form A, $r = .91$; form B, $r = .92$). He also found that the standard errors for the IRT estimates (form A, $SE = .04$; form B, $SE = .06$) were significantly lower than those for the CTT analysis (form A, $SE = .64$, form B, $SE = .83$, $p < .001$).

Item response analyses of the data from the present study began by calculating proficiency scores (θ) for each student to reflect his/her level of knowledge about road safety as measured by the individual tests. A detailed description of the basis of item response theory is provided in Chapter 2, sub-section 6.9.1. As a result of the way that θ is calculated, it is both independent of the particular set of items administered and of the population from which the examinees have been drawn (Hambleton et al., 1991). Since the θ score is invariant, examinees who respond to different sets of items can be compared using this score. The θ scale represents an absolute scale for the proficiency being measured (DeMars, 2010). Since the mean score on a proficiency scale is 0 with a standard deviation of 1, scores on these scales are often subjected to linear transformations to make them easier to interpret. In this study, the standardised proficiency scores were transformed in a manner similar to the one used for Intelligence Quotient (IQ) tests by multiplying the score by 15 and then adding 100.

5.3 Results of the item response analyses

5.3.1 Short knowledge tests

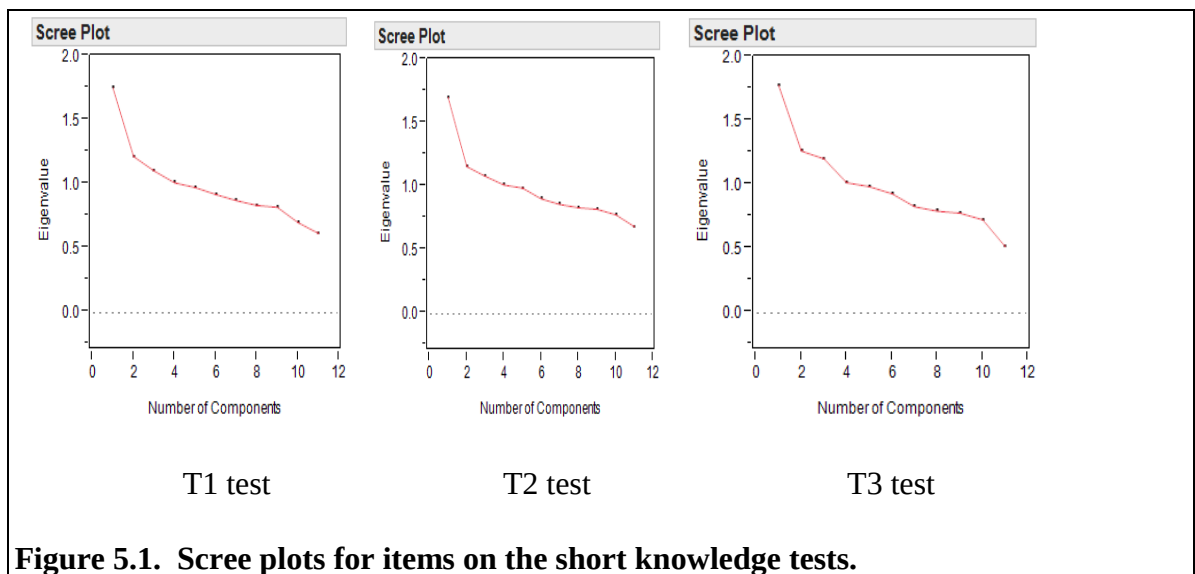
The psychometric properties of the knowledge tests from this study were established by examining the following criteria, as suggested by Hambleton et al., (1991);

1. Parametric assumptions

2. Item discrimination
3. Spread of item difficulties
4. Test Information Function (TIF) describes the relative contribution of each item to the overall test
5. Differential Item Functioning (DIF) compares test scores across different demographic groups

5.3.1.1 Parametric assumptions

The principal parametric assumptions that need to be met in item response analysis are unidimensionality and local independence (Hambleton et al., 1991). The data for all 3 short knowledge tests were checked for unidimensionality using the scree plot of the eigenvalues of the tetrachoric correlation matrix, which indicated the presence of one dominant factor, thus satisfying the assumption of unidimensionality (Figure 5.1).



Yen's Q_3 test (1984) was used to check for any violations of local independence in each test. The concept of local independence supposes that an examinee's response to a test item depends on their proficiency θ but not on the identity of or on the responses to, other test items (Lord, 1980). The results of the Q_3 test showed that, having controlled for θ , none of the pairwise residual correlations in the individual tests were greater than .2, which

is below the upper threshold recommended by Lord (1980) and thus satisfied the condition of local independence.

The tests were calibrated using a two-parameter logistic (2PL) model (Hambleton et al., 1991), where the parameters were estimated using the maximum marginal likelihood (MML) method. All items fitted their respective models reasonably well.

5.3.1.2 Item discrimination

The item discrimination score (a -parameter estimates) represents the extent to which an item is capable of differentiating between examinees with different levels of the construct being measured. High values on the item discrimination parameter suggest that these items are good at discriminating in favour of examinees that rank in the top 27% of a sample (DeMars, 2010). Starting with the T1 scores, inspection of the item discrimination parameter estimates revealed negative values for two items; item 10 (-0.76) and item 12 (-0.01) (see Table5.2).

Table5.2 Item discrimination and item difficulty indices for short knowledge tests

Item No.	<u>Item discrimination</u>			<u>Item difficulty</u>		
	Time 1	Time 2	Time 3	Time 1	Time 2	Time 3
1 (Number killed)	0.37	0.65	0.54	4.97	2.57	3.05
2 (Motorway speed limit)	4.84	1.32	1.57	0.28	0.42	-0.10
3 (Town speed limit)	0.12	0.70	0.81	11.23	2.37	2.01
4 (National speed limit)	7.92	1.21	1.47	0.52	1.65	1.16
5 (Local speed limit)	4.57	0.94	1.10	0.91	2.87	1.94
6 (Drowsy)	1.09	3.22	2.71	-1.53	-0.82	-0.87
7 (Slow driving)	0.93	2.80	2.61	-1.25	-0.49	-0.89
8 (Drink driving)	0.34	1.59	1.83	-0.55	-0.12	-0.61
9 (Manoeuvre 1 - Taking right-hand turns)	0.11	0.63	0.63	11.15	2.51	2.26
11 (Manoeuvre 5 - Rear-end shunts)	0.30	0.59	0.52	2.54	2.38	2.20
13 (Age group/risk)	0.50	2.10	1.89	-1.28	-0.52	-0.72

According to Woods (1960) negative values on this parameter suggests that these items were either poorly written or poorly understood by the examinees, since they discriminated against the top ranking candidates. Since he also advised that negative items should be

dropped to improve test validity, items 10 and 12 were dropped from the scale and the remaining eleven items were used to calculate the proficiency scores in all three tests. The item discrimination classification system devised by Ebel and Frisbie (1986) indicates that discrimination values that are $\geq .4$ are very good, those ranging between .30 and .39 are reasonably good, those between .20 to .29 are classified as marginal and those below .19 are regarded as poor discriminators. Based on these criteria, the α -parameter estimates for the T1 test showed that three of the four items testing knowledge of speed limits (2, 4, and 5) were the best discriminating items on this test. Items 6, 7, and 13 were also good, items 1 and 8 were reasonably good, item 11 was marginal, and items 3 and 9 were poor discriminators. Analysis of the item discrimination score for both the T2 and T3 tests show that all items were very good at discriminating between participants (see Table 5.2). The mean discrimination index was higher for the T1 test 1.92 ($SD = 2.63$), than it was for the T2 ($M = 1.43$, $SD = 0.91$) and the T3 ($M = 1.43$, $SD = .079$) tests, which suggests that the gap between the students with high levels of proficiency and those with low levels of proficiency was becoming narrower during the course of this study.

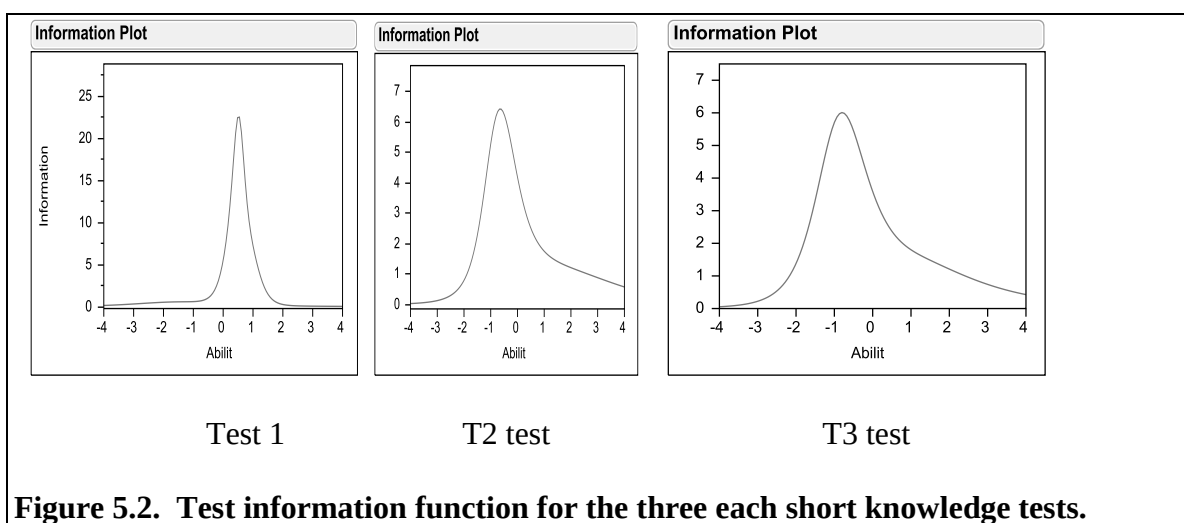
5.3.1.3 Item difficulty

The item difficulty index represents the proportion of students who identified the correct answer(s) for each of the questions (Hambleton et al., 1991). These b -parameter estimates were used to evaluate the tentative difficulty/appropriateness of the test items. The higher the difficulty score, the harder the item was for the participants to answer correctly. In accordance with the item difficulty classification system devised by Woods (1960), items with difficulty values that are $\geq .5$ were classified as difficult, those with values ranging between $-.5$ and $+.5$ standard deviations from the mean were classified as moderate and items with values of $\leq -.5$ were deemed easy. An item difficulty analysis of the items on the T1 test showed that it contained six difficult items (1, 3, 4, 5, 9 and 11), one moderate item (2) and four easy items (6, 7, 8 and 13). Item 3, which tested student

knowledge about the speed limit in towns/cities, had the highest difficulty index (11.23), and thus was the hardest item on this test. Item 6, that asked the students to identify the correct behaviour if they became drowsy whilst driving, had the lowest difficulty index (-1.53) and thus was the easiest item. Analysis of the item difficulty for items contained in the T2 and T3 tests produced similar results, with some exceptions. Items 7 and 8 were classified as ‘easy’ in the T1 test, as ‘moderate’ in the T2 test, and reverted back to ‘easy’ in the final test. The mean item difficulty score for the T1 test was 1.33 ($SD = 1.47$) and the difficulty index decreased for both the T2 test ($M = 0.6$, $SD = 1.11$) and for the T3 test ($M = -0.17$, $SD = .75$), indicating that the students found the tests easier to answer correctly as this study progressed (Table5.2).

5.3.1.4 Test Information Function

The item characteristic curves for the items on each test were summed to produce test information plots, where information is analogous to reduction in uncertainty (Hambleton et al., 1991). The item characteristic curve for the T1 test indicated that the maximum amount of information was produced by this test where the examinees’ proficiency was 0.8 standard deviations above the mean. The test information curve was quite peaked which indicated that the α -parameter was high (Figure 5.2).



Given the degree of kurtosis seen in this graph, it is evident that this test provided very little information about participants whose proficiency was either below average or more than 1 standard deviation above the mean. To address this limitation an additional, more comprehensive test was devised and used during the T2 and T3 tests (Full details of this test are provided later in this chapter). However, the information plots for both the T2 and T3 short knowledge tests revealed less kurtotic patterns, which indicates that as time progressed the short knowledge test provided more information about students across a wider range of abilities. Since the actual test remained unchanged this improvement in test information function suggested that there was an overall improvement in knowledge in the sample as time progressed. However, it is possible that some of this improvement may be due to practice effects.

5.3.1.5 Differential Item Functioning

One of the most important properties of any test is its fairness. Item response theory provides a unified framework for examining test bias at the level of individual test items (DeMars, 2010). The term differential item functioning (DIF) is used to describe the empirical evidence obtained when bias is investigated. From a psychometric perspective DIF is evidenced where individuals with the same proficiency, but from different groups, do not have the same probability of answering a test item correctly (Hambleton et al., 1991). Thus, testing for DIF is essential to support claims for the reliability and validity of any test involving multiple groups. Separate DIF analyses were conducted on the results of all three short knowledge tests, with respect to three demographic categories; males/females; urban/rural dwellers and high/low SES. The first group in each pair is referred to as the focal group and the second group is referred to as the reference group (DeMars, 2010). Two criteria were used to identify items that were functioning differently in these groups, the Mantel-Haenszel statistic (Δ_{mh}), and the ETS classification. The Δ_{mh} is derived from the ratio of the likelihood of a correct response on the target item for both

groups and takes the form of a chi-square, testing the null hypothesis that the difference in probability of responding correctly to the item between the focal group and the reference group is zero (P. W. Holland & Thayer, 1988). Although a statistically significant Chi-square statistic can flag differences, this does not indicate that the magnitude of the DIF is practically significant. Therefore the three-level DIF classification system developed by Zieky (1993) for the Educational Testing Service (ETS) in the USA, was used to assess the magnitude of the Δ_{mh} . In the ETS classification system, items for which the value of Δ_{mh} is < 1.0 and/or the p-value $> .05$ are deemed to display little or no DIF and are classified as level A and items not meeting these criteria should be examined closely. The direction of the DIF should be examined also. Items with a negative Δ_{mhs} are considered to favour the reference group as the item was more difficult for the focal group. The scores from each of the simple knowledge tests were analyzed using these criteria. In each comparison, many items were flagged for *DIF* using the criterion of statistical significance ($p < .01$), which was expected, given the large sample size (see P. W. Holland & Thayer, 1988). However, using the ETS system, all of the items in each test were classified as ‘A’, which indicated that the short knowledge tests did not favour either males, or females, urban or rural dwellers or students with either high or low SES, thus establishing that the tests were fair.

5.3.2 Item response analysis of the supplementary knowledge tests

5.3.2.1 Missing Data

Since missing values in tests of declarative knowledge indicate gaps in knowledge, these were not filled using imputation, with one exception: A small number of students did not have enough time to finish the questionnaire during T2 test, due to timetabling issues in two of the schools. A missing data analysis showed that this was a problem for 27 students (1.4%), half of whom did not answer any of the last seven questions in the survey. The nature of the missing data was investigated using Little’s test (2002) which indicated that

the missing data were not MCAR. Rather they were classified as MAR, because of their relationship to other measured variables in the dataset, but not to the underlying values of the incomplete variable (school and student specific characteristics potentially influenced the absence of this data) (see Little & Rubin, 2002; Rubin, 1987). Data were imputed only for missing values that appeared consecutively towards the end of the test for these individuals, since failing to do so would result in an underestimation of their actual knowledge in the T2 test. This, in turn, could potentially distort any differences that might occur when these data were compared with the results of the T3 supplementary knowledge test. Since the amount of data that needed to be imputed was small the EM option in SPSS was used (see Scheffer, 2002).

5.3.2.2 *Parametric assumptions*

Item response analysis was conducted on the results for both of the supplementary knowledge tests, using a similar procedure to the one used for the short knowledge tests. To assess the dimensionality of the data, a scree plot of the eigenvalues of the tetrachoric correlation matrix was graphed for the scores on the two tests and both showed the presence of one dominant factor, thus satisfying the assumption of unidimensionality for the tests (Figure 5.3).

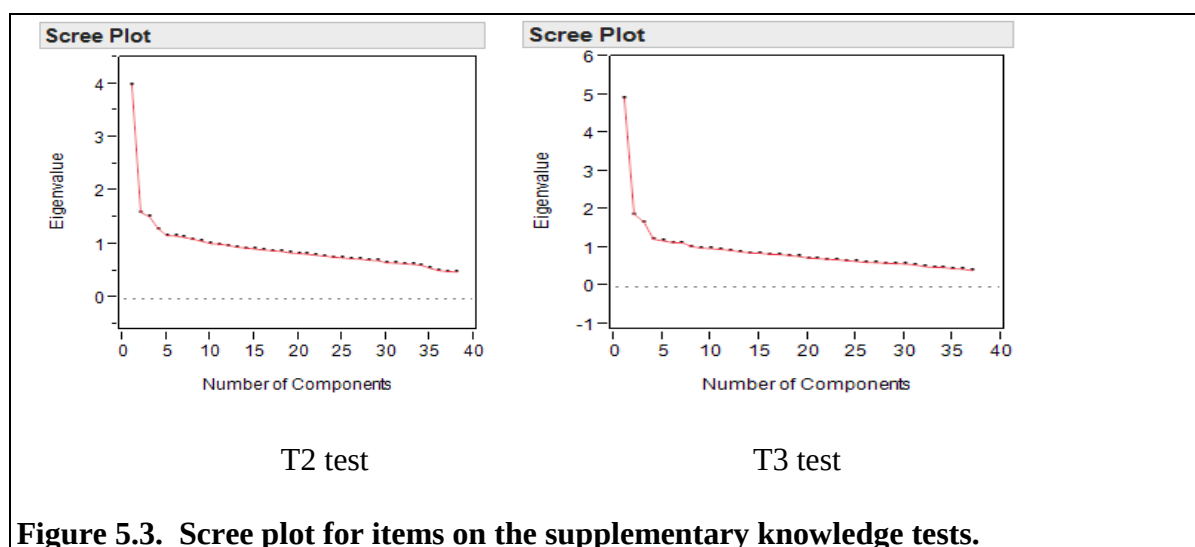


Figure 5.3. Scree plot for items on the supplementary knowledge tests.

Yen's Q_3 test (1984) was used to check for any violations of local independence.

After controlling for θ , none of the pairwise residual correlations in either test were greater than .2, evidencing local independence. The items in each test were calibrated using a two-parameter logistic (2PL) model, using the maximum marginal likelihood method. Test scores were then transformed linearly to a scale similar to the one used for IQ tests, whereby the mean = 100 and the standard deviation = 15.

5.3.2.3 Item discrimination

An inspection of the item discrimination indices for both tests showed that all five correct responses for question number 7 produced negative values, which indicated that they were poor at discriminating between students. These items were removed from the tests and all subsequent analyses were conducted using the remaining 38 items. Since the item discrimination parameters for the remaining items in both tests were all $>.4$, they were regarded as very good for discriminating between the students in the sample (Table 5.3). The item discrimination index for the T2 test was high ($M = 1.07$, $SD = 0.37$) and this rose slightly for the T3 test ($M = 1.33$, $SD = 0.52$), which indicated that these tests were very good at discriminating between students with higher and lower levels of proficiency.

Table 5.3 Item discrimination and item difficulty indices for supplementary knowledge tests

Item No.	<u>Item discrimination</u>		<u>Item difficulty</u>	
	T2	T3	T2	T3
1	0.96	1.35	-0.53	-0.60
2a	1.30	1.27	-0.30	-0.52
2d	1.04	1.29	0.25	-0.67
3	0.46	0.54	4.13	3.41
4	0.46	0.52	2.79	2.30
5a	1.47	2.13	-0.15	-1.60
5c	0.68	1.38	1.16	-0.62
5d	0.51	1.23	3.33	-0.14
6	1.80	0.93	-0.88	0.18
8	0.75	1.56	1.16	-0.69
9	0.73	0.85	0.42	0.20
10	1.10	1.68	0.02	-0.90

(cont.)

Item No.	<u>Item discrimination</u>		<u>Item difficulty</u>	
	T2	T3	T2	T3
11b	0.71	0.78	1.26	0.86
11c	0.85	1.09	0.23	0.19
11d	1.56	2.20	-1.30	-0.86
12	0.56	0.59	1.69	1.00
13	0.67	1.18	1.87	0.67
14	0.53	0.89	2.16	0.24
15	1.26	1.82	0.18	-0.19
16a	0.80	0.97	0.58	0.13
16c	1.36	1.45	-0.89	-0.88
16e	1.03	1.12	0.07	-0.03
17a	0.76	0.68	1.65	1.65
17c	1.00	2.52	-0.18	-0.83
17d	1.50	2.01	-0.66	-0.49
18	1.15	0.80	0.13	1.29
19	0.88	1.08	0.23	0.17
20	1.18	1.55	-0.33	-0.06
21	1.59	2.34	-1.04	-0.72
22	1.53	1.44	-0.21	-0.67
23	1.66	2.34	-1.15	-0.86
24	1.33	1.57	0.00	-0.76
25a	0.98	0.94	-0.03	-0.07
25d	1.20	0.87	-0.16	0.50
26a	1.72	1.78	-1.11	-1.00
26b	0.96	1.07	0.08	-0.04
26d	1.37	1.53	-0.51	-0.53
26c	1.13	1.23	-0.34	-0.37

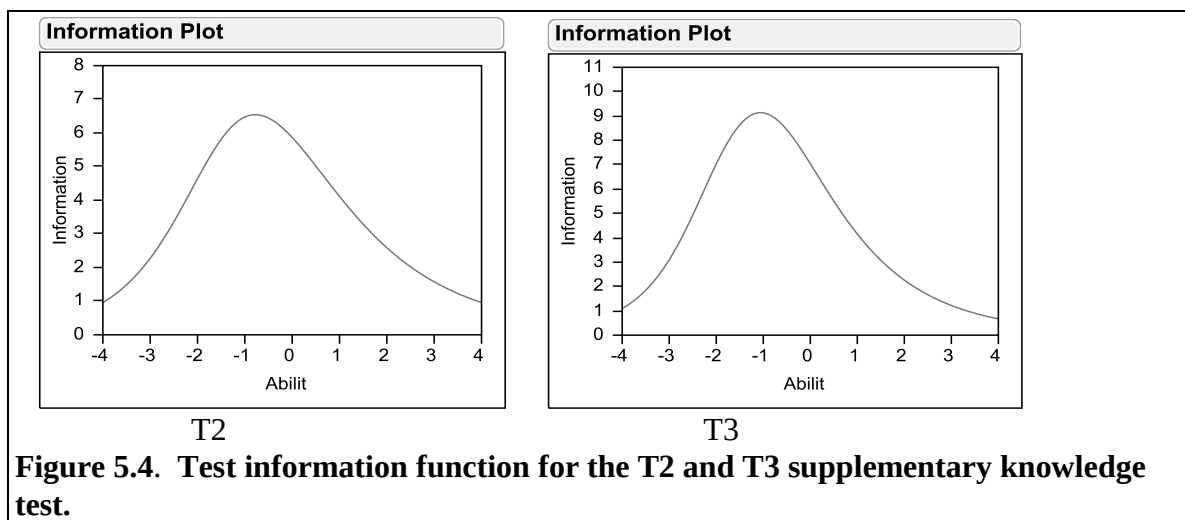
5.3.2.4 *Item difficulty*

Analysis of the item difficulty parameters indicated that the T2 test contained nine easy items, eighteen moderate items and eleven difficult items (Table 5.3). Classification of some items changed over time and analysis of the T3 indices showed that this test contained sixteen easy items, fifteen moderate items and seven difficult items. Item 3 “In which of (the following) circumstances must you NOT overtake other vehicles?” and item 4 “What should a driver do when approaching this (yield) road sign?” were classified as highly difficult for the students on both occasions. The students found one of the correct options for question 11 “If you arrive at the scene of an accident what should you do?”

very easy to answer on both occasions (“use your mobile phone to call the emergency services”). Similarly, they found question 23 “When is it permissible to carry more passengers in your car than there are seats available” was very easy to answer in each test. The difficulty index for the T2 test was quite low ($M = 0.36$, $SD = 1.24$) and this dropped slightly for the T3 test ($M = -0.03$, $SD = 0.97$), suggesting that the students found these tests increasingly easy to answer correctly as time progressed.

5.3.2.5 Test information function

The item characteristic curves for the items on each test were summed to produce two test information plots (Figure 5.4).



The threshold values on both tests ranged between -4 and +4, where their information value rose noticeably, which indicates that these supplementary tests provided information about students across a wider range of abilities than did the shorter knowledge tests, which supports Wood’s (1960) hypothesis that longer tests are better at tapping into the proficiency construct than shorter ones. The maximum amount of information was produced by this test where the examinees’ proficiency was approximately one standard deviation below the mean.

5.3.2.6 Differential item functioning

Differential item functioning was tested for the scores on the supplementary tests, using a similar process to the one used for the simple knowledge tests. The results of the Mantel-Haenszel statistic, (Δ_{mh}) (P. W. Holland & Thayer, 1988) and the corresponding test of significance showed that many items functioned differently between the focal group and the reference group. However when the ETS criteria (Zieky, 1993) were applied all of the items on both tests were rated as 'AA', suggesting that these tests did not operate differently between either males/females, or urban/rural dwellers or students classified as having high or low SES.

Since the results of the item response analyses on the three short knowledge tests and on the two supplementary knowledge tests met the various criteria used to establish reliability and validity (Hambleton et al., 1991), the scores from these tests were deemed suitable for further analysis.

5.4 Results of the descriptive and HLM analyses

This section begins by reporting the results of the analyses of the short knowledge test scores, which examined patterns of change in knowledge proficiency in the intervention phase (i.e. between the T1 and T2 tests), and also between the initial and the final test in the study (i.e. between the T1 and T3 tests). Similar analyses of the supplementary knowledge test scores are reported in the next section. Since the supplementary knowledge tests were conducted only at T2 and T3, just one set of analyses was needed for these comparisons.

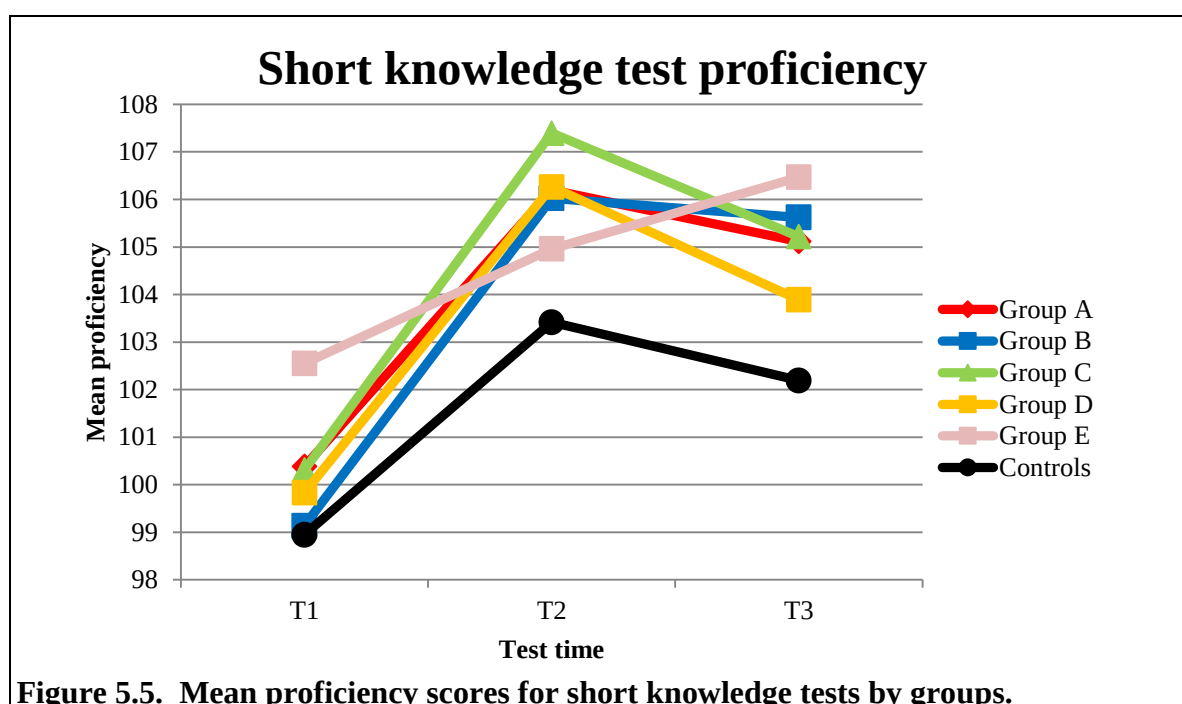
The raw mean number of items that the students answered correctly in the T1 test was 4.90 ($SD = 1.56$), and this increased slightly in the T2 test ($M = 5.05$, $SD = 1.1$), and again in the T3 test ($M = 5.44$, $SD = 1.65$). Since each test contained eleven items, these results show that, on average, the students in this sample answered less than 50% of the questions correctly in these tests. Following the linear transformation of the proficiency

scores, in the manner outlined previously, mean scores were calculated for the individual groups and also for the sample as a whole (see Table 5.4).

Table 5.4 Mean knowledge proficiency scores by test time and experimental condition

Experimental condition	T1 (n = 1880)		T2 (n = 1292)		T3 (n = 1381)		Differences		
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	T1/T2	T2 /T3	T1/T3
Group A	100.38	15.95	106.20	13.49	105.12	13.41	5.8%	-1.0%	4.7%
Group B	99.14	15.28	106.02	13.94	105.62	15.19	6.9%	-0.4%	6.5%
Group C	100.31	10.46	107.39	12.95	105.22	13.03	7.1%	-2.0%	4.9%
Group D	99.83	17.44	106.27	16.19	103.89	15.73	6.4%	-2.2%	4.1%
Group E	102.55	16.95	104.96	14.93	106.47	15.82	2.3%	1.4%	3.8%
Control group	98.95	11.89	103.42	12.01	102.19	12.74	4.5%	-1.2%	3.3%
Drop-out groups	98.79	12.33	-	-	-	-	-	-	-
Overall	99.99	14.33	105.71	13.55	104.75	14.32	5.7%	-0.9%	4.8%

The table above shows that there was an increase of approximately 5.7% in the sample mean for knowledge proficiency between the T1 ($M = 99.99$, $SD = 14.33$) and the T2 ($M = 105.71$, $SD = 13.55$) tests. This was followed by a decrease of almost 1% between the T2 and the T3 ($M = 104.75$, $SD = 14.32$) tests, resulting in an overall increase of approximately 4.8% over the course of the study. An examination of the proficiency scores for the experimental and control groups revealed short-term increases in these scores (i.e. between the T1 and T2 tests), in group C, B, D, A, controls and E respectively that ranged from 7.1% to 2.3% respectively. Long-term gains (i.e. between the T1 and T3 tests) of between 6.5% and 3.3% were seen in groups B, C, A, D, E and the controls respectively. As expected, levels of knowledge proficiency in the control group were lower than those in the experimental group in each of the tests. Students who took a PLDE course gained 5.7% in knowledge in the short-term, and 4.8% over the longer term. However, it is interesting to note that the results for the controls follow a similar pattern of increase and decrease as that recorded by many of the PLDE groups (Figure 5.5).



5.4.1 HLM analysis of short knowledge test scores

A series of three-level, intercepts-and-slopes-as-outcomes HLM regression models were fitted for the proficiency estimates. Separate analyses were conducted on the proficiency scores in both phases of the study. These results are reported in chronological order starting with the comparisons of the intervention phase (IP) scores (T1 and T2), which is followed by the comparisons of the scores from the initial and the final test (T1 and T3). The modeling process for each set of scores commenced with the estimation of three-level unconditional models to establish the variability in the data at each. Subsequent models (2-6) were used to test the hypotheses of interest in the study (see Chapter 1, subsection 1.4.2).

Intervention phase models

Six models were constructed in order to describe the relationship between variables at all three levels during the intervention phase. Details of all of the models described in this section are provided in Table 10.5¹⁹.

¹⁹ Note: Tables and figures containing the prefix “10” can be found in the Appendices.

Unconditional model (model 1)

The results for the unconditional model showed that the mean regression coefficients for this test varied significantly around the grand mean ($\beta = 103.03$). The ICC indicated that most of the variation in the proficiency estimates (81%) was attributable to intra-student (level-1) factors. Between-student differences (level-2) accounted for an additional 16% of the variance and between groups differences (level-3) were responsible for just 3% of the variation in the model. The results of chi-square goodness-of-fit tests indicated that there was a significant amount of variation in the between students ($\chi^2 = 1689.81$, $df = 1212$, $p < 0.001$) and in the between schools ($\chi^2 = 5.31$, $df = 37$, $p < 0.001$) estimates. To gauge the magnitude of these variations, plausible values ranges, based on 95% confidence intervals (CIs), were calculated for all three levels. These suggested that there was a small amount of variation in the between-groups scores, 95% CI (98.6, 107.58). The variation in the between-student estimates was over twice as large, 95% CI (91.52, 114.66) and the within-student variation was almost six times greater than the between-group variation and twice as large as the student level variation, 95% CI (77.17, 129.01). Thus intra-student factors accounted for the majority of the variation in the data.

Change by time/age (model 2)

The effects of the level-1 predictors i.e. time and mean age were tested in model 2. Preliminary analysis showed that there was no main effect of age ($\beta = -0.41$, $t(40) = -0.66$, $p > .05$), therefore 'age' was dropped from the model. The subsequent time-only model showed that there was a significant amount of both between-student variation ($\chi^2 = 1848.02$, $df = 1212$, $p < .001$) and between groups variation ($\chi^2 = 78.51$, $df = 37$, $p < .001$) in knowledge proficiency scores at the intercept (i.e. T1), which supports hypothesis 1. Knowledge proficiency increased significantly in the sample during the intervention phase ($\beta = 5.50$, $t(37) = 10.25$, $p < .001$, $d = .02$), endorsing hypothesis 2. An inspection of the tau beta (τ_b) matrices revealed a negative correlation between the intercept and the slope

scores which suggested that students who had less knowledge proficiency in the T1 test gained more knowledge in the intervention phase than those who demonstrated less proficiency at T1 ($pseudo-R^2 = 0.02$). For instance, an inspection of the raw data confirmed that whereas school groups with a mean proficiency score that was below 100 (i.e. the metric mean) in the T1 test gained 7.41 points on average in the T2 test, those whose mean was above 100 initially only gained 4.48 points on average in the second test. Since both the intercept and slope estimates were statistically significant, both parameters were needed to explain the growth trajectory. The inclusion of time as a predictor resulted in an 8.8% reduction in the explainable variance at the within-student level. A chi-square goodness-of-fit test showed that the inclusion of time in model significantly improved the fit of the data when compared to the unconditional model (model 1), $\chi^2 = 112.29$, $df = 3$, $p < 0.00$, $pseudo-R^2 = .03$. Thus it appears that the increase in proficiency over time represented a small, but significant factor in explaining variations in knowledge in the intervention phase.

PLDE effects (model 3)

Model 3 tested the effect of taking a PLDE course in Transition Year on changes in proficiency scores over time. The results showed that there was no significant difference between the initial proficiency estimates (T1) for students who took a PLDE course ($\beta = 100.28$) and the estimates for those who received no PLDE in school ($\beta = 0.33$, $t(36) = 0.22$, $p > .05$). However, the slope coefficients showed that the PLDE group gained a significant amount of proficiency between the T1 and T2 tests ($\beta = 5.96$, $t(36) = 10.77$, $p < .001$), and that the gains achieved by the non-PLDE group were significantly lower ($\beta = -2.91$, $t(36) = -2.08$, $p < .05$, $d = .14$). This evidence for a main effect of participating in PLDE supports hypothesis 4, albeit that the difference was quite small. The results of a goodness-of-fit comparison between this model and model 2 showed that the inclusion of

PLDE group membership as a predictor did not produce a significant reduction in the variance in the data ($\chi^2 = 4.99$, $df = 2$, $p > .05$).

PLDE group effects (model 4)

The effects of attending specific types of PLDE courses were tested in model 4. The results showed that there was no significant difference in knowledge proficiency between any of the experimental groups before the interventions were delivered. The outcome for the slope indicated that, students in the control group gained a significant amount of knowledge between the T1 and T2 tests ($\beta = 3.01$, $t(32) = 2.34$, $p < .05$). However the gains in knowledge made by students who took PLDE courses A ($\beta = 2.82$, $t(32) = 1.56$, $p < .05$, $d = .1$), B ($\beta = 3.72$, $t(32) = 2.67$, $p < .05$, $d = .21$) and C ($\beta = 4.25$, $t(32) = 2.41$, $p < .05$, $d = .25$), were significantly larger, providing limited support for hypothesis 5. However, a goodness of fit comparison between this model and model 2 indicated that the additional specification of programme group membership did not result in a significant reduction in the unexplained variance in the data when compared to the simpler model ($\chi^2 = 13.57$, $df = 10$, $p > 0.5$).

Between-student effects (model 5)

Model 5 estimates involved the addition of the 14 level-2 predictors listed in Table 2.3 to the time-only model (2) and the subsequent trimming of all non-significant coefficients from the model, as recommended by Raudenbush & Bryk (2002), (see Chapter 2, sub-section 6.6 for a detailed explanation of this process)²⁰. The results showed that several between-students factors significantly influenced the T1 (intercept) and the T2 (slope) estimates for this model. The intercept estimates showed that students with higher SES ($\beta = 0.96$, $t(37) = 2.65$, $p < .05$), and more experience with using vehicles ($\beta = 2.47$, $t(37) = 3.27$, $p < .01$), had significantly more proficiency in the T1 knowledge test than students with average to low levels of these attributes, and those with more exposure to

²⁰ Note that all between-student models in this research were constructed using this methodology.

aberrant driving practices ($\beta = -3.29$, $t(37) = -3.33$, $p < .01$) and those with higher trait impulsiveness ($\beta = -2.37$, $t(37) = -2.29$, $p < .05$) were significantly less proficient on the T1 test than were their counterparts. However, the differences in scores between students with high levels of these attributes when compared with those with average to low levels of these characteristics were small in real terms. This provides very limited support for hypothesis 6. For instance, the difference in relation to SES was just 1%, and it was 2.5%, -3.2% and -2.3% for experience, exposure, and impulsiveness respectively. The slope estimates showed that whereas students gained a significant amount of knowledge proficiency between the two tests ($\beta = 5.27$), those with more exposure to aberrant driving gained significantly more proficiency during that period ($\beta = 2.64$, $t(37) = 2.45$, $p < .05$) than did their counterparts. There was an estimated improvement of 8.1% in the scores for this group between the two tests. Thus, these results offer limited support for hypothesis 6. The results of a chi-square goodness-of-fit test showed that when compared to model 2, the inclusion of significant between-student predictors in model 5 improved the fit of the data significantly ($\chi^2 = 102.46$, $df = 60$, $p < 0.001$, $pseudo-R^2 = .08$).

A final model was built to test for cross-level interactions between significant predictors from the previous models, however no significant effects were found. Furthermore, given the small decreases in the -2-log likelihood deviance between successive models and also the magnitude of the deviance in model 5, it is clear that none of the models tested represented a particularly good fit for the present data.

5.4.1.1 Initial and final test comparison models

Comparisons of the knowledge proficiency scores recorded in the initial test (T1) and those recorded in the final test (T3) were made in a similar progression to the one described for the intervention phase comparisons reported earlier. Details of all of the models described in this section are contained in Table 10.6.

Unconditional model (model 1)

The unconditional model showed that there was a significant amount of variation in the grand mean scores for knowledge proficiency during this study ($\beta = 102.78$, $t(37) = 187.26$, $p < .001$). The estimates indicated that 91% of the explained variance in scores was accounted for by intra-student (level-1) factors, a further 6% was associated with between-student (level-2) factors, and the final 3% was attributable to between-group factors. The results of chi-square goodness-of-fit tests showed that there was a significant amount of variation in the between-student estimates ($\chi^2 = 1246.73$, $df = 1105$, $p < 0.01$) and also between schools ($\chi^2 = 96.67$, $df = 37$, $p < 0.001$). The plausible values range for proficiency estimates scores at school-level (97.96, 107.60) and the range at student level (95.45, 110.11) was just 1.5 times wider. However, the range of variation between the scores on the T1 and T3 tests at intra-student level (74.87, 130.69) was almost four times greater than those at the between-student level and almost 6 times greater than that at the between-groups level.

Change over time (model 2)

The level-1 variables 'time' and 'mean age' were added in model 2. Preliminary analysis showed that there was no main effect of age ($\beta = -0.22$, $t(37) = -0.32$, $p > .05$), therefore 'age' was dropped from the model. The results for the subsequent time-only model showed that there was a significant increase in knowledge proficiency in the sample between the start and the finish of this study ($\beta = 5.04$, $t(37) = 8.35$, $p < 0.00$, $d = .3$), supporting hypothesis 3. However, whereas the tau beta correlations between the intercept and the slope in the corresponding IP model were negative, which suggests that students with greater knowledge proficiency during the T1 test, gained less knowledge over the shorter term, the corresponding correlations between the T1 and T3 tests ($R^2 = 0.95$) showed a reversal in this trend. Students with better knowledge proficiency on the T1 test,

gained more knowledge during the course of the study than did those who had less proficiency at the outset. The inclusion of 'time' as a predictor resulted in a 6% reduction in the explainable variance in proficiency scores at the within-student level. A chi-square goodness of fit test indicated that the inclusion of time in model 2 significantly improved the fit of the data, when compared with the unconditional model ($\chi^2 = 68.00$, $df = 3$, $p < 0.00$, $pseudo-R^2 = .03$). Thus, the increase in knowledge over time constituted a significant factor in explaining some of the variation in knowledge during the course of this study.

PLDE effects (model 3)

Model 3 tested the effects of taking a PLDE course in TY on changes in knowledge proficiency over time. The outcome showed that although students who took a PLDE course ($\beta = 5.46$, $t(36) = 8.31$, $p < .001$) gained more knowledge than those who did not take such a course, this difference was not statistically significant ($\beta = -2.64$, $t(36) = -1.64$, $p > .05$). This does not support hypothesis 4. A goodness-of-fit test compared the explanatory power of models 2 and 3 and the results showed that the addition of PLDE as a predictor significantly reduced the variance in the data ($\chi^2 = 297.15$, $df = 2$, $p < .001$, $R^2 = 0.06$, $pseudo-R^2 = .01$).

Programme effects (model 4)

Model 4 tested the effects of attending specific types of PLDE courses on changes in knowledge between the T1 and T3 tests. The results showed that only the students in group B ($\beta = 4.17$, $t(32) = 2.23$, $p < .05$) gained significantly more knowledge proficiency than did those in the control group ($\beta = 2.79$, $t(32) = 1.90$, $p > .05$, $d = .06$) over the longer term. Furthermore, the magnitude of this difference was quite small. A chi-square goodness-of-fit test was conducted between the previous model and this fuller model, and the results showed that the additional differentiation between PLDE group effects did not significantly reduce the variability in the data ($\chi^2 = 10.50$, $df = 10$, $p > .05$, $pseudo-R^2 = .01$).

Thus, membership of specific PLDE groups did not constitute a reliable predictor of knowledge proficiency in this test.

Between-student effects (model 5)

Model 5 involved estimating the effects the 14 level-2 predictors listed in Table 2.3. on the T1 and T3 knowledge proficiency estimates. This model was then trimmed of all non-significant predictors (see Chapter 2, sub-section 6.6). Similar to the findings from model 5 in the intervention phase, this trimmed model contained 4 variables that significantly influenced the proficiency estimates in the T1 test. The slope estimates showed that there was a significant positive effect for higher exposure to aberrant driving ($\beta = 3.53$, $t(37) = 2.68$, $p < .05$), which represented an increase in proficiency of almost 9% for students in that category over the long-term. Altogether, these findings offer very limited support for hypothesis 6. The results of a chi-square goodness-of-fit test showed that, when compared to model 2, the inclusion of significant between-student predictors in model 5 improved the fit of the data significantly ($\chi^2 = 92.15$, $df = 60$, $p < 0.01$, $pseudo-R^2 = .02$).

Finally, a further model that included all the significant variables from the previous models showed that there were no significant cross-level interactions between these predictors over the longer-term. Again, the magnitude of the -2 log likelihood deviance remained disappointingly high in all models, suggesting that the combination of predictors that were used to test hypothesis 6 were not very good predictors of knowledge proficiency in the present sample.

5.4.1.2 Effects of studying the ROTR

Since some of the PLDE courses featured in this study did not entail any formal study of the ROTR and since it is reasonable to expect that students who studied the ROTR would have better knowledge proficiency than those who did not, the absolute effects of studying the ROTR as part of a school-based PLDE course were investigated as a likely

predictor of knowledge proficiency on the short knowledge tests over the short-term and the longer-term. The results for T1 and T2 comparisons showed that students from groups that studied ROTR as part of their PLDE course ($\beta = 6.41$, $t(36) = 10.40$, $p < .001$), gained significantly more knowledge than those who did not study the ROTR in school ($\beta = -2.82$, $t(36) = -2.59$, $p < .05$, $d = .15$) in the short-term. The results for the initial and final test comparisons showed that this effect did not persist over the longer term; there was no significant difference between the increases in proficiency achieved by students in the active ROTR category ($\beta = 5.09$, $t(36) = 6.9$, $p < .001$) and the no-ROTR controls ($\beta = -0.15$, $t(36) = -0.11$, $p > .05$). Thus, it appeared that the benefits derived from studying the ROTR as part of a school-based PLDE course were short lived.

5.4.2 HLM analyses of the supplementary knowledge tests

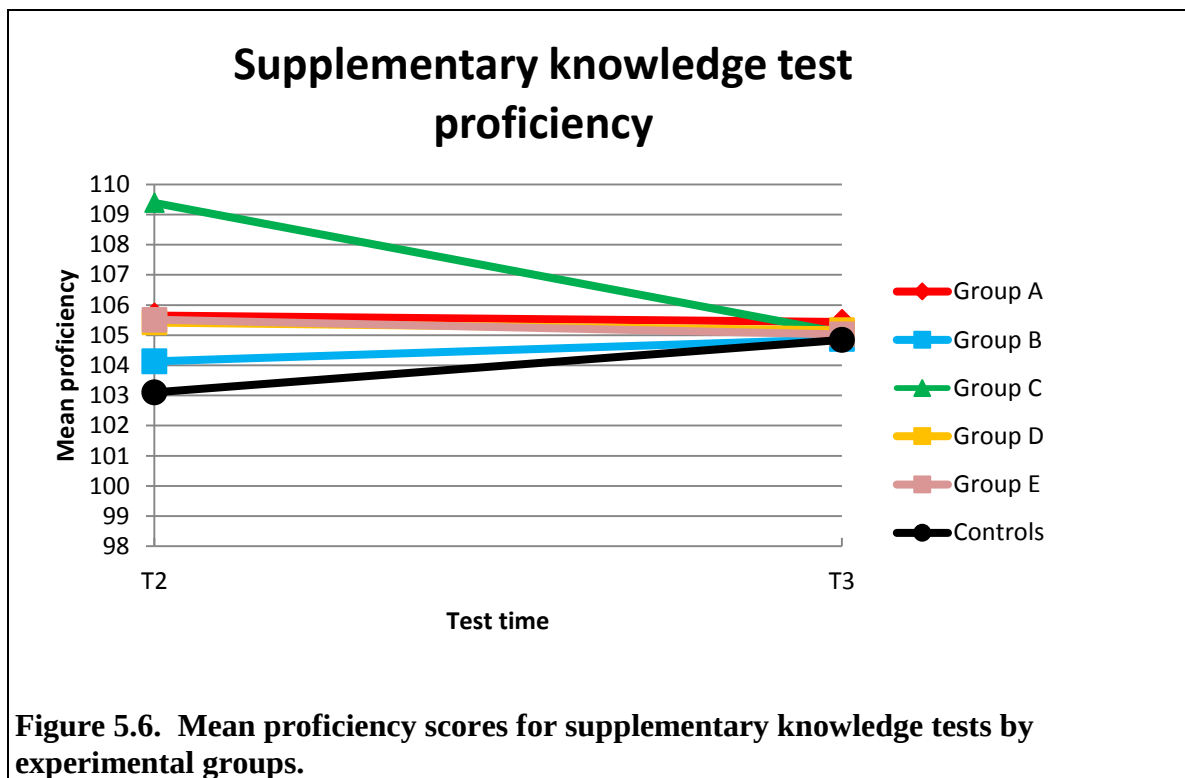
The mean number of items that the students answered correctly in the T2 test was 21.51 ($SD = 5.11$), and this decreased in the T3 test ($M = 20.49$, $SD = 5.05$). Since each test consisted of 38 items, this represented an average success rate of 57% in the T2 test and of 54% in the T3 test. Following the linear transformation of the proficiency scores from both tests (as outlined previously), mean scores were calculated for the each of the experimental group and for the sample as a whole (Table 5.5).

Table 5.5 Mean group and overall proficiency scores for the supplementary knowledge test

Condition	Post-intervention test (T2)			Follow-up test (T3)			Difference
	n	<i>M</i>	<i>SD</i>	n	<i>M</i>	<i>SD</i>	T2/T3
Group A	208	105.65	14.19	216	105.44	10.90	-0.2%
Group B	314	104.13	13.76	382	104.87	11.72	0.7%
Group C	226	109.39	13.21	227	105.08	10.64	-4.3%
Group D	231	105.42	14.58	210	105.17	11.02	-0.3%
Group E	124	105.54	12.88	135	105.03	9.88	-0.5%
Controls	193	103.10	12.44	240	104.84	13.07	1.7%
Overall	1296	105.53	13.52	1410	105.07	11.20	-0.5%

This analysis of the raw data showed that there was a small overall an overall decrease of 1% in sample mean for knowledge proficiency, between the T2 ($M = 105.53$, $SD = 13.52$)

and the T3 ($M = 105.07$, $SD = 11.20$) tests. The largest score changes were recorded in group C, which lost over 4% of its knowledge proficiency between the post intervention tests and in the control group, which gained over 1.7% of its knowledge proficiency between the two tests. Furthermore, it is interesting to note that whereas there was a 6.3-point gap between the highest and the lowest scoring group in the test that was taken immediately after the active groups completed their PLDE course, this gap had narrowed considerably by the time the T3 test was administered (Figure 5.6).



Similar to the modelling process used for the short knowledge test, a series of three-level intercepts-and-slopes-as-outcomes HLM regression models were fitted for the proficiency estimates on the supplementary knowledge test. These examined the effects of the relevant predictors at each of the three levels (see Chapter 2, Table 2.3). Details of all of the models described in this section are provided in Table 10.3.

Unconditional model (Model 1)

The null model was estimated and the results indicated that mean scores on the quiz varied significantly around the grand mean ($\beta = 105.54$, $p < .001$). The ICC for this model

showed that almost 70% of the variation in student proficiency for the supplementary test was attributable to time factors (level-1), over 27% was associated with students within schools (level-2) and the final 3% represented between schools variation (level-3). Separate chi-square tests indicated that there was a significant amount of variation in the between-student estimates ($\chi^2 = 1896.4$, $df = 1082$, $p < 0.001$) and also between schools ($\chi^2 = 88.147$, $df = 36$, $p < 0.001$). There was a small amount of variation in scores between schools, 95% CI (101.60, 110.12). The between-student variance was three times greater, 95% CI (93.06, 118.656) and the intra-student variation was almost five times greater than the between schools variation CI (99.17, 111.91). The intra-student variation was over one-and-a-half times greater than the variation between students.

Change over time (model 2)

The level-1 variables 'time' and 'mean age' were added in model 2. Preliminary analysis showed that there was no main effect of age ($\beta = -0.02$, $t(37) = -0.11$, $p > .05$), therefore 'age' was dropped from the model. The results for the subsequent time-only model showed that there was a small, non-significant decrease in knowledge proficiency in the sample between the T2 and the T3 tests ($\beta = -0.07$, $t(36) = -1.01$, $p > .05$).

Interestingly, since there was a negative covariance between the intercept and slope estimates, this suggests that students who knew more in the T2 test, lost less proficiency than those who knew less during that test ($R^2 = 0.8$). A chi-square goodness-of-fit test showed that the addition of 'time' as a predictor in this model improved the fit of the data significantly ($\chi^2 = 25.69$, $df = 3$, $p < 0.00$, $pseudo-R^2 = .01$). The addition of time as a predictor resulted in a 5% reduction in the explainable variance in the data at the within-student level.

PLDE effects (model 3)

The effects of taking a PLDE course were tested in model 3 and the results showed that there was a significant difference in knowledge proficiency between students who took

a PLDE course ($\beta = 105.97$) and those who did take such a course ($\beta = -2.51$, $t(36) = -2.01$, $p < .05$, $d = -0.02$) in the T2 test. The slope estimates showed that the subsequent decrease in proficiency experienced by the PLDE group was not significant ($\beta = -0.46$, $t(36) = -0.8$, $p > .05$) and although students in the non-PLDE groups gained some proficiency in the post-intervention period ($\beta = 2.26$, $t(35) = 1.17$, $p > .05$), the difference in the slopes between the two groups was not significant. These results suggest that although PLDE group membership produced measureable changes in knowledge proficiency in the short-term, these effects did not persist over time, which provides support for hypothesis 4, but not for hypothesis 5. Moreover, the chi-square statistic indicated that the inclusion of PLDE as a predictor did not improve the fit of the data, when compared with the time-only model (model 2) ($\chi^2 = 1.66$, $df = 2$, $p > .05$).

PLDE group effects (model 4)

The effects of attending specific types of PLDE courses were tested in model 4. This showed that there was no significant difference in knowledge proficiency between students in the control those in any of the active programme groups with respect to the T2 intercepts or the T3 slopes. Furthermore, the inclusion of specific PLDE course effects in this model did not account for any significant reduction in the variance in the data when compared to the time-only model ($\chi^2 = 10.92$, $df = 10$, $p > .05$). Thus, programme group membership was not useful predictor of knowledge proficiency in either of the post-intervention tests.

Between-student effects (model 5)

Model 5 involved the addition of all of the level-2 predictors to the level-1 predictor 'time'. All non-significant coefficients were then trimmed from the model as per Chapter 2, subsection 6.6. The final model showed that exposure to aberrant driving ($\beta = -1.39$, $t(36) = -2.06$, $p = .05$), and impulsiveness ($\beta = -2.31$, $t(36) = -3.03$, $p < .01$) significantly influenced the T2 proficiency estimates and none of the between-student

predictors used in this study influenced the change that occurred between the T2 and T3 tests. However, the results of a chi-square test indicated that this model represented a significantly better fit for the data than did the time-only model (model 2) ($\chi^2 = 16.59$, $df = 4$, $p < .01$, $pseudo-R^2 = .02$).

Since none of the between-groups variables produced significant changes in scores in the supplementary knowledge test, there was no need to test for interactions between predictors at all three levels.

5.4.2.1 *Effects of studying the ROTR*

The absolute effects of studying the ROTR on knowledge proficiency were measured and the results showed that although students who studied the ROTR as part of a PLDE course in school ($\beta = 107.19$, $t(35) = 116.35$, $p < .001$) had greater proficiency on the T2 supplementary test than those who did not ($\beta = -2.56$, $t(35) = -1.71$, $p > .05$), this difference was not statistically significant. Neither was there any substantial difference in the loss of proficiency experienced by the ROTR students ($\beta = -1.13$) and the non-ROTR students ($\beta = 0.93$, $t(35) = 0.61$, $p > .05$) in the post intervention phase. This evidence adds further weight to the view that studying the ROTR as part of a PLDE course does not have a significant effect on the gains in proficiency as measured the knowledge tests used in this study.

5.5 Discussion

In this part of the research, item response analyses were conducted to investigate the psychometric properties of tests which had been designed to measure declarative knowledge with respect to the ROTR and specific factors that increase risk in traffic in PLD adolescents. Having established the reliability and validity of these tests, knowledge proficiency scores were produced for each student and these were used subsequently to construct a series of HLMs that tested the hypotheses that were of interest in this study.

The results of these hypotheses tests will be reviewed first and a discussion of the item response analyses and the general methodology will follow thereafter.

The results from the HLM analyses of the T1 short knowledge test indicated that although there was a considerable amount of variation in knowledge proficiency in the sample, the students were reasonably knowledgeable about the ROTR and specific risk-increasing factors when they began in TY/year 13 of secondary school. The reported variation in knowledge proficiency is explicable in the context of the TCI model (Fuller, 2005), which suggests that personal capability arises as a result of a combination of physiological attributes, exposure to differential learning experiences and individual differences in personality.

The results from the null models (model 1) for the short test and for the supplementary tests indicated that the largest proportion of variation in the data was located at the intra-student level. The current research included just two predictors, age and time, that addressed variation at that level directly and it was found that these factors accounted for just 3% in the overall variation in the short-term and long-term short knowledge test scores and of just 1% in the supplementary test scores. Moreover, although a wide range of between-student and between-group predictors were included as part of the model construction exercises, the -2-log likelihood deviance scores remained stubbornly high. This suggests that a large proportion of the variation in knowledge scores was attributable to some factor(s) that were not taken into account in the current research design. Whereas it is acknowledged that the inclusion of predictors at any level of a HLM can influence changes in the amount of variation remaining at all levels of the model, it is clear nonetheless that the factors that were most likely to reduce the variance at the intra-student level in this research were ones that tend to vary over time. Although between-student factors such as experience with using vehicles, experience with RTCs were measured in each test, other factors which had the potential to vary over time were

measured just once i.e. personality traits such as impulsiveness, sensation seeking and Big-Five markers. Whilst it was not expected that these predictors would change substantially during the course of this project, with hindsight it is clear that the failure to account for the time-varying properties of trait predictors represents a flaw in the research design. Since preliminary analysis of the HLM results for the remainder of the study also showed that most of the variance in the relevant models was attributable to intra-student factors, possible sources of this will be examined in detail in the general discussion. In the interim, it should be noted that lack of an adequate range of significant, time varying intra-student predictors limited the potential of the current research to explain driving-related knowledge, risk perception skills and attitudes within the context of the TCI model (Fuller, 2005).

The results from the short tests suggested that sample as a whole gained a small, but statistically significant amount of knowledge over both the short-term and the long-term, supporting hypotheses 2 and 3. Furthermore, the results showed that taking a PLDE course in TY had a positive effect on knowledge acquisition. Students who took a PLDE course gained significantly more knowledge than did students in the control group in the short-term but not over the longer-term, offering some support for hypotheses 4. The current findings provide some support for the efficacy of PLDE in increasing driving-related declarative knowledge in adolescents, over a short period of time. They also accord with the results from previous studies which reported short-term improvements in driving-related cognition (Elkington, 2005; Harré & Brandt, 2000a; Poulter & McKenna, 2010) and declarative knowledge (Elkington, 2005) as a result of attending a PLDE course.

One surprising aspect of the present results was that the test scores for the control group followed roughly the same pattern of change across the three tests as did those for the experimental groups. The unanticipated increase in knowledge proficiency for the control group during the intervention phase and the subsequent decrease in the post-

intervention phase was somewhat perplexing, because it suggested that knowledge proficiency in this group was being influenced systematically by some extraneous factor. One possible explanation for this phenomenon was the eagerness to start driving in the sample, which was evidenced in Chapter 4. Many of the students in this study became eligible to apply for an LDP during the intervention phase of this study. However, since one needs to pass the driver theory test in order to get this permit, it seems likely that the unexpected increase in knowledge proficiency in the control group was due to the fact that many of these students were studying the ROTR in preparation for taking the theory test. This assumption is supported by findings that the rate of licensure was significantly higher for the controls than it was for students in the PLDE groups. The subsequent decline in proficiency seen in all groups is consistent with current knowledge with respect to the various processes involved in the acquisition and retention of declarative knowledge (e.g. Craik and Lockhart's (1972) levels of processing theory and Anderson's (1996) adaptive control of thought architecture). Specifically, memory traces for information that is salient and that is rehearsed regularly become strengthened, whereas those traces grow weaker when that knowledge is no longer being accessed on a regular basis. Another plausible explanation for the pattern in these data concerns the Hawthorne Effect (Parsons, 1974) which suggests that there would be an increased interest in driving and driving-related knowledge, risk perception skills and attitudes in the control group as a result of participating in the study.

The present findings also suggested that some types of PLDE courses were more effective in equipping students with knowledge proficiency than others. Students who took the various PLDE courses that featured in this study gained slightly more knowledge proficiency in the intervention phase and retained more knowledge over the longer term, than did those in the control group. However, only those students in groups B and C gained significantly more knowledge in the short term and only those in group B retained

significantly more knowledge over the longer term than did those in the control group. The results from the supplementary knowledge tests also showed that students in the active PLDE groups knew more about the ROTR at T2 (i.e. immediately after they completed their course) than did the controls. However, these differences were only statistically significant between groups C and the controls. As expected, students from groups that studied the ROTR as part of their PLDE course gained significantly more knowledge in the intervention phase than did those who did not. The apparent superiority of programmes B and C in equipping their students with factual knowledge over the shorter term may be due to the fact that all of the classes who took these programmes spent time studying the ROTR, whereas only some of the classes in groups A and D, and none of the classes in group E studied the ROTR as part of their programme. Furthermore, the average amount of time spent on focussed study of the ROTR that was reported by teachers in groups A and D was less than three hours, whereas the average time reported for groups B and C was more than 5 hours. Although several attempts were made to control statistically for the amount of time that the groups spent studying the ROTR and statistical, due to the absence of any sort of uniformity between the groups with respect to this issue, no valid solution to this problem could be found. The educational and policy implications of the apparent heterogeneity in the PLDE provision for TY students with respect to course content and delivery will be discussed in Chapter 8 of this thesis. In the meantime, it is acknowledged that this situation posed a significant problem when it came to assessing driving-related knowledge in this study. The current findings could also be critiqued on the basis that some of the information that would be needed in order to answer questions in the knowledge tests correctly may not have been provided as part of individual PLDE courses. In mitigation, it is argued that all of the knowledge questions dealt with important aspects of the ROTR and factors that are known to increase risk, and as such should have been addressed as part of a good PLDE course.

A large number of between-student predictors, including personal characteristics and direct and indirect experience in the traffic environment were used in an attempt to explain individual differences in knowledge proficiency. There were no significant effects of any of the Big-Five markers or of experience with crashing in any of the tests. Antecedent factors including SES and experience with using vehicles had a significant positive effect, and factors including exposure to aberrant driving and trait impulsiveness had a significant negative effect on knowledge proficiency during the initial test. These findings are consistent with previous research, which links higher SES with greater educational proficiency (Zwick & Greif Green, 2007) and higher trait impulsiveness with poorer academic performance (Fink & MCCown, 1993; Stanford et al., 1996), and personal direct and indirect experience with the acquisition of knowledge (Bandura, 1977; Skinner, 1974). Furthermore, students with more exposure to aberrant driving gained significantly more knowledge in the intervention phase than did their less exposed classmates. However, this improvement cannot be attributed to the effects of taking PLDE, since there was no interaction between exposure and PLDE group membership. These differences in intercept and slope values between students with high exposure to aberrant driving and those with low exposure may indicate that the former made genuinely greater gains but it may also reflect measurement error. Since the effects of SES, experience, impulsiveness, and exposure and were small in real terms, (1%, 2.3%, – 2.4%, and -3.3% respectively), these factors did not explain the variation in knowledge proficiency to any great extent.

One of the strengths of the current approach was the use of item response analyses, which revealed some interesting and potentially useful information. The analyses of the short knowledge test scores indicated that several of the items on the original tests were poor at discriminating between students with different abilities, which prompted the removal of these items to improve validity. The item difficulty indices for the short tests

showed that whereas the students found the T1 and T2 tests difficult to answer correctly, they found the T3 test much easier. The difficulty indices for the supplementary tests suggest that they found both the T2 and T3 tests easy to answer. The pattern of decrease in the difficulty indices for the short test, where all of the questions remained the same throughout the study, and for the supplementary test, where half of the questions were changed between the T2 and the T3 tests, were very similar. This suggests that the increasing ease with which the students answered the questions as time progressed reflected real increases in knowledge, rather than mere practice effects.

Since item difficulty analysis differentiated clearly between items that students in this sample found either easy or difficult to answer correctly, these results constitute a useful barometer of driving-related knowledge in Irish PLD adolescents. This information is potentially interesting for road safety professionals, who may wish to adapt road safety interventions and campaigns to better suit this age group. For instance, it is reasonable to suggest that considerable improvements in the efficiency and effectiveness of PLDE programmes might be achieved by concentrating less on strengthening student proficiency in areas where it is already adequate and focussing instead on trying to identify gaps in student knowledge and filling these gaps using additional content. In fact, there is general agreement in academic circles that the one-size-fits-all approach that is currently favoured by the majority of educational interventions is inefficient and ineffective (Durkin & Tolmie, 2010; McKenna, 2010a). One relatively simple way to address both of these issues would be for teachers to tailor existing programmes to cater for the needs of individual classes. In order to do this, teachers would need to conduct a pre-intervention test to measure pre-existing levels of knowledge (and other relevant competencies), which would identify the particular strengths and weaknesses in individual classes. This information could also be fed back to programme developers to help them improve their courses. For instance, the results from the short knowledge tests in this study suggest that

the students were quite knowledgeable about issues such as impaired driving (i.e. drowsiness, and DWI), dealing with slow drivers, and the fact that 15-24-year-olds are more likely than any other age group to be involved in a RTC at all times. This suggests that ongoing campaigns designed to increase awareness about these risk-increasing factors are having some effect in the general population. However, the present sample knew considerably less about speed limits, driving manoeuvres that are particularly problematic for young novice drivers and the number of people that die as a result of RTCs annually. Similar a review of the results from the supplementary knowledge tests indicated that the students were well aware of the number of passengers that a driver is allowed to carry, what to check for when buying a car, what to do at the scene of a RTC and the rules of the road for cyclists. They were less knowledgeable about the rules regarding overtaking other vehicles, what to do when approaching a 'yield' sign, the rules that apply at pedestrian crossings, and most importantly, the fact that learner drivers must be accompanied by an adult. Clearly, the introduction of a mechanism (e.g. an entry test) which would identify specific deficits in knowledge, both in PLDs in general and within individual class groups would serve to improve the efficiency and effectiveness of PLDE courses.

Chapter 6: Risk perception

6.1 Introduction

Whereas adolescent learner and novice drivers generally acquire the requisite knowledge and skill to handle a vehicle in traffic quite quickly (Hall & West, 1996), the higher-order perceptual and cognitive skills that underpin safe driving takes considerably longer to develop (Arnett, 2002; Deery, 1999; Keating & Halpern-Felsher, 2008). It is generally accepted that this delay represents a major source risk for adolescent drivers partially because it promotes overconfidence (Beyth-Marom, Austin, Fischhoff, Palmgren, & Jacobs-Quadrel, 1993; Finn & Bragg, 1986; Machin & Sankey, 2008; Matthews & Moran, 1986). One higher-order perceptual skill that has received a lot of attention in the past is risk perception (Deery, 1999; DeJoy, 1992; Ivers et al., 2009; Johah & Dawson, 1987). In the context of driving, risk perception entails the identification of potential hazards, assessments of the likelihood that those hazards can be mitigated and a subjective appraisal of one's skill to avoid such risks, and thus constitutes "the subjective experience of risk in potential traffic hazards" (Deery, 1999, p. 226).

The issue of subjective risk judgements is at the core of most theoretical models of health and risk behaviour including social cognitive theory (Bandura, 1989) the TPB (Ajzen, 1991), the PWM (Gibbons & Gerrard, 1995), the TCI model (Fuller, 2005) and GDE- framework (Hatakka et al., 2002) all of which were described in Chapter 1. Supported by a substantial body of accumulated empirical evidence, these theories posit that an individual's beliefs about the consequences of their actions, and their perceptions about their vulnerability to such consequences exert a strong influence on their behaviour (Millstein & Halpern-Felsher, 2002), and thereby on their exposure to risk. For instance, studies suggest that there is a negative relationship between risk perception and risky behaviour in adults (I. D. Brown & Groeger, 1988; Horwarth, 1988) and in adolescents

(Lavery & Siegel, 1993). According to Harré (2000), driver behaviour, especially that of young drivers, is contingent on their ‘risk state’, i.e. in situations where objective (actual) risk is high, but perceived risk is low, drivers behave recklessly, whereas those who perceive high risk adjust their behaviour to avoid such risks. Research shows that young drivers perceive less risk in relation to speeding, close-following and night-time driving than do older drivers, which suggests that the excessive crash risk for youngsters may be partially due to poor risk perception, rather than deliberate risk-taking (Finn & Bragg, 1986; Johah & Dawson, 1987). However, some studies show that young drivers are more aware of driving risks than are drivers of other age groups, especially regarding alcohol use (Ginsburg et al., 2008; Harré et al., 2000; Sarkar & Andreas, 2004). Evidence also suggests that young males are less proficient when it comes to perceiving driving-related risk than are young females (DeJoy, 1992). Furthermore, youngsters who undertake or are exposed to risky driving behaviours also tend to perceive the risks of driving as low (Ginsburg et al., 2008; Sarkar & Andreas, 2004; Shope, 2006), supporting Fuller’s (1992) “Learned Riskiness” hypothesis.

Although all novice drivers are exposed to a certain level of unavoidable risk due to inexperience (OECD - ECMT, 2006a), Fuller’s (2005) TCI model posits that inexperienced drivers can mitigate this risk to some extent by adapting the demands of the driving task to their (reduced) capability. However, success with this strategy depends on the accuracy of a driver’s judgements about his/her own skills and motivations (i.e. state awareness) and also his/her assessments of the relative dangers that are inherent in an array of driving situations (i.e. situation awareness) (SWOV, 2010). The process of aligning a driver’s judgements with objective reality is known as ‘calibration’ (de Craen, 2010). The dramatic reduction in crash likelihood which occurs during the first six months of solo driving, which was detailed in Chapter 1, suggests that direct experience with driving facilitates the calibration process. However, the educational approach to reducing risk-

taking is based on the premise that peoples' subjective perception of risk can be calibrated in a more forgiving environment than the open road (Masten, 2004). In this regard, Mayhew and Simpson (1995, 1996) suggested that the effectiveness of pre-learner and pre-driver education courses might be improved by focussing on addressing skill deficits in areas such as hazard recognition and risk assessment. However, whereas the available evidence indicates that hazard perception can be improved by means of off-road training (Crick & MCKenna, 1992), it remains unclear as to whether risk perception is equally amenable to educational intervention.

6.1.1 Objective crash risk

In order to conduct valid assessments of an individual's ability to perceive risk in any given situation, one first has to know what the actual risks are in that situation. For instance, crash data from the UK suggests that the one-year odds for dying in a crash in 2004 were 1 in 17,655, on average, with corresponding lifetime odds of approximately 1 in 204 (Bandolier, 2012). Furthermore, according to data published by US motor insurance providers, drivers submit a collision claim once in every 17.9 years on average. Based on these calculations an individual who starts driving at 17-years-old might expect to file at least one claim before they reach 35-years-old (National Safety Council, 2012). Although recent estimates suggest that novice drivers are 45% more likely to be involved in a crash than are experienced drivers (Insurance Corporation of British Columbia, 2010) it is clear nonetheless that there is less than a 50/50 chance that the average young novice will be crash-involved in his/her first five years of driving. It is also acknowledged that crash risk increases disproportionately for young learner and novices when driving capability is impaired due to drinking, taking drugs, fatigue, or where task demands are increased as a result of speeding, distractions and peer influences (e.g. L. Evans, 1991; Mayhew et al., 2003; OECD - ECMT, 2006b; Shope & Bingham, 2008).

6.1.2 Cognitive biases in risk perception

Numerous studies show that young drivers believe that their risk of crashing while engaging in a number of dangerous behaviours is lower than do older drivers (Arnett, 2002; Deery, 1999; DeJoy, 1992; Finn & Bragg, 1986). They also tend to rate themselves as more skilled, less risky and less likely to have a collision than are their peers (Harré, Foster, & O'Neill, 2005; Horswill, Waylen, & Tofield, 2004; McKenna, 1993). It should be noted however that research shows that drivers of all ages tend to overestimate their driving skills (Horswill et al., 2004) and underestimate their vulnerability to crash risk (DeJoy, 1989; Svenson, 1981), which results in excessive risk taking in the driving population as a whole (Sundström, 2008). Such errors in judgement are problematic because evidence suggests that drivers who believe that they are more skilful commit more driving violations and have more crashes than other drivers (Horswill et al., 2004).

The tendency to overestimate skills, i.e. "...to describe oneself more positively than normative criteria would predict" (Krueger, 1998, p. 505), is termed 'self-enhancement bias' (J. D. Brown, 1986). The tendency to view the likelihood of negative events as lower for oneself than it is for others is termed 'optimism bias' (Svenson, 1981). Thus far, efforts to reduce self-enhancement and optimism biases in youngsters have been largely unsuccessful. For instance, Harré, Foster and O'Neill (2005) tried to influence risk judgements in a group of university students by showing some of them advertisements that featured young drivers driving dangerously, resulting in a crash, and showing others advertisements of young drivers making safe decisions. The results showed that students in the former condition displayed more optimism bias than did those in the latter. It has also been demonstrated that whereas drivers may agree with the messages in road safety campaigns, they frequently perceive that this information is not personally relevant (McKenna & Horswill, 2006; Svenson, 1981). Nevertheless, some studies have been

partially successful in reducing driver optimism by getting drivers to recall their negative driving experiences and risky driving behaviour (McKenna & Albery, 2001).

6.1.2.1 Measuring cognitive biases in risk perception

The methodology used to investigate self-enhancement and optimism biases has been criticised on several grounds (see Sundström, 2008, p. for a review). For instance, whereas perceptions of driver competence are usually measured by asking drivers to compare their own driving skill with that of a putative “average” driver, it is inherently difficult to make reliable assessments regarding the driving ability of such a person (Sundström, 2011). At best, the term ‘average’ is ill-defined and at worst it has negative connotations, which may promote feelings of superiority among individuals in the comparison group (Groeger, 2001). Evidence shows that when the criterion or trait of interest is clearly defined people are better able to compare their own performance to that of their peers (Dunning, Heath, & Suls, 2004). Thus, it has been suggested that perceived capability and likelihood estimates should be measured in terms of clearly defined criteria to increase reliability (Sundström, 2011).

Risk perception and vulnerability to risk can be conceptualized and measured in a variety of alternative ways. Millstein, and Halpern-Felsher (2002) suggested that researchers could find out whether or not an individual recognizes the risks inherent in a particular situation, or examine the accuracy of their risk judgements in that situation. This method was used as part of the American National Youth Driver Survey (Ginsburg et al., 2008), which began by eliciting and prioritizing the beliefs of 443 American adolescents in response to the question “What makes a difference in whether teenagers are safe in cars” ? This yielded 25 risk-increasing factors which were then used in a survey of 5,665 9th – 11th grade students, aged approximately 14- 17-years, where participants were asked to judge how much of a difference each factor makes. In addition, their judgements regarding the prevalence of those risk-increasing factors in the teenage driving population were

measured by asking them how often they were exposed to these behaviours as passengers of teenage drivers. The results of this study were reported in terms of the percentage of students who agreed that a factor made a lot of difference to teen safety in cars. The factors that were believed to make the most difference were, DWI (87%), text-messaging or using hand-held devices (79%), racing other cars (77%), smoking marijuana (72%), driver anger/road rage (70%), paying attention to passengers who are acting 'wild' (65%). Inexperience with driving appeared in 10th position (60%) and having other teenagers in the car (10%) was judged as making the least difference to teen safety. The prevalence results showed that having other teenaged passengers was the most commonly reported activity (64%) and this was followed by speeding (59%), drivers talking on cell phones (57%), and selecting music. However, incidences of DWI (16%) and driver inexperience (15%) were relatively low, as were incidences of teenage drivers and passengers who had been smoking marijuana or drinking alcohol (12%). These results demonstrate that American adolescents were aware of the well-documented relative dangers of DWI (e.g. Shope & Bingham, 2008), driver distraction (e.g. Strayer & Drews, 2004; Strutts, Reinfurt, & Rodgman, 2001) and speeding (e.g. Williams, Preusser, Ulmer, & Weinstein, 1995). However, the study also revealed noteworthy gaps in the participants' understanding of driving-related risk for teenagers. For instance, whereas it is well-known that inexperience is a major contributory factor in crashes involving young novice drivers (see Chapter 1 for a review), the participants in that study underestimated the importance of experience. Furthermore, given that the sample consisted entirely of adolescents, all of whom would be considered as inexperienced drivers, surprisingly few reported frequent sightings of inexperienced drivers. In addition, whereas observations of teen drivers carrying peer passengers were commonplace, the participants did not seem to recognize the inherent danger in this situation. For instance, using the FARS database, Chen, Baker, Braver and Li (2000) calculated that, the relative risk of dying in a RTC for 17-year-old

drivers with one passenger was 1.48 times that for a similarly aged driver without passengers. This risk increased to 2.58 with two passengers and to 3.07 with three or more passengers. In sum, the results from the National Youth Driver Survey suggest that the risk judgements of American adolescents regarding driver inexperience, and carrying peer passengers were quite inaccurate.

Research also suggests that the relationship between perceived risk and perceived vulnerability to risk may also be contingent on perceptions regarding the controllability of such risk (Sjöberg, Moen, & Rundmö, 2004). For example, McKenna (1993) showed that perceptions of risk are lower amongst drivers than they are amongst passengers. Findings that people believe that they are more in control than they really are may partly explain why risk perception tends to be poorly calibrated in the driving population. One study examined the effects of perceived skill on risk judgements by measuring the extent to which motorcyclists believed that they could avoid death or injury whilst engaging in a range of activities, using personal skill alone (Sexton, Hamilton, Baughan, Stradling, & Broughton, 2006). The results showed that motorcycling was perceived as less risky than skiing, rock climbing and hang-gliding, and that the participants believed that motorcycling accidents are more under personal control than are accidents that might occur while engaging in these other activities. These researchers also reported that a substantial number of these bikers believed that statistical risk did not apply to them because they were 'good riders'. This suggests that the concept of controllability could be used to better understand risk-related judgements in the general road user population.

6.1.3 Alternative measures of risk perception

Studies investigating driving-related cognitions, such as risk perception, rely heavily on self-report measures, whereby participants are required to make judgements about the degree to which they either agree or disagree with propositional statements.

These methods were used in both of the studies described above. However, an increasing

body of empirical evidence suggests that such methods are not effective when it comes to accessing and measuring personally relevant constructs and propositions about the issue at hand which are stored in memory (Stacy, 1997). Such evidence supports dual-process explanations of information processing, which demonstrate the existence of two different modes of processing, a propositional mode and an associative mode (J. S. B. T. Evans, 2003; Gawronski & Bodenhausen, 2007; Wilson, Lindsey, & Schooler, 2000). On the one hand, the propositional system relies on explicit cognitive processes, which unfold in a slow, deliberate and largely conscious way and which are amenable to self-report methods. On the other hand, the associative system relies on implicit, automatic reactions within the brain, which occur quickly, and remain largely outside of conscious awareness (J. S. B. T. Evans, 2008), and thus are not accessible using self-report measures. The associative system has been explained in terms of spreading neural activation, whereby connections between stimuli and responses are established and subsequently strengthened on the basis of the frequency of their co-occurrence (Anderson, 1983). Whereas a detailed account of the associative system is outside the remit of this thesis (see Saling & Phillips, 2007 for a review of automatic behaviour), it suffices to say that there is general agreement among cognitive psychologists that experiences become encoded in memory in the form of mental representations and that strength of these representations can be inferred on the basis of the relative automaticity with which individuals access these representations (Bargh & Williams, 2006).

6.1.4 Implicit tests

Measures of implicit cognition, such as the implicit association test (Greenwald, McGhee, & Schwartz, 1998) capitalize on the notion that implicit associations (i.e. mental representations) can be identified and measured on the basis of response latency i.e. accessibility. For example, Stacy, Leigh and Weingardt (1994) demonstrated that whereas many adults have a variety of positive alcohol-related outcomes stored in their long-term

memory, frequent exposure to alcohol increases the accessibility of these consequences. Free recall memory tasks allow researchers to assess the availability and accessibility of mental representations in response to particular stimuli, and thus constitute a valuable resource for revealing such information. To illustrate, research conducted with over 1,000 Irish male drivers, aged between 17 – 28-years aimed to examine their mental representations in response to the following hypothetical scenario;

“John, a young man of 20, loved driving fast and showing his mates how he could push his car to the limit. One rainy day, with two of his mates with him in the car, he took a corner too fast, lost control and slammed into a tree at 120km/h...

What do you think might be the consequences of this crash?” (Gormley & Fuller, 2008, p. 15).

Respondents were encouraged to mention all of the consequences that came to mind. The results were analysed in terms of the frequency with which a consequence was mentioned, testing availability, and also with respect to the order in which the responses were given, testing accessibility. The results showed that seven types of consequences came to mind for these drivers, namely, in order of frequency, Death, Serious injury, Damage to car/property, Injury, Impact on friends/family, Legal consequences and Costs. They also showed that whereas death was mentioned with similar frequency by all of the participants, younger drivers mentioned death significantly later than did older drivers. These results suggest that the association between crashing and death may be less strongly established in younger male drivers, and this might partially explain why some young drivers underestimate their chances of crashing. Gormley and Fuller also remarked on the relative inaccessibility of social consequences e.g. impact on family and friends and the absence of references to consequences such as permanent disability. Such findings can be used to improve DE interventions by alerting course developers to specific deficits in knowledge and lack of insight which could not be identified using self-report measures.

6.2 Method

6.2.1 Design

See Chapter 2, sub-section 2.1.

6.2.2 Participants

See Chapter 2, sub-section 2.2.

6.2.3 Procedure

See Chapter 2, sub-section 2.5.

6.2.4 Measures

See Chapter 2, sub-section 2.4. An abbreviated description of the items used in this part of the study, including references to the appendices, where the actual questions can be seen appears below (Table 6.1). During the final test, the students were also asked to estimate the likelihood that they would engage in risk-increasing practices, and/or encounter risk-increasing situations while they were gaining driving experience. Furthermore, since the results from Tests 1 and 2 suggested that a substantial number of the students would be driving before they took the final test, a number of measures of actual driving behaviour were included in the T3 test.

Table 6.1 Risk perception measures

Appendix / Question	Description	No. of items	Scale
D/21	Beliefs about personal self-efficacy and locus of control	7	1 = Strongly agree - 5 = Strongly disagree
D/24, 30, 33	Estimating crash likelihood for self and others	9 ^a	1 = Very unlikely - 5 = Very likely
D/27 ^b	Judging the role of skill in mitigating crash risk (controllability)	8 ^a	1 = Always - 4 = Never
D/32	Willingness to take risks in traffic	7	1 = Very unwilling - 5 = Very willing (cont.)

D/36 ^c	Judging factors that increase risk for adolescent drivers	20 ^a	1 = No difference - 3 = A lot of difference
F/34 ^c	Estimating the likelihood of encountering risk-increasing factors listed in question D/36 while gaining experience with driving	20	1 = Very Unlikely - 3 = Very Likely
F/34 ^c	Has already encountered risk-increasing factors listed in question D/36 while driving	20	0 = No 1 = Yes
D/49 ^d	Estimating the consequences of a high-risk scenario (vignette)	N/A	Open response

^a Scores for these items were reversed prior to data analysis; consequently higher scores for these items are associated with poorer perception of the risks involved.

^b Adapted from Sexton et al., (2006).

^c Adapted from Ginsburg et al. (2008).

^d Adapted from Gormley and Fuller (2008).

6.3 Results

A PCA was conducted on the scores for the 52 repeated measures items from the T1 test. This was done to create the dependent variables on which the HLMS would be conducted subsequently. Similar PCAs were conducted on the scores from the T2 and T3 tests to ensure that the internal consistency of the factors remained intact at all three time periods. The HLM analyses proceeded in accordance with the modelling strategy that was outlined in Chapter 2, sub-section 2.6.5, models 1 tested hypothesis 1, model 2 tested hypotheses 2 and 3 and models 3-5 tested hypotheses 4-6. The various analyses of the responses to the high-risk scenario will be described at the end of this section.

6.3.1 Principal component analysis of the repeated measures items

The PCA of the scores for the 52 items contained in the 7 multiple-item questions in the T1 test began by inspecting the correlation matrix, revealing the presence of many coefficients $\geq .3$. The KMO was adequate (.84) and Bartlett's (1954) test of sphericity was statistically significant, supporting the factorability of the matrix. This initial solution indicated the presence of 12 components with eigenvalues > 1 , representing 59.4% of the

variance. However, the scree plot was hard to interpret, since no clear break between the components was apparent (Figure 10.4)²¹. Thus, a 7 factor solution was imposed on the data, to correspond with the 7 different sources from which the survey questions were taken. However this did not produce a simple structure either, because all 7 items from question D/21 either cross-loaded onto several factors or failed to load strongly onto any factor (Table 10.8). A subsequent exploratory HLM analysis of these items showed that these items did not reveal anything particularly interesting, thus they were dropped from the study. In addition, two items from question D.36, items 13 (“Traffic is heavy”) and item 15 (“Driver is talking on a hands-free mobile phone”), were also removed from the study, because they did not load strongly on to any of the factors. Thereafter, another PCA was conducted on the remaining 42 items. Inspection of the resulting correlation matrix showed the presence of many coefficients $\geq .3$, KMO = .84, and Bartlett’s test of sphericity $< .05$, supporting the factorability of the correlation matrix. Eleven factors with eigenvalues exceeding 1 were present, and these explained 55.87% of the variance in the data. The scree plot demonstrated a clear break after the fourth component, thus four components were retained for further investigation (Figure 10.5). A simple structure emerged following a varimax rotation, with all four factors showing a number of strong factor loadings, and all variables loading substantially on to just one component (Table 10.9). These four factors explained 37.25% of the variance, and were labelled as “Perceived risks for adolescent drivers” (PRAD), “Crash risk likelihood estimates” (CRLE), “Perceived controllability of risk” (PCR) and “Willingness to take risks in traffic” (WTRT), respectively. Details of the variance explained by, and the associated internal consistency of, these factors in all three time periods, appear in (Table 6.2).

²¹ Note: Tables and figures containing the prefix “10” can be found in the appendices.

Table 6.2 Factor structure of the 42-item risk perception test

	<u>T1</u>		<u>T2</u>		<u>T3</u>	
Scale	Variance explained	α	Variance explained	α	Variance explained	α
PRAD	14.47%	0.86	15.88%	0.87	15.16%	0.84
CRLE	9.19%	0.82	9.68%	0.87	10.17%	0.86
PCR	7.60%	0.82	8.86%	0.87	8.25%	0.84
WTRT	5.68%	0.75	6.03%	0.73	5.78%	0.74
Total variance	37.21%		40.45%		39.36%	

A similar procedure was used to test the factor structure of the responses to the same 42 items in the T2 and T3 tests. The results for the T2 data showed that the KMO value was .85 and Bartlett's test of sphericity reached statistical significance. The analysis revealed the presence of ten components with an eigenvalue exceeding 1, representing 57.95% of the variance in the data. Since an inspection of the scree plot did not suggest a clear break between the factors (Appendix N, Figure 10.6), a four-factor solution was imposed on the data to facilitate the longitudinal analysis, and all of items loaded on to the expected factors (Table 10.10). These four components accounted for 40.45% of the variance, and all of the scales had good internal consistency (Table 6.2). The analysis of the T3 data showed that the KMO value was .83 and Bartlett's test of sphericity was $< .05$. Ten items had an eigenvalue exceeding 1, representing 58.23% of the variance. Again, although the scree plot did not suggest a clear solution (Figure 10.7), a 4-factor solution was imposed on the data. All of the test items loaded on to the expected factors (Table 10.11). These factors accounted for 39.36% of the variance in the data and they had good internal consistency ($> .8$) (Table 6.2).

6.3.2 Perceived risks for adolescent drivers scale (PRAD)

Raw sample means for the revised 18-item PRAD scale from the T1, T2 and T3 tests are depicted graphically in Figure 6.1. DWI was judged as the riskiest activity in all three tests; T1 ($M = 1.14$, $SD = 0.48$), T2 ($M = 1.19$, $SD = 0.54$) and T3 ($M = 0.11$, $SD = 0.44$) and this was followed by racing other cars; T1 ($M = 1.19$, $SD = 0.56$); T2 ($M = 1.26$,

$SD = 0.65$); T3 ($M = 1.17$, $SD = 0.53$). Driving in the dark was judged as the least risky activity in the three tests; T1 ($M = 2.27$, $SD = 0.94$), T2 ($M = 2.12$, $SD = 0.88$), T3 ($M = 2.22$, $SD = 0.95$). This was followed by carrying teenage passengers; T1 ($M = 2.07$, $SD = 0.97$), T2 ($M = 1.76$, $SD = 0.82$), T3 ($M = 1.83$, $SD = 0.8$). The means for driver inexperience at T1 ($M = 21.39$, $SD = 0.55$), T2 ($M = 1.46$, $SD = 0.57$), T3 ($M = 1.38$, $SD = 0.53$) placed this factor in 7th place in terms of riskiness.

Factors that were perceived to increase risk for teenage drivers

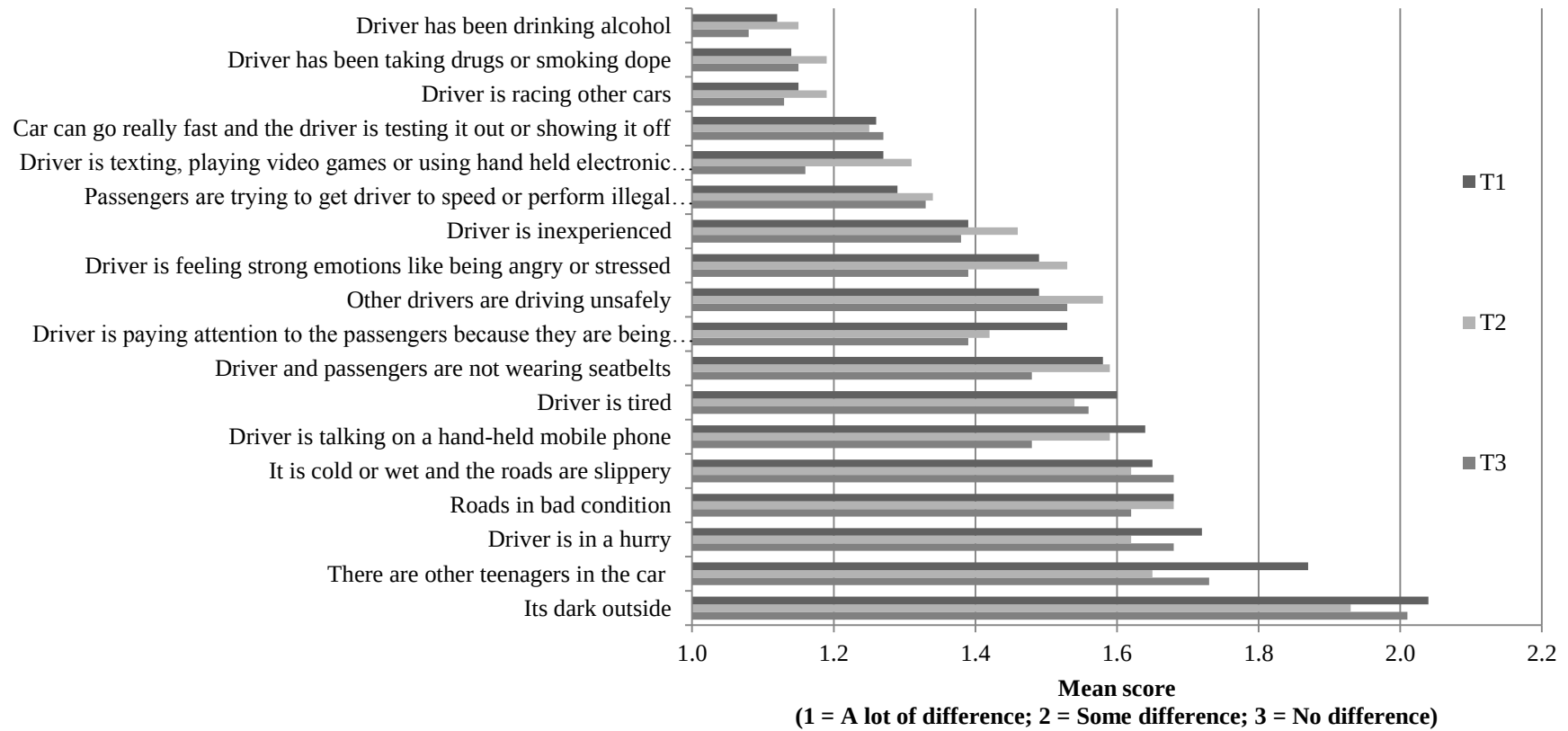


Figure 6.1. Sample means for the PRAD scale in the T1, T2 and the T3 tests.

The overall mean scores on the PRAD scale at T1 was 1.49 ($SD = 0.26$, $\alpha = .85$), which was lower than the scale mean. Mean scores decreased slightly in successive tests, T2 ($M = 1.48$, $SD = 0.28$, $\alpha = .87$), and T3 ($M = 1.45$, $SD = 0.26$, $\alpha = .85$), suggesting that perception of the risks involved improved over time. However, these improvements were quite small, i.e. 6% between the T1 and the T2 test and 2.5% between the T1 and the T3 tests.

6.3.2.1 HLM analysis of the PRAD scale

A series of HLMs were constructed to examine the effects of the relevant predictors on PRAD scores in the intervention phase, thus measuring short-term effects (see Table 10.12).

Unconditional Model (model 1)

The unconditional model showed that the mean estimates varied significantly around the grand mean ($\beta = 1.47$, $t(37) = 157.19$, $p < .001$). The ICCs indicated that the proportion of variance in the model at intra-student, between-student and between-groups levels was 69%, 29% and 2% respectively. The results of a chi-square goodness-of-fit test indicated that there was a significant amount of variation in the scores between students ($\chi^2 = 2250.24$, $df = 1212$, $p < 0.001$), and also between schools ($\chi^2 = 78.33$, $df = 37$, $p < 0.001$). The variation between schools groups, 95% CI (1.27, 1.67) and between students, 95% CI (1.19, 1.75) was quite small. However, the intra-students variation was twice as large as the between-groups variation, 95% CI (1.03, 1.91).

Change over time (model 2)

Model 2 examined changes in PRAD estimates as a function of time and age. There were no significant effects of either age ($\beta = 0.01$, $t(37) = 0.82$, $p > .05$) or time ($\beta = -0.01$, $t(37) = 0.88$, $p > .05$) on PRAD, contrary to hypothesis 2. Since, inspection of the random coefficients showed that there was no significant variance remaining in the between-group estimates ($\chi^2 = 49.88$, $df = 37$, $p > .05$) there was no need to construct

models 3 and 4 to test for the effects of taking a PLDE course or attending a specific PLDE course. However, because the between-student residuals ($\tau\pi$) were statistically significant ($\chi^2 = 0.02$, $df = 1212$, $p < 0.001$), a further model was built to test for the effects of between student predictors on the intercept scores.

Between-student effects (model 5)²²

The results from model 5 showed that there was a significant effect of gender, exposure to aberrant driving practices and impulsiveness on pre-intervention PRAD scores. The intercept for females ($\beta = -0.04$, $t(1209) = -2.42$, $p < .05$), was significantly lower²³ and the intercepts for students with higher levels of exposure to aberrant driving practices ($\beta = 0.12$, $t(1209) = 8.35$, $p < .001$) and for students with higher impulsiveness ($\beta = 0.10$, $t(1209) = 5.34$, $p < .001$) were significantly higher than were those for their counterparts ($\beta = 1.49$). None of the between-student predictors significantly influenced short-term slope changes in PRAD estimates. A chi-square goodness-of-fit test compared the fit of this model and model 2 and the results showed that the inclusion of these between-student predictors reduced the variation in the model significantly ($\chi^2 = 159.1$, $df = 9$, $\beta < .001$, $pseudo-R^2 = .05$).

A second set of HLMs examined the influence of the relevant predictors on the scores for the PRAD scale in the T1 and the T3 tests, thus measuring long-term effects (see Table 10.13).

Unconditional model (model 1)

The results from the unconditional model showed that the means estimates varied significantly around the grand mean, ($\beta = 1.48$, $t(37) = 131.14$, $p < .001$). The ICCs indicated that the amount of variance in the data at levels 1 – 3 was 71%, 25% and 4% respectively. The results of a chi-square goodness-of-fit test demonstrated that there was a

²² Reminder: All 14 between-student predictors were entered into each of the between-student models (i.e. model 5) that were tested. However, only the results for significant predictors are reported here.

²³ Scores on this scale had been reversed, therefore lower scores equate to higher estimated risk.

significant amount of variation in the scores between students ($\chi^2 = 1797.98$, $df = 1106$, $p < 0.001$) and also between schools ($\chi^2 = 96.85$, $df = 37$, $p < 0.001$). The amount of variation in the between groups scores was quite small, 95% CI (1.37, 1.59), the variation between students was almost three times as large, 95% CI (1.20, 1.76) and the within-students variation was four times larger than the between groups variance, 95% CI (1.04, 1.92).

Change over time (model 2)

Time and mean age were added as predictors in model 2, which showed that although there was no significant effect of age ($\beta = -0.01$, $t(37) = .86$, $p > .05$), there was a significant decrease in PRAD estimates over the long-term ($\beta = -0.05$, $t(37) = -3.98$, $p < .05$, $d = -0.04$). This suggests that students' perceptions of the risks involved in driving improved over time. A chi-square goodness-of-fit test showed that model 2 fitted the data significantly better than did model 1 ($\chi^2 = 18.84$, $df = 3$, $p < .001$, $pseudo-R^2 = .02$).

General PLDE effects (model 3) and specific PLDE course effects (model 4)

The results from Models 3 and 4 Model 3 showed that perceptions of risk for adolescent drivers improved slightly more in students who took PLDE in comparison to the controls, however these differences were not statistically significant. The results of chi-square goodness-of-fit tests indicated that the inclusion of PLDE effects in model 3 ($\chi^2 = 2.36$, $df = 2$, $p > .05$), and in model 4 ($\chi^2 = 10.23$, $df = 10$, $p > .05$) did not improve the fit of the data in comparison to model 2.

Between-student effects (model 5)

Between-students factors had no effect on long-term slope changes in PRAD estimates. A chi-square goodness-of-fit test was used to compare the fit of this model and the time-only model and the results showed that the inclusion of significant between-student predictors did not reduce the variation in the model significantly ($\chi^2 = 3.15$, $df = 3$, $p > .05$).

6.3.3 Likelihood of encountering risk-increasing factors while gaining experience with driving

Since it was estimated that many of the students in this sample would be learning to drive by the time that the T3 test was conducted, as part of that test, participants were asked to estimate the likelihood that they would engage in any of the 18 risk-increasing activities mentioned above while they were gaining driving experience (see question F/34). Raw sample means for the scale items are graphed in Figure 6.2 which shows that the likelihood estimates mainly accorded with the seriousness of the risks involved. Students predicted that they were least likely to drink alcohol ($M = 1.24$, $SD = 0.71$), take drugs ($M = 1.3$, $SD = 0.77$), or race other cars ($M = 1.35$, $SD = 0.78$) while they were driving. Students estimated that they were most likely to drive in the dark ($M = 2.23$, $SD = 0.86$), carry teenage passengers ($M = 2.21$, $SD = 0.88$), and to drive on poor quality roads ($M = 2.16$, $SD = 0.89$). Somewhat surprisingly, given the question wording, the survey item “The driver is inexperienced” was judged in 7th position in terms of likelihood, based on the sample means. The overall mean for this scale was 1.76 ($SD = 0.49$) and the internal consistency was good ($\alpha = .89$). HLM analyses showed that although the likelihood estimates were higher for the control group than for the active PLDE groups, these differences were not statistically significant (Table 10.14). There were no significant effects of any of the relevant between-student predictors on the likelihood estimates

Question F/34 also included a box that the students could tick if they had already experience that range of risk increasing factors while they were driving. However, not enough students responded to this section of the question to permit any meaningful analyses to be conducted on this data.

Likelihood of encountering risk-increasing factors while gaining driving experience

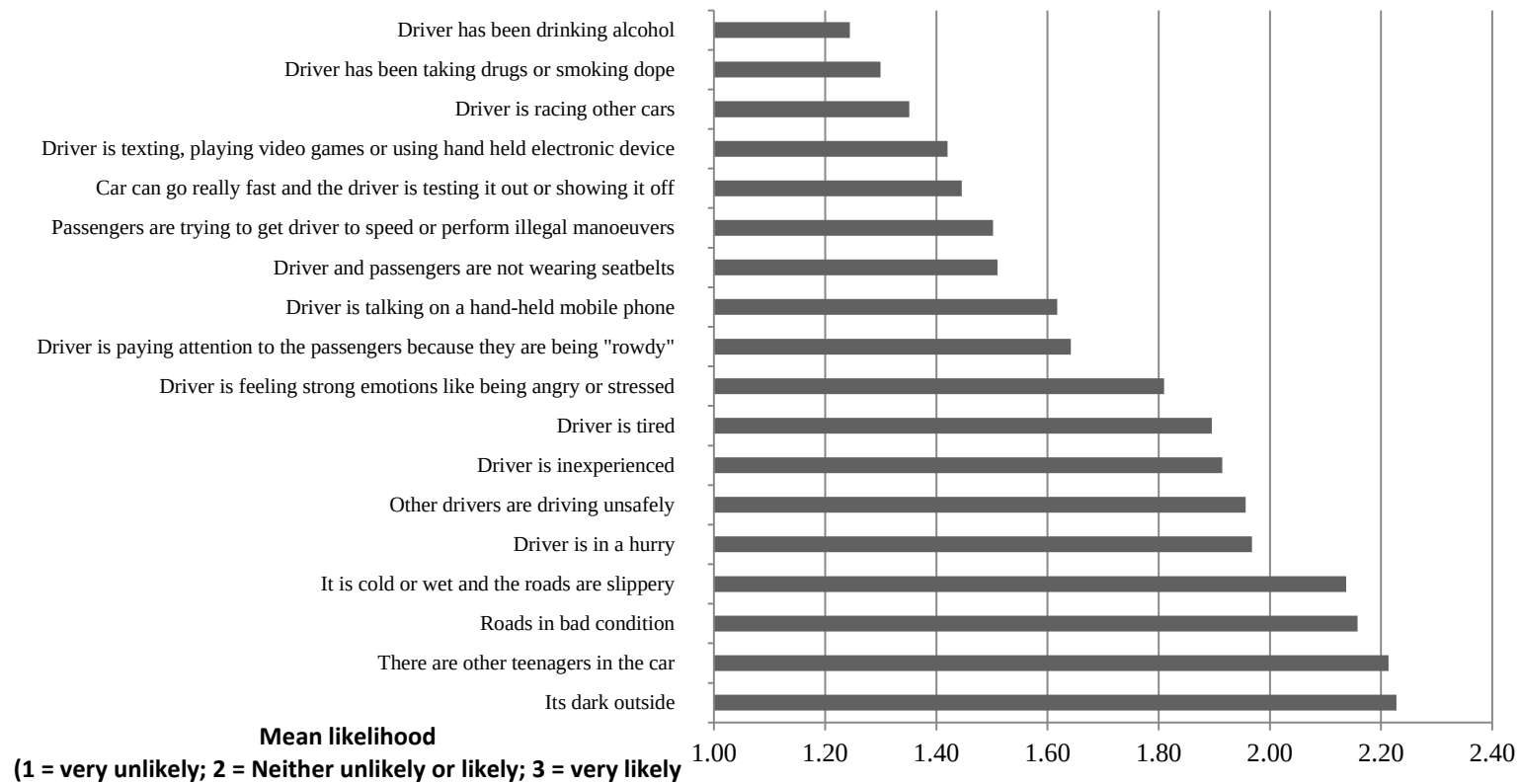


Figure 6.2. Likelihood of encountering risk-increasing factors while gaining driving experience.

6.3.4 Crash risk likelihood estimates scale (CRLE)

Sample means were calculated for the items in the CRLE scale (Table 6.3). These showed that the scores for eight of the nine items in this scale were higher than the scale midpoint, which suggests that the current students believed that there was a less than 50/50 chance that the specified types of road users/drivers would be involved in any type of an RTC over the next 5 years. There were small decreases in CRLE between the T1 ($M = 3.47$, $SD = 0.91$), the T2 ($M = 3.39$, $SD = 0.92$) tests (-2.2%), and between the T1 and the T3 ($M = 3.43$, $SD = 0.94$) tests (-1.1%), suggesting that the estimated likelihood of crashing increased slightly in both the short-term and the long-term. The internal consistency of the CRLE scale was good.

Table 6.3 Mean CRLE scores in the T1, T2 and T3 tests

Categories and items	T1 (n = 1880)		T2 (n = 1323)		T3 (n = 1411)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
<u>Chances of crash involvement for a typical road user^a</u>						
Minor property damage crash	2.49	0.90	2.49	0.92	2.46	0.91
Moderate property damage/minor injury crash	3.13	0.79	3.11	0.76	3.17	0.81
Serious injury/loss of life crash	3.71	1.00	3.71	0.96	3.78	0.95
<u>Chances of crash involvement for participant themselves as road users^a</u>						
Minor property damage crash	3.07	0.96	3.05	0.99	3.00	1.03
Moderate property damage/minor injury crash	3.67	0.83	3.56	0.83	3.58	0.88
Serious injury/loss of life crash	4.18	0.88	4.01	0.93	4.06	0.93
<u>Chances of crash involvement for participant themselves a learner/novice driver^b</u>						
Minor property damage crash	3.11	1.06	3.05	1.05	3.10	1.09
Moderate property damage/minor injury crash	3.71	0.89	3.57	0.88	3.65	0.93
Serious injury/loss of life crash	4.16	0.92	3.99	0.95	4.08	0.94
Mean for all 9 items	3.47	0.91	3.39	0.92	3.43	0.94
Cronbach's <i>a</i>	.82		.84		.86	

Note: Scale range = 1 – 5: The higher the value, the lower the estimated risk of crash involvement.

^a Within the next 5 years.

^b Before they have held a full licence for 1 year.

6.3.4.1 HLM analyses of the CRLE scale

A series of HLMs were constructed to examine the influence of the relevant predictors on the CRLE scale estimates in the intervention phase (Table 10.15).

Unconditional Model (model 1)

The unconditional model demonstrated that the mean estimates varied significantly around the grand mean ($b = 3.44$, $t(37) = 164.47$, $p < .001$). The ICCs indicated that the variation in the data at levels 1 – 3 was 67%, 31% and 2% respectively. The results of chi-square goodness-of-fit tests indicated that there was a significant amount of variation in the scores between students ($\chi^2 = 2250.05$, $df = 1212$, $p < 0.001$) and also between schools ($\chi^2 = 74.08$, $df = 37$, $p < 0.001$). There was a small amount of variation in the between-groups scores, 95% CI (3.24, 3.64), and the between students variance was three times larger, 95% CI (2.82, 4.06). The within-students variation was five times larger than the between-groups variance, 95% CI (2.44, 4.44).

Change over time (model 2)

When time and mean age were included as predictors, the results showed that although there was no significant effect of age, there was a small, significant decrease in CRLE values between the T1 ($\beta = 3.46$), and the T2 ($\beta = -0.06$, $t(37) = -3.05$, $p < .05$, $d = -0.07$) tests. The results of a chi-square goodness-of-fit test indicated that accounting for time and mean age in model 2 improved the fit of the data significantly ($\chi^2 = 9.91$, $df = 3$, $p < 0.05$, $pseudo-R^2 = .01$).

General PLDE effects (model 3) and specific PLDE course effects (model 4)

The results from models 3 and 4 showed that the slopes for students who took PLDE decreased more than did those for the control group however this effect was not statistically significant. A chi-square goodness-of-fit test indicated that the inclusion of PLDE effects in model 3 ($\chi^2 = 2.49$, $df = 2$, $p > .05$), and 4 ($\chi^2 = 6.61$, $df = 10$, $p > .05$) did not improve the fit of the data in comparison to model 2.

Between-student effects (model 5)

Model 5 tested for the effects of between-student predictors. The results for the trimmed model indicated that the males ($\beta = 3.52$) perceived the likelihood of crashing as lower than did the females ($\beta = -.14$, $t(37) = -3.09$, $p < .01$) in the T1 test. However, there was no significant difference between decreases in CRLE for the males ($\beta = -0.06$, $t(37) = -1.93$, $p > 0.05$) and for the females ($\beta = -0.01$, $t(37) = -0.42$, $p > .05$) in the intervention phase. Whereas the chi-square statistic indicated that this model provided a better fit for the data than did model 2 ($\chi^2 = 14.42$, $df = 2$, $p < .001$, $pseudo-R^2 = .01$), the amount of variance accounted for by gender was very small.

Another series of HLMs were constructed to examine the influence of the relevant predictors on the coefficients produced by comparing the initial and final scores on the CRLE scale, thus testing long-term effects (Table 10.16).

Unconditional model (model 1)

The unconditional model showed that mean CRLE varied significantly around the grand mean, ($\beta = 3.46$, $t(37) = 155.92$, $p < .001$). The ICC estimates showed the amount of variance in the data at levels 1 – 3 was 70%, 28% and 2% respectively. A chi-square goodness-of-fit test indicated that there was a significant amount of variation in the scores between students ($\chi^2 = 1935.69$, $df = 1106$, $p < 0.001$) and also between schools ($\chi^2 = 76.37$, $df = 37$, $p < 0.001$). The amount of variation in the between groups scores was quite small, 95% CI (3.26, 3.66), the variation between students was more than three times larger, 95% CI (2.84, 4.08). The within-students variation was over four times larger than the between groups variance, 95% CI (2.46, 4.46).

Change over time (model 2)

Model 2 demonstrates that there was no significant effect of time or of mean age on slope changes in CRLE over the long-term. A chi-square goodness-of-fit test showed that model 2 did not represent a significantly better fit for the data than did the unconditional model ($\chi^2 = 4.78$, $df = 3$, $p > .05$).

General PLDE effects (model 3) and specific PLDE course effects (model 4)

Models 3 and 4 demonstrated that there were no significant effects of exposure to PLDE in general, or of attending specific PLDE courses on the long-term slope values for CRLE. Chi-square goodness-of-fit tests showed that the inclusion of PLDE effects in models 3 ($\chi^2 = 4.05$, $df = 2$, $p > .05$), and 4 ($\chi^2 = 12.37$, $df = 10$, $p > .05$) did not improve the fit of the data in comparison with model 2.

Between-student effects (model 5)

Model 5 tested for the effects of between-student predictors. The trimmed model indicated that there were significant gender differences in long-term CRLE slope values. Whereas the scores for the boys increased slightly ($\beta = 0.02$), those for the girls decreased significantly more in the same period ($\beta = -0.10$, $t(1067) = -2.33$, $p < .05$). This model represented a significantly better fit for the data than did model 2 ($\chi^2 = 139.34$, $df = 2$, $p < .001$, $pseudo-R^2 = .04$).

6.3.5 Perceived controllability of risk scale (PCR)

Raw sample means for the items for the PCR scale appear in (Table 6.4). Since higher scores on this scale signify stronger beliefs that crash risk is controllable as a function of skill, these results suggest that the current students believed that skill plays a greater role in avoiding crashing while speeding and a lesser role in avoiding crashing where capability is impaired due to the influence of drugs, distraction or alcohol. The overall scale mean was 2.33 ($SD = 0.87$) at T1, and this decreased in T2 ($M = 2.25$, $SD = 0.93$), and then remained stable in the T3 test ($M = 2.25$, $SD = 0.83$).

Table 6.4 Mean PCR scores at T1, T2 and T3

Items	<u>T1</u> (n = 1880)		<u>T2</u> (n = 1323)		<u>T3</u> (n = 1412)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Avoid crashing/injury after taking drugs	1.87	1.03	1.84	1.05	1.69	0.87
Avoid crashing/injury when texting or playing computer games	2.05	0.95	2.04	0.99	1.97	0.85
Avoid crashing/injury after drinking 4 units alcohol	2.11	0.90	1.99	0.98	2.00	0.81
Avoid crashing/injury after taking prescription drugs	2.43	0.86	2.29	0.90	2.36	0.84
Avoid crashing/injury when travelling in car where people are not wearing seatbelts	2.45	0.88	2.35	0.96	2.51	0.86
Avoid crashing/injury when talking on a mobile phone	2.49	0.79	2.35	0.89	2.25	0.83
Avoid crashing when exceeding speed limit by 10 km/h in a 100 zone	2.50	0.87	2.41	0.89	2.44	0.86
Avoid crashing/injury when exceeding speed limit by 10 km/h in a 50 zone	2.74	0.72	2.75	0.78	2.77	0.73
Scale mean	2.33	0.87	2.25	0.93	2.25	0.83
Cronbach's <i>a</i>	0.82		0.87		0.84	

6.3.5.1 HLM analyses of the PCR scale

A series of HLMs were constructed to examine the influence of the relevant predictors on the mean intervention phase scores for this test. (Table 10.17).

Unconditional model (model1)

The unconditional model indicated that the mean estimates for PCR varied significantly around the grand mean ($\beta = 2.18$, $t(37) = 105.44$, $p < .001$) and the ICCs suggested that the amount of variation at levels 1 – 3 were 84%, 15% and 1% respectively. The results of chi-square goodness-of-fit tests indicated that there was a significant amount of variation in the scores between students ($\chi^2 = 1636$, $df = 1212$, $p < 0.001$) and also between schools ($\chi^2 = 69.66$, $df = 37$, $p < 0.01$). There was some variation in the between-groups scores, 95% CI (1.98, 2.38), and the between students variance was almost three times larger, 95% CI (1.66, 2.70). The within-students variation was six times larger than the between-groups variance, 95% CI (0.94, 3.42).

Change over time (model 2)

‘Time’ and mean age were added as predictors in model 2 and the results showed that although there was no significant effect of age, there was a small, significant decrease in PCR estimates between the T1 ($\beta = 2.22$), and the T2 ($\beta = -0.06$, $t(37) = -2.42$, $p < .05$, $d = -0.07$) tests. A chi-square goodness-of-fit test indicated that accounting for age and change over time improved the fit of the data significantly ($\chi^2 = 9.08$, $df = 3$, $p < 0.05$, $pseudo-R^2 = .01$).

General PLDE effects (model 3) and specific PLDE course effects (model 4)

The results from models 3 and 4 showed that although perceived controllability of crash risk decreased more in the active, PLDE groups than it did in the control group in the intervention phase, these differences were not statistically significant. Chi-square goodness-of-fit tests indicated that the inclusion of PLDE effects in model 3 ($\chi^2 = 0.2$, $df = 2$, $p > .05$), and 4 ($\chi^2 = 15.8$, $df = 10$, $p > .05$) did not improve the fit of the data compared to model 2.

Between-student effects (model 5)

Model 5 tested for the effects of between-student predictors. The intercept results for the trimmed model indicated that students with above average levels of exposure to aberrant driving ($\beta = 0.11$, $t(1209) = 3.9$, $p < .001$), experience with using vehicles ($b = 0.08$, $t(1209) = 3.81$, $p < .001$), or impulsiveness ($\beta = 0.24$, $t(1209) = 5.51$, $p < .001$) perceived that personal skill played a greater role in controlling risk than did students with lower levels of those attributes ($\beta = 2.22$) in the T1 test. The slope estimates showed that whereas there was a significant decrease in perceptions of controllability ($\beta = -0.06$), this decrease was significantly greater for students with above average impulsiveness ($\beta = -0.14$, $t(1173) = -2.48$, $p < .01$). The chi-square statistic indicated that this model provided a better fit for the data than did model 2 ($\chi^2 = 73.06$, $df = 4$, $p < .00$, $pseudo-R^2 = .03$), providing some support for hypothesis 6.

A second set of HLM's were used to examine the influence of the relevant predictors on the coefficients produced by comparing the initial and final scores from this test, thus investigating longer-term effects (Table 10.18).

Unconditional model (model 1)

The unconditional model indicated that the mean estimates varied significantly around the grand mean ($\beta = 2.19$, $t(37) = 142.46$, $p < .001$). The ICC estimates showed the amount of variance in the data at levels 1 – 3 was 90%, 9% and 1% respectively. The results of chi-square goodness-of-fit tests indicated that there was a significant amount of variation in the scores between students ($\chi^2 = 1333.09$, $df = 1106$, $p < 0.001$), but not between schools ($\chi^2 = 47.24$, $df = 37$, $p > .05$). The 95% CI indicated that the variation between students was small (1.79, 2.57), that the within-student variation was three times greater than this (0.99, 3.37).

Change over time (model 2)

Model 2 showed that there was no significant effect of either time or mean age on long-term changes in PCR estimates.

General PLDE effects (model 3) and specific PLDE course effects (model 4)

The results from models 3 and 4 showed that although perceived controllability of crash risk decreased more in the active, PLDE groups than it did in the control group during this study, these differences were not statistically significant. Chi-square goodness-of-fit tests indicated that the inclusion of PLDE effects in model 3 ($\chi^2 = 0.21$, $df = 2$, $p > .05$), and 4 ($\chi^2 = 15.8$, $df = 10$, $p > .05$) did not improve the fit of the data in comparison to model 2.

Between-student effects (model 5)

In model 5, all of the between-student predictors were added to the time-only model (2). Similar to the findings from the intervention phase model, the long-term estimates for PCR decreased significantly more in students with higher impulsiveness

($\beta = -0.15$, $t(1173) = -2.48$, $p < .05$) than it did in the less impulsive counterparts.

Although this model represented a significantly better fit for the data than did model 2 ($\chi^2 = 73.06$, $df = 4$, $p < .001$), the inclusion of significant between-student predictors in this model did not produce a meaningful reduction in the variance in the data ($R^2 < .01$).

6.3.6 Willingness to take risks in traffic scale (WTRT)

Raw sample means were calculated for the items on the WTRT scale (Table 6.5). These indicated that students were most willing to cycle without a helmet and to refrain from wearing a seatbelt in a school bus and least willing to take a lift with a driver who had been drinking and to ride a motorcycle without a helmet, in each test. There was very little change in the overall scale means between the T1 ($M = 2.48$, $SD = 1.08$), the T2 ($M = 2.51$, $SD = 1.06$) and the T3 ($M = 2.51$, $SD = 1.07$). The internal consistency of the willingness scale was adequate.

Table 6.5 Mean WTRT scores in the T1, T2 and T3 tests

Items	T1 (n = 1880)		T2 (n = 1322)		T3 (n = 1412)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Willing to cycle without a helmet	3.92	1.13	3.80	1.10	3.90	1.10
Willing to refrain from wearing a seatbelt in a school bus	3.27	1.23	3.31	1.19	3.34	1.23
Willing to cross a busy road from between parked cars	2.93	1.17	2.98	1.14	3.07	1.19
Willing to take a lift with a driver who speeds	2.56	1.06	2.57	0.98	2.51	1.01
Willing to drive parents car without permission	2.00	1.19	2.08	1.17	2.13	1.17
Willing to refrain from wearing seatbelt in car	1.88	1.05	1.96	1.07	1.90	1.07
Willing to ride motorcycle without a helmet	1.69	0.92	1.78	0.92	1.75	0.93
Willing to take a lift with a driver who has been drinking	1.57	0.86	1.63	0.92	1.50	0.84
Scale Mean	2.48	1.08	2.51	1.06	2.51	1.07
Cronbach's alpha reliabilities	0.75		0.73		0.74	

6.3.6.1 HLM analyses of the WTRT scale

A series of HLMs were constructed to examine the influence of the relevant predictors on the intervention phase estimates for this test (Table 10.19).

Unconditional model (model 1)

The unconditional model demonstrated that the mean score for willingness varied significantly around the grand mean ($\beta = 2.38$, $t(37) = 71.99$, $p < .001$). The ICCs suggested that the amount of variation at levels 1 – 3 was approximately 60%, 34% and 4% respectively. The results of chi-square goodness-of-fit tests indicated that there was a significant amount of variation in the scores between students ($\chi^2 = 2561.77$, $df = 1212$, $p < 0.001$) and also between schools ($\chi^2 = 143.39$, $df = 37$, $p < 0.001$). There was a small amount of variation in the between-groups scores, 95% CI (2.04, 2.72), and the between students variance was twice as large, 95% CI (1.57, 3.16). The within-students variation was three times larger than the between-groups variance, 95% CI (1.32, 3.44).

Change over time (model 2)

Time and mean age were added as predictors in model 2. Although there was no significant effect of age, there was a small, significant increase in short-term willingness ($\beta = 0.06$, $t(37) = 2.73$, $p < .05$, $d = 0.05$). The results of a chi-square goodness-of-fit test indicated that accounting for ‘time’ and mean age improved the fit of the data ($\chi^2 = 8.32$, $df = 3$, $p < 0.05$, $pseudo-R^2 = .01$).

General PLDE effects (model 3) and specific PLDE course effects (model 4)

The results from models 3 and 4 showed that although willingness to take risks increased more in the control group than it did in the active, PLDE groups, these differences were not statistically significant. Chi-square goodness-of-fit tests indicated that the inclusion of PLDE effects in model 3 ($\chi^2 = 5.01$, $df = 2$, $p > .05$), and 4 ($\chi^2 = 15.49$, $df = 11$, $p > .05$) did not improve the fit of the data in comparison to model 2.

Between-student effects (model 5)

Model 5 tested for the effects of between-student predictors. The results for the trimmed model indicated that several between-student factors affected the T1 scores significantly. Females were less willing to take risks ($\beta = -0.16$, $t(1208) = -3.84$, $p < .001$)

than were males. Students with above average levels of exposure to aberrant driving ($\beta = 0.18$, $t(1208) = 5.53$, $p < .001$), impulsiveness ($\beta = 0.54$, $t(1208) = 12.63$, $p < .001$), or sensation seeking ($\beta = 0.25$, $t(1208) = 7.24$, $p < .001$) were significantly more willing to take risks than were their counterparts. The T2 slope estimates showed that whereas willingness increased in the reference group ($\beta = 0.06$, $t(37) = 2.65$, $p < .05$), in comparison, it decreased significantly for students with higher impulsiveness ($\beta = -.024$, $t(1272) = -3.68$, $p < .001$), with higher sensation seeking ($\beta = -0.11$, $t(1172) = -2.19$, $p < .04$). The chi-square statistic indicated that this model provided a better fit for the data than did model 2 ($\chi^2 = 358.06$, $df = 9$, $p < .001$, $pseudo-R^2 = .18$), which suggested that the combination of these three variables were important predictors of WTRT.

Another series of HLMs were constructed to examine the influence of the relevant predictors on the coefficients produced by comparing the initial and final scores on this test, to measure longer-term effects (Table 10.20).

Unconditional model (model 1)

The results of a three-level unconditional model that compared the likelihood estimates from the initial and final test showed that the means scores varied significantly around the grand mean, ($\beta = 2.38$, $t(37) = 79.59$, $p < .001$). The ICC estimates showed the amount of variance in the data at levels 1 – 3 was 70%, 26% and 4% respectively. The results of chi-square goodness-of-fit tests suggested that there was a significant amount of variation in the scores between students ($\chi^2 = 1937.7$, $df = 1106$, $p < 0.001$) and also between schools ($\chi^2 = 106.88$, $df = 37$, $p < 0.001$). There was a small amount of variation in the between-groups scores, 95% CI (2.10, 2.66), and the between students variance was two and a half times larger, 95% CI (1.67, 3.09). The within-students variation was four times larger than the between-groups variance, 95% CI (1.24, 3.52).

Change over time (model 2)

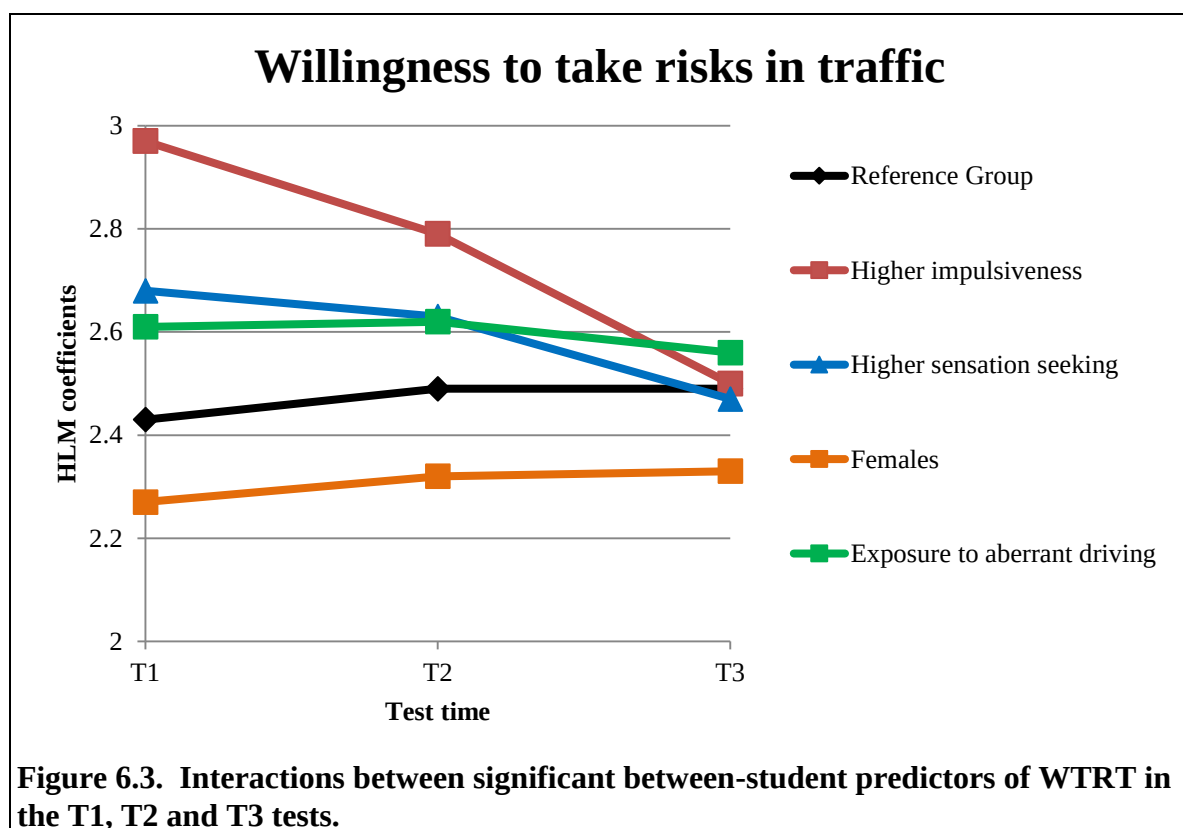
Time and mean age were added as predictors in model 2. The results showed that although there was no significant effect of age, there was a small significant long-term increase in WTRT estimates ($\beta = -0.06$, $t(37) = -3.05$, $p < .05$, $d = -0.05$). The results of a chi-square goodness-of-fit test indicated that accounting for time and mean age in model 2 improved the fit of the data significantly ($\chi^2 = 9.91$, $df = 3$, $p < 0.05$, $pseudo-R^2 = .02$).

General PLDE effects (model 3) and specific PLDE course effects (model 4)

The results from models 3 and 4 showed that although WTRT increased more in the control group than it did in the active, PLDE groups during the course of this study, these differences were not statistically significant. Chi-square goodness-of-fit tests indicated that the inclusion of PLDE effects in model 3 ($\chi^2 = 2.39$, $df = 2$, $p > .05$), and 4 ($\chi^2 = 6.61$, $df = 10$, $p > .05$).

Between-student effects (model 5)

The effects of between-student predictors was tested in Model 5, which showed that the long-term slope change for WTRT increased in the reference group ($\beta = 0.06$, $t(37) = 2$, $p < .05$). In comparison, the slope decreased significantly for students with higher impulsiveness ($\beta = -.029$, $t(1066) = -5.38$, $p < .001$), or with higher sensation seeking ($\beta = -0.16$, $t(1066) = -2.95$, $p < .05$). Furthermore, the chi-square statistic indicated that this model provided a better fit for the data than did model 2 ($\chi^2 = 294.19$, $df = 6$, $p < .001$, $pseudo-R^2 = .16$), suggesting that gender, exposure, impulsiveness and sensation seeking were important predictors of WTRT in the longer-term. The interactions between these factors are shown in Figure 6.3.



Finally, it should be noted that although the available evidence suggested that it was unlikely that there would be any significant interaction effects for between-student and between-groups slope changes in the risk perception scale scores, additional models were nonetheless constructed to test for such interactions. No significant interactions were indeed found and these models are not presented due to pressure on space.

6.3.7 High-risk vignette

Mental representations of the consequences of high-risk driving-behaviour were determined by eliciting responses to three almost identical vignettes. These described scenarios which involved a range of factors which both individually and collectively increase risk for adolescent drivers and passengers, and other road users i.e. age, inexperience, speeding, late night driving and the presence of peers. Students were given the following instructions at the start of each vignette:

“We would like you to consider the situation described below and then answer the question as fully and honestly as you possibly can. There is no need to worry about projecting a good image because the answers you give in this survey are totally confidential.”

The T1 vignette:

“Mark is 17 years old and has had a learner permit to drive for 6 months. One Saturday night while his parents were away he decided to use his dad's car to take some of the lads to a disco in a nearby town. The disco finished at 2am and on their way home Mark decided to see how fast the car can go.” (Appendix D, question 49).

The T2 vignette:

“James is 17 years old and has been learning to drive for the past 6 months. After the disco last Friday night, James brought his mates back to his house because his parents were away. When they got there they realized that their friend David had been left behind. James decided that they should take his dad's car and go back to the disco to collect David. Since they were in a hurry he decided to drive as fast as the car could go.” (Appendix E, question 33).

The T3 vignette:

“David is 17 years old and has been learning to drive for the past 6 months. One Friday night while his parents were away he decided to use his dad's car to take some of the lads to football training and afterwards they went to a disco. The disco finished at 2am and on their way home David drove as fast as the car could go because it was so late.” (Appendix F, question 44).

The instructions provided at the end of each vignette were as follows: “What are the possible consequences of this? Please write as many things as you can think of, numbering them as you go along, starting with the number 1.”

The responses were analysed with respect to;

1. The types of consequences listed (testing availability)
2. The number of consequences listed (testing availability)
3. The rank order in which consequences were listed (testing accessibility)
4. The absence of important consequences (testing accessibility)

The first stage of data analysis involved the identification and categorisation of the listed consequences. The responses provided by 25% of the T1 participants, which had

been selected at random, were coded independently by 3 experienced researchers from the Department of Psychology, TCD. During this process, 12 categories of consequences were identified and an inter-rater reliability analysis showed that there was good consistency in agreement between the researchers regarding these categories ($Kappa = .73$ ($p < .001$) 95% CI (.57, .89)). Responses from all three tests were then collapsed into these categories, while simultaneously preserving the order in which items had been listed. The number of consequences listed by each student was ascertained by re-coding the responses in these categories into 12 new binary variables i.e. 0 = not listed, 1 = listed.

6.3.8 Results for vignettes

6.3.8.1 Availability of consequences

A summary of the responses from each test is provided in (Table 6.6) which shows that serious outcomes, including ‘crashing’, ‘death’ and ‘injury’ were cited most frequently in each test. These were followed in terms of availability by consequences such as being ‘caught by the Gardaí’, ‘damage to cars/property’, and losing control of the car. Although over 21% of the students listed ‘legal problems’ (e.g. getting penalty points, going to court, being jailed) as a possible consequence in the T1 test, this figure dropped markedly over time to 13.9% at T2 and to 3.2% at T3. Listings of ‘trouble with parents’ and ‘increased risk/danger’ were quite stable across the tests. Between 10% and 12% of students suggested that there might be no consequences as a result of the high-risk behaviour described in the vignettes. However, it should be noted that this outcome was rarely listed as the sole reaction to the vignette. A numbers of students mentioned beneficial consequences e.g. “They’ll get home faster” the driver “could show off his driving skills and drive safely home”; “...the girls will be impressed....” Here again, very few students listed only beneficial consequences. Just a small number of students listed social/moral consequences, e.g. “They will crash and the passengers will be injured or killed and he

(the driver) will have to live with than on his conscience for the rest of his life”. Listings of neutral, beneficial and/or social/moral consequences decreased in successive tests.

Table 6.6 Mean availability of scenario consequences

Category	<u>T1</u>		<u>T2</u>		<u>T3</u>	
	(N = 1831)		(N = 1212)		(N = 1365)	
	n	Frequency	n	Frequency	n	Frequency
Crash	1570	85.7%	1067	88.0%	1164	85.3%
Death	939	51.3%	520	43.1%	692	50.7%
Injury	893	48.8%	407	33.6%	528	38.7%
Caught by Gardaí	700	38.2%	385	31.8%	520	38.1%
Damage to cars/property	632	34.5%	291	23.9%	234	17.1%
Lose control	420	22.9%	181	14.9%	204	14.9%
Legal problems	396	21.7%	167	13.9%	43	3.2%
Trouble with parents	286	15.6%	158	13.0%	239	17.5%
Increased risk/danger	220	12.0%	157	13.1%	127	9.3%
Nothing	237	12.9%	149	12.3%	130	9.5%
Moral issues	96	5.3%	28	2.3%	13	1.0%
Benefits	91	4.9%	32	2.6%	21	1.5%

6.3.8.2 Number of consequences

The mean number of consequences listed by the students in the T1 test was 3.54 ($SD = 1.54$) and this decreased in successive tests, T2 ($M = 2.92$, $SD = 1.44$), T3 ($M = 2.87$, $SD = 1.24$). This reflects a drop in the mean number of negative consequences listed between T1 ($M = 3.36$, $SD = 0.48$), T2 ($M = 2.77$, $SD = 1.4$) and T3 ($M = 2.76$, $SD = 1.21$) and also a drop in the number of neutral/beneficial consequences between T1 ($M = 0.18$, $SD = 0.43$), T2 ($M = 0.15$, $SD = 0.37$) and T3 ($M = 0.11$, $SD = 0.32$).

A series of HLMs were constructed to examine the influence of the relevant predictors on the numbers of consequences listed in the intervention phase tests (Table 10.21) and a second series compared the scores from the initial and final tests (Table 10.22). The unconditional models showed that the ICCs at levels 1-3 for the short-term models were 76%, 16% and 8% respectively and those for the long-term models were 81%, 15% and 4% respectively. Model 2 showed that there were small, statistically

significant decreases in the numbers of listed consequences in the short-term ($\beta = -0.6$, $t(37) = -9.1$, $p < .00$, $d = .19$) and also in the long-term ($\beta = -0.31$, $t(36) = -6.31$, $p < .001$, $d = .22$). There was no significant effect of mean age, taking PLDE or of attending specific PLDE courses on the numbers of consequences listed. However, the intervention phase model for the between-student predictors (model 5) showed that students with high trait impulsiveness mentioned significantly fewer consequences in the T1 test ($\beta = -0.34$, $t(1216) = -4.64$, $p < .001$, $d = 0.17$). There was no significant effect of impulsiveness on changes in the numbers of consequences listed in either short-term or long-term. In addition, the model summaries show that the inclusion of significant predictors at each level of analysis had very little impact on the model deviance statistic, suggesting that additional factors, which were not included as part of this study would be needed to reduce the model variance.

6.3.8.3 Accessibility of consequences

The mean order in which the students listed the consequences was used to infer the accessibility of these outcomes (Table 6.7).

Table 6.7 Mean accessibility of high-risk vignette consequences

Consequence	T1 (N = 1831)			T2 (N = 1212)			T3 (N = 1365)		
	n	M	SD	n	M	SD	n	M	SD
Crash	1570	1.34	0.72	1068	1.26	0.56	1164	1.24	0.57
Lose control	420	2.03	1.30	181	1.76	1.02	204	2.07	1.20
Increased risk/danger	220	2.60	1.49	156	2.06	1.13	127	1.79	1.04
Death	939	2.63	1.10	520	2.54	1.04	692	2.48	0.91
Injury	893	2.70	0.99	407	2.71	0.95	528	2.51	0.78
Caught by police	700	2.98	1.32	385	2.82	1.26	520	2.73	1.07
Damage to car/property	632	3.26	1.21	290	3.13	1.08	234	3.05	1.11
Nothing	238	3.38	1.79	149	2.64	1.35	130	2.65	1.49
Benefits	91	3.48	1.94	32	2.78	1.29	21	2.86	1.68
Legal consequences	397	3.87	1.47	167	3.66	1.50	43	3.56	1.32
Trouble with parents	286	3.89	1.45	158	3.49	1.39	239	3.21	1.24
Social/moral consequences	97	4.34	1.64	28	4.25	1.74	13	3.69	1.32

On average, the first consequence that sprang to mind in the current sample in each test was ‘crashing’; T1 ($M = 1.34$, $SD = 0.72$), T2 ($M = 1.26$, $SD = 0.56$), T3 ($M = 1.24$, $SD = 0.57$). This was followed by non-specific consequences such as ‘losing control’ and ‘increased risk and danger’. Next, came serious consequences, including ‘death’ and ‘injury’, and these were followed by ‘getting caught by the police’ and ‘damaging cars or property’. Next came neutral and beneficial consequences, and these were followed by legal consequences, getting into trouble with parents and finally social or moral consequences.

A series of hierarchical linear Poisson distribution models with a log-link function (Raudenbush & Bryk, 2002) were used to analyse differences in the accessibility of the three most serious types of consequences, i.e. crash, death, injury. In the Poisson model, the event rate ratio is the exponential of a coefficient ($\exp(b)$), which is a measure of relative effect size, because it can be interpreted as the percentage change in the dependent variable associated with an increase of 1 unit in the independent variable, holding other factors constant (Raudenbush & Bryk, 2002). In the present analyses the $\exp(b)$ represents the relative position in which a consequence was listed. All models were corrected for over-dispersion of the level-1 variances as recommended by Raudenbush and Bryk (2002).

6.3.8.4 Accessibility of “crashing” as a consequence

Table 10.23 contains the intervention phase results for the accessibility of ‘crashing’. The unconditional model indicated that there was a significant amount of variance in the log-rate of accessibility between the T1 and the T2 tests ($\beta = 0.25$, $t(36) = 18.58$, $p < .001$). Model 2 showed that there was a significant increase in accessibility between T1 ($\beta = 0.28$, $t(36) = 15.1$, $p < .001$, $\exp(b) = 1.32$) and T2 ($\beta = -0.6$, $t(36) = -2.31$, $p < .05$, $\exp(b) = 0.94$), i.e. crashing was listed 6% sooner in the second test. Model 3 investigated the influence of taking a PLDE course on accessibility and the slope results showed that students who took PLDE mentioned crashing 12% sooner ($\beta = -0.13$, $t(36)$

= -2.20, $p < .05$, $\exp(b) = 0.88$), than did those in the control group. Model 4 showed that whereas there was a slight decrease in accessibility in the controls between the T1 and the T2 tests ($\beta = 0.06$, $t(31) = 0.99$, $p > .05$, $\exp(b) = 1.06$), there was an increase in accessibility in all of the PLDE groups. Furthermore, this increase was statistically significant in the case of groups B ($\beta = -0.18$, $t(32) = -2.28$, $p < .05$, $\exp(b) = 0.84$), and C ($\beta = -0.18$, $t(31) = -2.23$, $p < .05$, $\exp(b) = 0.83$). This indicated that crashing was mentioned between 16% and 17% sooner by students in groups B and C respectively than it was by those in the control group. There were no significant effects of between-student predictors on crash accessibility.

Long-term changes in the accessibility of crashing as an outcome were tested using the scores from the T1 and the T3 tests (see Table 10.24). The unconditional model indicated that there was a significant amount of variance in the log-rate of immediacy between the two tests, ($\beta = 0.24$, $t(36) = 9.72$, $p < .001$). Model 2 showed that there was a significant increase in accessibility between T1 ($\beta = 0.28$, $t(36) = 8.85$, $p < .001$, $\exp(b) = 1.33$) and T2 ($\beta = -0.4$, $t(36) = -2.04$, $p < .05$, $\exp(b) = 0.95$), indicating that crashing was listed 5% sooner in the second test. However, the results from models 3 and 4 and an additional model that tested for the effects of between-student variables showed that none of these predictors influenced the accessibility of crashing as a consequence of the high-risk vignettes in the long-term.

6.3.8.5 Accessibility of ‘death’ as a consequence

The accessibility of ‘death’ as a consequence was tested by comparing the T1 and T2 scores in a series of models (see Table 10.25). The unconditional model showed that there was a significant amount of variance in accessibility $\beta = 0.88$, $t(36) = 47.21$, $p < .001$, $\exp(b) = 2.43$). However, models 2 and 3 showed that there were no significant effects of either time, or of taking PLDE on differences in accessibility. Model 4, which was used to compare estimates for the control group and those for students who attended

specific PLDE courses indicated that whereas accessibility decreased in the control group between the T1 and the T2 tests ($\beta = 0.07$, $t(31) = 0.84$, $p > .05$, $\exp(b) = 1.07$), it increased in each of the PLDE groups. However, this difference was only significant with respect to groups A ($\beta = -0.27$, $t(31) = -2.17$, $p < .05$, $\exp(b) = 0.76$) and C ($\beta = -0.19$, $t(31) = -2.04$, $p < .05$, $\exp(b) = 0.81$). This indicates that students in groups A and C listed death as a consequence 24% and 19% faster than did those in the control group in the post-intervention test. There were no significant effects of between-student predictors on the short-term accessibility of death as a consequence.

The results of the accessibility of ‘death’ over the long-term shown in Table 10.26, which shows that there were no significant effects of time, taking PLDE, attending a specific PLDE course or of between-student predictors on changes in the accessibility of ‘death’ as a consequence over the long-term.

6.3.8.6 Accessibility of ‘injury’ as a consequence

The models outlined in Tables 10.27 and 10.28 demonstrate that there were no significant effects of time, taking PLDE, attending a specific PLDE course, or between-student factors on intercept or slope change values over the short-term or the long-term respectively.

6.3.8.7 Accessibility of ‘injury’ and ‘death’ in conjunction with crashing

An inspection of the raw data from the vignettes in (Table 6.6) revealed a large discrepancy in the frequency with which serious consequences such as crashing, injury of death were mentioned. When averaged across the three tests, approximately 86% of the sample listed crashing as consequence of the high-risk scenarios, whereas only 48% listed injury and 40% listed death as a possible outcome. Since students had been encouraged to list all possible consequences, and since they listed three consequences on average in each test, and since crashing was the most accessible of all the listed outcomes (see Table 6.7), this suggests that the mental representation of crashing was not strongly linked with mental

representations for injury and/or death for some students. In fact, during the T1, T2 and T3 tests, approximately 26%, 38% and 28% (respectively) of students who listed crashing as an outcome made no mention of either injury or death. The strength of this apparent dissociation between mental representations of crashing and injury/death (i.e. crashing without death or injury (CWDI) was tested using a series of binomial HLMs.

The HLM models for the T1 and T2 scores for CWDI are outlined in Table 10.29, which show that whereas there was a 47% likelihood of listing CWDI in the T1 test ($\beta = -0.76$, $t(37) = -9.95$, $p < .001$, $OR = 0.47$), these odds increased by 68% in the T2 test ($\beta = 0.52$, $t(37) = 5.15$, $p < .001$, $OR = 1.68$). The results for model 3 show that whereas there was an increase of 63% in the likelihood of mentioning CWDI for students who took a PLDE course, the likelihood for the controls was 25% greater. The results for model 4 show that the slope increases with respect to CWDI were lower for in each of the PLDE groups than it was in the control group, albeit that these differences were not statistically significant. However, gender differences were evident in the T1 scores: Compared to males, females were 28% less likely to list CWDI ($\beta = -0.32$, $t(37) = -2.17$, $p < .05$, $OR = 0.72$). There was no significant effect of gender on short-term slope changes for CWDI. The HLM models comparing the T1 and T3 scores for CWDI showed that there was no significant effect of time, PLDE, PLDE group membership, or gender on changes with respect to this variable over the long-term (see Table 10.30).

At the close of this results section it is worth reiterating that each of the between-student models tested here were constructed initially using all of the between-student predictors listed in Table 2.3 and that non-significant predictors were subsequently trimmed from the models. These results showed that there were no significant effects of domicile location, SES, experience with RTCs or any of the Big-Five personality traits on either the intercept or slope values in any of the tests that were conducted.

6.4 Discussion

Risk perception was measured in this part of the study using four self-report scales and a vignette. The scales measured a) perceived risk for adolescent drivers (PRAD), b) crash risk likelihood estimates (CRLE), c) perceived controllability of risk (PCR), d) willingness to take risks in traffic (WTRT). These factors had been derived on the basis of principal component analyse which showed that collectively, they accounted for approximately 37%, 40% and 39% of the variance in the T1, T2 and T3 data respectively. A series of HLMs, were constructed to address the hypotheses outlined in Chapter 1. The results from the null models indicated that the largest proportion of the variation in risk perception in this study was located at intra-student level, supporting hypothesis 1. Hypotheses 2 and 3 predicted that they would be significant changes in risk perception in the short-term and long-term respectively, and the results provided mixed support for these propositions. Whereas there were some changes in risk perception in the desired (less risky) direction in the short- and the long-term, these changes were small in magnitude. Small, significant short- and long-term increases in willingness to take risks in traffic were also found.

Hypotheses 4 and 5, which posited that exposure to PLDE would result in significant improvements in risk perception were not supported. Although greater improvements were seen in the active PLDE groups than were seen in the control group, these differences were not statistically significant. The current results also demonstrated that the inclusion of PLDE in general and of specific PLDE courses as predictors did not result in significant improvements in the model fit, which suggests that PLDE was not an important predictor of changes in risk perception during this study. These findings do not accord with findings from some previous PLDE evaluation studies that tested for risk perception. For example, evaluations of the UK “Drive” initiative (H. Simpson et al., 2002), and “Risk management and Road Safety” programme in New Zealand (Harré &

Brandt, 2000a) found that risk perception improved significantly for students who attended these PLDE programmes when compared with no-programme controls. Several factors may explain the discrepancy between the current findings and those earlier results. For instance, the assessments that were carried out in previous studies were more limited in scope and in scientific rigour than were the ones conducted here. As mentioned above, the Drive study (H. Simpson et al., 2002) used just 14 items to measure risk perception, and reported very small improvements, the statistical significance of which was almost certainly influenced by the large sample size. Furthermore, whereas Harre and Brandt's evaluation reported small significant short-term improvements in risk perception, and since only 9 items were used, it is likely that the construct of risk perception was inadequately represented in that study. In contrast, the current research used 42 items incorporated in 4 scales, each of which had good internal consistency, and thereby constituted a more reliable and valid test of risk perception. Furthermore, the available evidence suggests that the vast majority of researchers in the driver education field do not analyze their data using statistical techniques that adjust for the non-independence of observations in studies using time-series data. This increases the likely occurrence of Type-1 errors (Shaughnessy et al., 2009). The use of HLM techniques to control for this problem in the current study undoubtedly made it more difficult to attribute statistical significance to the findings. However this was considered as a small price to pay in order to improve the reliability of such findings. Other steps were taken to improve the validity of risk perception estimates in this study. Instead of comparing the CRLEs which the students provided for the average road user, with the estimates that they provided for themselves as road users, and for themselves as drivers, the scores for these three scales were combined to yield a single aggregate score. By avoiding the pitfalls associated with measuring comparative risk judgements which were described earlier, this score represented a more accurate measure of estimates of crash risk likelihood in the current sample.

6.4.1 Between-student predictors of risk perception

A number of between-student factors influenced risk perception in the pre-intervention (T1) test, including gender, exposure to aberrant driving, experience with using vehicles, trait impulsiveness and sensation seeking, supporting hypothesis 6. These findings are consistent with the social learning (Bandura, 1977, 1989) and TCI (Fuller, 2005) perspectives on human (and driver) behaviour, which posit that distal antecedents such as gender and personality and proximal antecedents such as learning as a result of direct experience or exposure to role models influence an individual's capability – in this instance his/her ability to perceive risk. The expected trends emerged with respect to these influences: Males perceived less risk than did females on the PRAD and the CRLE scales, which accords with previous findings regarding pre-learner, learner and novice drivers (e.g. DeJoy, 1992; Ginsburg et al., 2008; McKenna, 1993). Likewise the findings that males were more willing to take risks in traffic than were females (e.g. Johah & Dawson, 1987; OECD - ECMT, 2006b; Twisk & Stacey, 2007). High levels of exposure to aberrant driving predicted poorer perceptions of risk in the T1 test and subsequent attendance at a PLDE course did little to reverse this trend. Research suggests that perceptions about what is 'normal' or expected behaviour while driving develop as a result of exposure to the driving behaviours of parents, and a range of other significant others, especially peers Shope (2006). The results of the present study provide additional evidence to support the effects of social influence in the development of risk-perception. Furthermore, since there were no significant interactions between exposure to aberrant driving behaviour and exposure to PLDE, this further supports the view that social learning represents a far stronger influence on risk perception in adolescents than does educational learning. Some researchers believe that one possible way to overcome the strong influence of parents and friends would be to provide road safety education in a more systematic way and over a longer period of time (Christie, 2001; Lonero et al., 1995; Lonero & Mayhew, 2010;

Siegrist, 1999). An alternative approach would be to provide parents and significant others with insight into the effects that their driving behaviour can have on the driving-related thoughts, feelings and actions of children and adolescents. To date, little research has been conducted to investigate parental awareness of the effect that their behaviour as drivers can have on driving-related cognition in their offspring. Such research is long overdue. However, research conducted in Australia by Harrison that investigated parent-focussed road safety interventions suggests that parents can be influenced to increase their effectiveness when it comes to improving road safety outcomes for their children (Harrison, 2009)

High levels of trait impulsiveness also predicted poorer risk perception in relation to the PRAD, PCR and WTRT scales, and high sensation seeking was also associated with greater WTRT, which accords with other findings reported in the personality domain (e.g. Arnett et al., 1997; Beirness & Simpson, 1988; Jonah, Thiessen, & Au-Yeung, 2001; Stanford et al., 1996). There was significant decline (improvement) in perceptions regarding the controllability of risk and in willingness to take risks in traffic in students with above average levels of impulsiveness. There was also a significant decline in willingness in students with above average levels of sensation seeking. There are two possible explanations for these results. First, empirical evidence suggests that trait impulsiveness and sensation seeking levels decline from mid-adolescence onward, i.e. from age 16 (Steinberg et al., 2008), thus these results may reflect real declines in risk-perception and willingness for these students. Second, since these traits were only measured in the initial test the possibility exists that those test scores did not represent an accurate measure of sensation seeking and impulsiveness in subsequent tests. However, considering that the mean interval between the T1 and T2 tests was just 26 weeks, and the mean interval between the T1 and T3 tests was 76 weeks, it was not be expected that these traits characteristics would have changed significantly over such relatively short time

spans. Nevertheless, this does highlight problems regarding the measurement of traits in adolescents and suggest that researchers conducting research involving children and adolescents and which involve trait-based predictors should re-measure those traits on each test occasion.

Similar to the findings reported in the previous chapter with respect to knowledge, the model summaries for the PRAD, CRLE, PCE and WTRT scales showed that the inclusion of significant predictors at the intra-student, between-student and between groups levels did very little to reduce the variation in the data, which suggests that factors other than the ones stipulated as part of this study were exerting a major influence on risk perception in the current research.

6.4.2 Perceptions of inexperience

A detailed examination of the scores for the scaled items produced some findings that could help to inform the future development of PLDE programmes. First, the adolescents in this study were well aware of the relative risks associated with the commission of driving violations e.g. impaired driving and speeding. Second, their estimations of the likelihood that they would engage in these risk-increasing activities whilst driving were generally commensurate with the seriousness of such risk. Third, the mean scores from the CRLE scale indicated that student estimates for the likely risk of crashing were closely aligned with the actual risk of crashing, which was outlined above. This suggested that insight regarding factors that increase driving risk was generally good in the sample, even before the PLDE courses were delivered.

Nevertheless, some important errors of judgement were identified, most notably with respect to inexperience and the presence of peer passengers. A vast accumulation of evidence shows that inexperience and age constitute major risk-increasing factors for young novice drivers (Elvik et al., 2009; L. Evans, 1991; Groeger, 2006; Groeger & Brady, 2004; OECD - ECMT, 2006b). It is also known that these state dependent factors serve to

amplify the risks associated with the commission of driving violations (e.g. speeding, impaired driving) and also that it is easier to mitigate risk posed by inexperience than by age (Shope, 2006; Shope & Bingham, 2008). The PRAD scale results in this study showed that inexperience was consistently judged as constituting a lesser risk for teenage drivers than were six other factors including drinking, drugs, racing, speeding, texting and inappropriate peer influence. Furthermore, when asked to estimate the likelihood that they would encounter any of those same risk factors while they were gaining driving experience, the students judged that they were less likely to drive while inexperienced than they were to drive either in the dark, or with other teenagers, or on bad roads or when in a hurry. Similar findings have been reported previously as part of the US National Young Drivers Survey (Ginsburg et al., 2008), where just 60% of the participants viewed inexperience as a significant hazard, placing it 10th position in terms of threats to teen safety. Furthermore, just 15% of the participants reported seeing inexperience often in teen drivers, apparently because experience was determined on the basis of driving licensure, which suggested that they did not “recognize what merits experience” (Ginsburg et al., 2008, p. 1391).

A review of the PLDE courses that were featured in this study (see Appendix A for a brief overview) showed that whereas they all devote a great deal of time and effort to informing students about factors that increase risk for all drivers (e.g. speeding and driver impairment), far less effort is devoted to overtly addressing state dependent risk factors which apply specifically to adolescent drivers e.g., inexperience and age. Given that all PLDs are, by definition, subject to the pervasive influence of inexperience and age, this constitutes a significant omission; not least because it is clear that adolescents do not grasp the import of inexperience in increasing their exposure to risk as drivers. Thus, there is a pressing need to develop programme content and processes that address the concept of inexperience in a direct and obvious way and thus facilitate the calibration of state

awareness in adolescent drivers. For instance, there is an evident need to ensure that all PLDE courses provide students with a clear definition of what constitutes ‘experience’ in the context of driving and thereafter, with an adequate understanding of their increased exposure to driving risk simply by virtue of their age and inexperience.

The PRAD scale results also showed that whereas adolescents seemed aware of the detrimental effects of carrying aberrant passengers, they appear to be much less aware that carrying peer passengers *per se* increases driving risk for young learners and novices: The former appeared near the top of the risk rankings, whereas the latter appeared close to the bottom. Similar findings have been reported as part of the US Young National Driver study (Ginsburg et al., 2008). In addition, results from Australian DRIVE study (Ivers et al., 2006), which involved over 20,000 young novice drivers showed that whereas over half of the participants reported driving with multiple passengers, making it the most prevalent risk increasing behaviour in that group, this behaviour was ranked second lowest in terms of riskiness by these novices. Thus there appears to be a clear need to better inform young pre-learners, learners and novices about the potential risks of carrying peer passengers, and also about why this risk arises in the first place.

6.4.3 Mental representations of risk

A vignette was also used in this research to further explore risk perception processes in Irish adolescents and thus build on earlier research conducted by Gormley and Fuller (2008). Responses to these high risk scenarios permitted the availability and accessibility of mental representations of the consequences of such behaviour to be inferred. The present results concurred broadly with those reported in Gormley and Fuller’s study, since it showed that 12 broad categories of outcomes were associated with such behaviour. In order of frequency these were; crashing, losing control of the car, death, injury that serious consequences, including crashing, death, injury, getting caught by the police, damage to cars/property, losing control, legal problems, getting into trouble

with parents, increased risk/danger, nothing, moral issues and beneficial consequences. The numbers of consequences listed decreased significantly over the short- and the long-term. The magnitude of the decrease was larger over the short-term than it was over the longer-term. However, since the interval between the first and second test was twice as short as that between the first and third test it is possible that these decreases may be due in part to boredom and a contingent lack of effort when it came to thinking about this question and writing down the responses.

Whereas ‘crashing’ was seen as the most available and accessible consequence in the sample in all tests, other serious consequences such as death and injury came to mind less easily. For example, in the T1 test there was an almost 50% chance that a student would list crashing without mentioning either death or injury. These odds increased to 68% at T2 and dropped back to 50% again in the final test. Since the thought of crashing did not cue thoughts of highly likely subsequent consequences i.e. death and/or injury, this suggests that mental representations for crashing and those for death and injury were weakly linked in the adolescents in this sample. It also appeared that these associations were more weakly linked in the males than they were in the females: The former were 28% less likely to associate crashing with death and/or injury than were the females in the pre-intervention test. These findings may help to explain gender differences in driving-related attitudes (Harré, Field, & Kirkwood, 1996), tendencies to commit driving violations (de Winter & Dodou, 2010), risk-taking (Ames, Zogg, & Stacy, 2002) and crash involvement among young novice drivers (OECD - ECMT, 2006b). The current results also showed that exposure to PLDE in TY did little to strengthen these links.

The relatively poor availability and accessibility of social/moral consequences in this study was notable, suggesting that the moral and social dimension of high-risk driving behaviour was poorly represented in the minds of the adolescents in this sample. Moreover, similar findings were reported in Gormley and Fuller’s earlier study of male

drivers aged between 17 – 28-years. Kohlberg's theory of moral development (Kohlberg, 1984) predicts that by the time an individual reaches adolescence they will have reached the 'conventional' stage of moral development, and thus be capable of discerning appropriate moral responses with respect to hypothetical situations. This view is supported by recent psycho-physiological research which shows conclusively that adolescents become more capable of complex, abstract, deliberative and hypothetical thinking as they mature from late childhood into mid-adolescence (Steinberg, 2008). Therefore, the fact that such moral consequences did not come to mind easily for the participants in these studies suggests that they may not have given sufficient thought to such issues in the past. This is an area where PLDE had the potential to make a difference.

The current results also demonstrated the absolute accessibility (as opposed to the relative accessibility which was outlined above) of mental representations of crashing, death and injury as a consequence of high-risk behaviour. The accessibility of crashing improved significantly as a function of time, and of exposure to PLDE. Crashing was mentioned between 7% and 17% faster by students in PLDE groups A-E in the post-intervention (T2) test than it was by those in the control group. Similarly, death was listed as a consequence between 2% and 24% faster in the T2 test by students in the active groups than it was by students in the control group. Although these improvements in accessibility were generally small in magnitude, they suggest nonetheless that PLDE has some potential when it comes to improving students' mental representations of the consequences of high-risk driving behaviour.

Overall, the use of vignettes to examine the availability and accessibility of explicit and implicit mental representations of high-risk driving behaviour in this study constituted a more nuanced approach than that which is commonly used in research involving PLDs and PDs (e.g., self-report and/or observation). This technique revealed the types of consequences that adolescents associate with such behaviour, the ways in which these

associations changed over time, and subtle differences in the mental representations between males and females. It also showed that exposure to PLDE served to strengthen mental representations of the consequences of high risk driving to some extent. Thus, this methodology represents a promising avenue for future research. However, additional research would be needed to develop a methodical and efficient approach to the creation of driving-related vignettes, for instance it would be interesting to see what would happen if the scenario that was depicted was more ambiguous. One drawback of scenario-based research concerns the risk that participants will interpret the narrative in unintended ways (Stecher et al., 2006). In the current research for example, some students included suggestions that the driver may have been drinking, a factor that was not intended to be accounted for part of the scenario. However, such problems could be averted by providing more detailed instructions.

Chapter 7: Attitudes towards speeding

7.1 Introduction

Speed is an important component in the traffic system (Aarts & Van Schagen, 2006) because it regulates the interface between the two somewhat conflicting primary goals of driving i.e. the desire for mobility and the need for safety (Fuller, 2000; Mayhew, 2007). Speeding can be classified as being excessive (i.e. driving above the speed limit) or inappropriate (i.e. driving too fast for the prevailing conditions) (Fuller, Bates, et al., 2008). Empirical evidence demonstrates that there is a strong positive relationship between speed and crash likelihood (Elvik et al., 2009; L. Evans, 1991; OECD-ECTM, 2010; WHO, 2009). This relationship has been mapped with considerable accuracy using a set of power functions developed by Nilsson (2004), and estimates thus derived suggest that a mean increase in speed of 5% leads to an increase of approximately 10% in injury crashes and of approximately 20% in fatal crashes (Aarts & Van Schagen, 2006; Elvik et al., 2009; OECD - ECMT, 2006a). A review of data from OECD member states showed that speeding constitutes the biggest road safety problem in many regions, contributing to approximately one third of fatal accidents, while simultaneously constituting an aggravating factor in all accidents (OECD - ECMT, 2006a). Similarly, reports from the ROI suggest that speeding was a contributory factor in almost 40% of all collisions in that jurisdiction in 2010 (RSA, 2011). Despite the evident risk, speeding is a ubiquitous feature in most driving cultures (OECD-ECTM, 2010; OECD - ECMT, 2006a; RSA, 2011; United Nations Road Safety Collaboration, 2011). For instance, OECD (2006a) estimates suggest that over 50% of individuals who are driving in that region at any given moment are exceeding legal speed limits.

Excessive and inappropriate speed contributes substantially to the disproportionate crash liability of young adolescent drivers when compared with older motorists (McKnight & McKnight, 2003; OECD - ECMT, 2006b; Wasielewsky, 1984). Following an analysis of the official reports from almost 1,300 accidents involving 17 - 25-year-old UK drivers, Clarke Ward and Truman (2005) reported that voluntary risk-taking, most notably speeding, was involved in approximately 26% of 'to blame' crashes. Similarly, McKnight, and McKnight's (2003) investigation of non-fatal crashes among 16 – 19-year-olds in California, and Maryland showed that over 20% of these collisions were due to inappropriate speed, and that the crash risk of younger drivers in this group was greater than it was for older drivers. Stradling Meadows, and Beatty (2004) also attested to the propensity of 17-20-year-olds for speeding, and also noted that up to the age of 50, males reported a higher affinity for speed than did females.

Given the consistency with which speeding has been shown to increase risk (see Aarts & Van Schagen, 2006; Ballesteros & Dischinger, 2000; Shope & Bingham, 2008; Williams, 2003), speeding was identified as a key target in the Irish National Road Safety Strategy (2007 – 2012). This aimed to ensure that all road users develop appropriate attitudes and safe behaviour with respect to speed choice, using education as a primary tool (RSA, 2007). In support of this strategy, the current study aimed to discover what types of attitudes Irish PLDs hold towards speeding as they entered Transition Year (TY)²⁴ in secondary school and to measure the effect that taking a PLDE course during that year might have on changing those attitudes in a desirable direction. Speeding was chosen as a focus for this study for other pragmatic and substantive reasons. First, since speeding is the most common driving violation (Reason et al., 1990), adolescent pre-drivers are likely to have had sufficient exposure to speeding behaviour as passengers, and as general road users to allow them to form attitudes about speeding. Second, speeding has been described

²⁴ As was explained in Chapter 2, some students in the control group were not taking a TY course and thus had transferred directly from year 11 into year 13.

as ‘an ambivalent dimension’ (Delhomme, Verlhiac, & Martha, 2009), because it simultaneously allows drivers to minimise the perceived costs of travel, maximise the perceived benefits in terms of saving time, while remaining as a source of increased risk. This ambivalence, may explain why it is so difficult to deter individuals, especially adolescents, from speeding or travelling with drivers who have a tendency towards speeding. It is reasonable to expect that such ambivalence regarding speeding would be addressed as part of a good PLDE course.

7.2 Theoretical perspectives on speeding

Several theoretical approaches have been used to explain decision making under conditions of risk. Since speeding constitutes a well-recognized risk factor for drivers of all ages, these theories have been used to explain and predict speeding, and to inform the development of interventions which attempt to reduce this behaviour. These includes the general models such as the TPB (Ajzen, 1991), the PWM (Gibbons & Gerrard, 1995), and driving specific models such as the TCI (Fuller, 2005) which were outlined in Chapter 1.

In sum, the TPB (Ajzen, 1991) suggests that beliefs about speeding are derived on the basis of a three-term contingency between antecedent conditions, behavioural responses to those conditions, and the ensuing consequences (Fuller et al., 2008). Specifically, where drivers believe that the benefits of speeding outweighs the risks, and where their significant others (family, friends, peers) approve of speeding, and where they themselves believe that they have the means and opportunity to speed (or to expose themselves to speeding), their intention to do so will increase, which in turn increases the likelihood that they will engage in speeding behaviour (Fylan, Hempel, Grunfeld, Conner, & Lawton, 2006). Research conducted by Holland and Conner (1996) supports this prediction: They reported that as a result of past experience, and exposure to societal norms, many drivers have come to believe that breaking the speed limit is socially

acceptable, that their peers approve of speeding, and that the likelihood of being caught by the police or crash involvement is slim.

The inclusion of PWM constructs contributes additional explanatory power to the TPB model by suggesting that behaviour is also influenced by prototypical images of individuals who engage in the behaviour in question (e.g. speeders) and personal willingness to engage in such behaviour (Gibbons et al., 1998). Regarding young novice drivers, Gerrard, Gibbons, and Gano (2003) indicated that a willingness to speed, particularly in the presence of peers, can be a stronger predictor of speeding than actual intentions. Other research has shown that where a young novice has a favourable socially shared image (prototype) of a typical risky driver (e.g. speeder), it is more likely that he/she will speed when the circumstances permit (Ouellette, Gerrard, Gibbons, & Reis-Bergan, 1999). Since willingness to engage in speeding activity and favourable prototypical evaluation of speeders predict greater involvement with speeding, this suggests that these constructs may represent potentially useful targets for the developers of PLDE courses.

The TCI model (Fuller, 2005) posits that drivers regulate the difficulty of the driving task on the basis of subjective judgements about their personal capability, and the ongoing demands of the driving task. Speeding clearly increases task difficulty, since it reduces the time available to anticipate and perceive oncoming hazards, and to take the appropriate action. For instance research has shown that whereas drivers are theoretically capable of reacting to a potential hazard in as little as one second, actual response times typically range from 1.5 to 4 seconds (L. Evans, 1991). To illustrate the effect of this delay, consider what might happen if a child runs out into the road 13 metres ahead of a car. At a speed of 30 km/h the car will stop just before hitting the child, whereas at a speed of 50 km/h the car will have travelled an additional 14 meters, and the resulting impact

would mean that the child would have little chance of survival (Global Road Safety Partnership, 2008).

The high prevalence of speeding in the driving population suggests that many drivers lack adequate insight regarding the negative impact that speeding has on their capability and on task demand, and thereby underestimate the difficulty of driving at excessive or inappropriate speed, and thereby on the attendant risk of crashing. However, empirical support for these assumptions has been somewhat equivocal. On the one hand, research conducted by Walton and Bathurst (1998) showed that drivers rated speeding as the main factor in unsafe driving. In addition, research by Adams-Guppy, and Guppy (1995) revealed a modest negative correlation between self-reports of speeding, and the perceived risk of speeding. Of the 572 British company car drivers surveyed, those who less frequently exceeded the speed limit were more likely to regard speeding as an important risk factor. This suggests that drivers are aware of the relationship between speeding and risk. On the other hand, a study by McKenna and Horswill (2006) indicated that factors other than increased risk had a substantial influence on speeding behaviour. They found that while the costs (e.g. legal sanctions, economics) and benefits (e.g. reduction in journey time, thrill) associated with speeding played a significant role in predicting this behaviour, concerns about crashing were the worst predictor of speeding. Furthermore, results from the UK arm of the Social Attitudes to Risk in Europe study (SARTRE 3) showed that whereas UK drivers were more aware that driving too fast was a major contributory factor in accidents, than were drivers in most other EU countries, when it came to their own driving, they did not associate fast driving with dangerous driving (Quimby, 2005). On balance, these results suggest that drivers' understanding of the relationship between speeding and risk is quite poor. Since the most obvious way to address this deficit is through education, it is clear that this issue should be dealt with as part of a good PLDE course.

7.2.1 Speeding and young drivers

Young novice drivers have limited experience with matching the demands of the driving task to their (limited) capabilities (de Craen, Twisk, Hagenzieker, Elffers, & Brookhuis, 2008), therefore speeding is a particularly acute problem in this population (Sundström, 2008). A recent Australian study investigated the speeding-related beliefs of 398 novice drivers aged between 17- and 24-years who had been classified as either high intenders or low intenders with respect to speeding on the basis of a median split. The results showed that high intenders had more positive behavioural beliefs about speeding, perceived more support from friends for speeding, and perceived that they had more control over speeding than did low intenders (Horvath, Lewis, & Watson, 2012). The same study reported that males had greater intentions of speeding than did females. A Norwegian study involving 4,500 adolescents showed that those with a positive attitude towards traffic safety were less likely to report risky driving behaviour ($r = .79$) (Ulleberg & Rundmo, 2003). A recent study involving over 3,000 French novices aged between 18 – 25-years using TPB and PWM constructs showed that that speeding intention was strongly correlated with past speeding behaviour, attitudes and also with the participants' perceived similarity to deviant prototypes (Cestac, Paran, & Delhomme, 2011). Moreover, scores for all of the variables tested in that study were all slightly below the mid-point on the scale that was used, suggesting that attitudes, beliefs and intentions were not particularly risky in this sample generally. These findings support evidence presented in Chapter 1 which suggested that TPB and PWM constructs constitute reliable and valid measures of driving-related beliefs, attitudes, intentions, and behaviour in adults (Conner et al., 2007; M. A. Elliott & Thomson, 2010; Forward, 2009), and adolescents (M. A. Elliott, 2004; Poulter & McKenna, 2010). It was also noted in Chapter 1 that interventions based on TPB principles were somewhat successful in changing intentions and subsequent behaviour (Hardeman et al., 2010). To date, however, very few studies have used TPB constructs,

and none were identified by the current researcher which used PWM constructs to investigate the attitudes, intentions and behaviour of PLDs. One study of PLDs involving the TPB model, which was described in Chapter 1, reported changes in the desired directions with respect to attitudes, peer norms and future intentions in the short-term, but not over the longer-term (Poulter & McKenna, 2010).

7.2.2 Attitude development

In order to develop effective and efficient PLDE courses, it is important to understand what types of attitudes young adolescents hold about driving, and to know when and how these attitudes become established (Deighton & Luther, 2007; Lonero, Clinton, & Black, 2000). It is generally accepted that attitudes are acquired as a function of direct experience (classical and operant conditioning) and social learning (observation) (see Ajzen, 1991; Eby & Molnar, 1998). A detailed description of learning processes was provided in Chapter 4, where it was established that social influence, notably by parents and peers, affected the driving-related attitudes and behaviours of children, adolescents and young adults (Allen & Brown, 2008; DiBlasio, 1988; M. A. Elliott & Baughan, 2004; Green & Dorn, 2008; Simons-Morton & Ouimet, 2006; Taubman - Ben-Ari et al., 2005). As part of the review of PLDE in Chapter 1, evidence was presented which showed that driving-related attitudes were present in children as young as 11-years-of-age (Waylen & McKenna, 2002, 2008). Findings from similar studies involving school students aged between 11- 16-years, suggested that a proportion of the participants believed that it was safe to travel at excessive speed (Harré et al., 2000), or expressed tolerance for breaking the speed limit where they believed that it was safe to do so (O'Brien et al., 2001). In addition, the attitudes expressed by young males were consistently riskier than those expressed by young females (O'Brien et al., 2001; Parker & Stradling, 2001; Waylen & McKenna, 2002, 2008). Thus it is evident that driving-related beliefs and attitudes develop

before children and adolescents have the opportunity to gain direct experience with driving.

Research also suggests that attitudes towards driving tend to become more risky as adolescence progresses. For instance, research conducted in New Zealand (Harré et al., 2000) showed that 14 – 15-year-olds (n = 168) expressed less risky driving-related attitudes than did 16-17-year-olds (n = 109) with respect to speeding, travelling with a drink-driver, and back-seat belt usage. Lonero, Clinton and Black (2000) used focus groups to elicit the beliefs and attitudes that US teenagers had about driving, whereby they noted that the 15-year-olds in the groups generally believed that they would become careful and thoughtful drivers, whereas the 16 – 18-year-olds talked more about the laws that they broke and how much they got away with. These findings suggest that it is important to ascertain the beliefs of Irish PLDs, because this would assist in the development of educational interventions that are relevant for this particular group.

7.2.3 Measuring attitudes towards speeding in pre-learner drivers

However, the measurement of attitudes towards speeding in individuals who are below the legal age for driving represents something of a challenge, because such beliefs, attitudes, and behavioural intentions are more a matter of conjecture than of fact. Nevertheless, this direct approach remains popular with researchers who work with PLDs. For instance, a recent study involving pre-driving adolescents in Scotland and New Zealand, measured TPB constructs using items such as “My refraining from speeding would be easy/difficult” (Mann, 2010). Similarly, a UK study that evaluated a PLDE course, used questions such as “After I pass my test, exceeding the speed limit by more than 10 mph on a country road outside a built-up area would be (1: exciting; 7 boring) (Poulter & McKenna, 2010). However, it is debateable as to whether individuals who don’t already drive can provide well-informed (i.e. valid) responses to such questions. The authors of a well-respected TPB manual recommend that researchers should use their own

judgements regarding the types of questions that seem to make sense in the context of the behaviour in question and of the sample that is being examined (Francis et al., 2009). Thus, in the present study, whereas it seemed reasonable to measure the students' prototypical impressions of speeders, since they had direct and indirect contact with such individuals, it seemed more sensible to measure their behavioural and normative beliefs, perceived behavioural control and willingness with reference to speeding-related behaviours that featured within their current behavioural repertoire. Thus, these TPB and PWM constructs were measured with respect to travelling as a passenger with a known speeder.

To date, very few studies have examined the beliefs and attitudes of adolescent passengers. However a study conducted by Ulleberg (2004) involving 4,397 Norwegian adolescents showed that the majority of those believed that it was fairly acceptable to travel with an unsafe driver ($M = 3.42$, on a 5-point scale). Furthermore, such beliefs reduced the likelihood that passengers would challenge unsafe driving, and were more pronounced in adolescents who travelled with friends who drove in a risky manner. Although Ulleberg did not report any statistical information regarding the frequency with which these participants travelled with speeders, these findings suggest that exposure to aberrant driving as a passenger can influence passenger-related beliefs, attitudes and intentions. This suggests that passenger-related attitudes and behaviours represent legitimate targets for PLDE courses and also for those who wish to evaluate such courses.

It is worth noting here that because this study was predominantly interested in ascertaining the attitudes, beliefs and intentions of Irish PLDs both before and after the delivery of PLDE in Transition Year, no attempt was made to test the actual TPB and PWM models themselves since such analyses were beyond the scope of this research. This kind of approach is also endorsed by Francis et al. (2009) who supported the feasibility of

using individual TPB items in repeated measures studies to determine the efficacy of interventions on specific variables.

7.2.4 Aims and hypotheses

The main aims and hypotheses for this part of the study are those expressed in Chapter 1, sub-section 1.2.7. Thus, consistent with current knowledge regarding TPB and PWM constructs it is hypothesised that;

H1. Risky attitudes towards travelling with speeders will be present in the current sample in the pre-intervention test (T1).

H 2 & 3. Attitudes regarding speeding will become riskier over time and expectations, willingness and perceptions of behavioural control will increase over time.

H4. Attitudes will change in a desirable direction as a result of exposure to PLDE.

H5. Attitudes will change in a desirable direction as a result of attending specific PLDE courses.

H6. There will be significant effects of between-student factors on both pre-intervention levels of these attributes (T1) and on changes that occur in these attributes over the short-term (T2 slope) and the longer-term (T3 slope) in this study;

- Males will express riskier attitudes than will females
- Differential exposure to aberrant driving will predict attitudes
- Personality factors including impulsiveness, sensation seeking and Big-five factors will influence attitudes.

7.3 Method

7.3.1 Design

See Chapter 2, sub-section 2.1.

7.3.2 Participants

See Chapter 2, sub-section 2.2.

7.3.3 Procedure

See Chapter 2, sub-section 2.5.

7.3.4 Measures

See Chapter 2, sub-section 2.4.

An abbreviated description of the items used in this part of the study, including references to the appendices, where the actual questions can be seen appears below (Table 7.1). The TPB (Ajzen, 1991), and PWM (Gibbons & Gerrard, 1995) constructs were measured at T1, T2, and T3 using 29 items. Scores for items with negative endpoints were reversed so that higher scores reflected more favourable (riskier) attitudes towards speeding. To help to contextualize these data, details about recent experience of travelling as passengers of speeding drivers were collected during the T1 test.

A series of 10 adjectives were used to measure socially shared prototypical images of speeders, using a 5-point Likert scale ranging from 1 = Not at all, to 5 = Very. These were elicited during earlier research during which 75 adolescents, (42 males, and 33 females) aged between 15 – 17-years, were asked to list all of the adjectives that they could think of to describe drivers who speed. This produced 27 adjectives, the 10 most popular of which were used in the current study. Coincidentally, five of these adjectives described positive speeder characteristics (cool, popular, responsible, smart, and skilful) and five reflected negative attributes (impatient, immature, risky, selfish, and unrealistic).

Table 7.1 Theory of planned behaviour/Prototype willingness model measures

Appendix/ Question	TPB construct	Description	No. of items	Scale
D/37	Behavioural beliefs ²⁵	What it would be like to be a passenger of a speeding driver	4	1 = Very pleasant - 4 Very unpleasant*; 1 = Very bad - 4 = Very good; 1 = Very safe - 4 = Very risky*; 1 - Very harmful - 4 = Very beneficial
D/38	Subjective Norms	Normative beliefs (Peers)	1	Free response between 0% - 100%**
D/41	Subjective Norms	Normative beliefs (Significant others)	1	1 = Strongly disagree - 7 = Strongly agree
D/44	Subjective Norms	Motivation to comply with parents'/teachers' views	1	1 = Totally - 7 = Not at all*
D/45	Subjective Norms	Motivation to comply with peers' views	1	1 = Totally - 7 = Not at all*
D/42	Perceived Behavioural Control	Ability to refuse to travel with a with a speeder	1	1 = Very easy - 7 Very difficult*
D/43	Perceived Behavioural Control	Control over decisions about whether or not to travel with a speeder	1	1 = Strongly agree - 7 = Strongly disagree*
D/40	Expectations/intentions	Expectations of travelling with a speeder	1	1 = Definitely will - 7 Definitely won't*
D/39	Prototypical speeders	Characteristics of prototypical speeders	10	1= Not at all - 5 = Very
D/32/4	Willingness	Willingness to travel with a speeder	1	1 = Very unwilling - 5 = Very willing
D/46	Experience	Frequency of travelling in with speeders	1	1 = Never – 5 = Many times
D/47	Experience	Who drove the speeding car	6	Mother, Father, Brother/Sister, Other relative, Friend, Other.

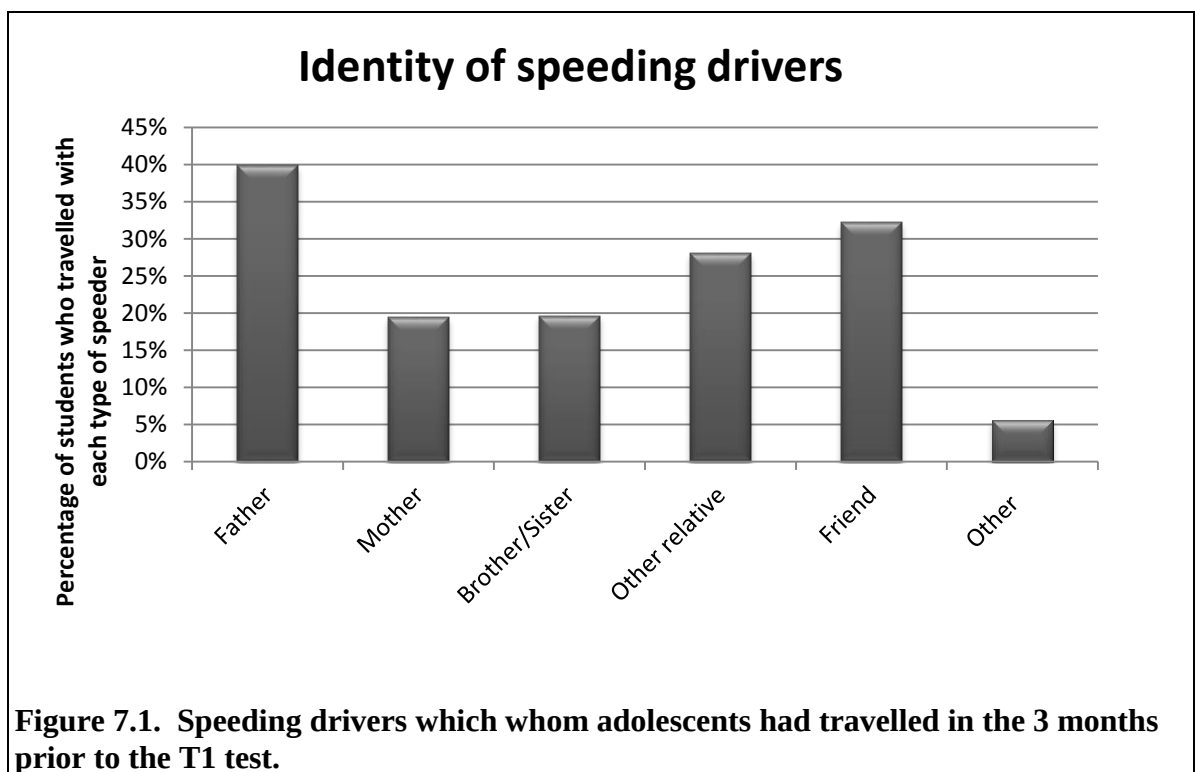
* Scores for these items were reversed.

** Percentage scores were collapsed into 7 categories - 1 = 0% - 15% to 7 = 86% - 100%.

²⁵ Although behavioural beliefs are usually referred to as “attitudes” within the TPB framework, to simplify the narrative, the current study uses the term “Attitudes” to refer to TPB and PWM constructs collectively.

7.4 Results

Experience with travelling with speeders was measured during the T1 test. The results showed that 34% of the students had ‘never’ travelled with a speeder in the three months prior to taking the T1 test. A further 52% indicated that they had done so either ‘rarely’ (26%) or ‘occasionally’ (26%), and the remainder reported that they had done so ‘often’ (8%) or ‘many times’ (6%). Of those students who reported recent experience with travelling with speeders, 40% indicated that the driver in question was their father, 32% had travelled with speeding friends, and 28%, 20% and 19% had travelled with speeding relatives, siblings and mothers respectively²⁶ (Figure 7.1).



A series of Zero-order correlations were calculated to examine the relationship between the mean scores at T1 for experience of travelling with speeders, and those for the TPB and PWM constructs (Table 7.2). The results show that increased experience was

²⁶ A number of students had travelled with more than one type of speeding driver.

associated with the expression of riskier behavioural and normative beliefs regarding speeding. Increased experience was also associated with lower perceived control over decisions about travelling with speeders and greater willingness to do so, albeit that the size of this effect was small.

Table 7.2 Zero-order correlations between attitudes towards speeding and frequency of travelling with speeders

Question	Attitude variables	<i>r</i>	<i>Effect size%</i>
D/37	<u>Behavioural beliefs</u>	.33**	11%
	<u>Subjective norm</u>		
D/38	Peer norm	.28**	8%
D/41	Significant other norm	.32**	10%
D/44	Motivation to comply with parents	-.05*	0.3%
D/45	Motivation to comply with peers	-.05*	0.3%
	<u>Perceived behavioural control</u>		
		-	
D/42	Ability to refuse to travel with speeder	.29**	8%
	Control over decisions about travelling with	-	
D/43	speeders	.26**	7%
D/40	Expectation	.63**	40%
D/32/4	<u>Willingness</u>	.33**	11%
D/39	<u>Prototypes</u>		
		-	
	Negative prototypes	.23**	5%
	Positive prototypes	.30**	9%

Note: n = 1857 based on listwise deletion.

*p < .05. **p < .01. ***p < 0.001.

However, these results show that recent experience with travelling with speeders accounted for almost 40% of the variance in the scores for future expectations of taking trips with drivers who are known for speeding. Regarding prototypes, increased experience was positively related to positive impressions of speeders ($r = .3$), whereas it was negatively associated with negative impressions of such drivers ($r = -.23$). Although experience had a significant, negative effect on students' motivation to comply with parents and with peers, this effect was very small ($r = -.05$).

7.4.1 Principal components analysis

The analysis of the TPB and PWM components of the test began with the calculation of mean scores for the 29 attitude variables, which were then used as the basis for a series of PCAs, with the aim of reducing the number of DVs to be considered. A PCA of the T1 scores began with an inspection of the correlation matrix, which indicated the presence of many coefficients $\geq .3$. The *KMO* was adequate (.84), and Bartlett's test of sphericity was statistically significant, supporting the factorability of the matrix. This initial solution indicated the presence of 6 components with eigenvalues > 1 , representing 54.1% of the variance in the data. These factors were subjected to a varimax rotation, which did not produce an interpretable result, because several items loaded on to more than one factor (Table 10.31)²⁷, and the scree plot (Figure 10.8) did not suggest a suitable alternative structure. Thereafter, separate PCAs were conducted for the constructs that were measured using multiple items (i.e. behavioural beliefs, subjective norm, perceived behavioural control, and prototype evaluations) with the objective of reducing those data.

7.4.1.1 Behavioural beliefs

A PCA, with varimax rotation was conducted on the T1 scores from the 4-item behavioural beliefs test. The *KMO* test (.70) and Bartlett's test of sphericity ($< .001$) supported the factorability of the correlation matrix. A single behavioural beliefs factor with an eigenvalue exceeding 1 was identified, and the existence of one main factor was also supported by evidence from the scree plot (Figure 10.9). This factor explained 51% of the variance, and the internal consistency of this scale was acceptable ($\alpha = .7$).

7.4.1.2 Subjective norm

A PCA was conducted on the scores from the T1, 4-item subjective norm test. The *KMO* value (.5) and the internal consistency ($\alpha = .2$) of this scale were unacceptable, and

²⁷ Tables and figures containing the prefix "10" (e.g. 10.31) are located in the appendices.

could not be improved by deleting any of the items. Consequently these items were analysed individually for the remainder of the study.

7.4.1.3 Perceived behavioural control

Similarly, the PCA for the T1 scores from the 2-item perceived behavioural control test revealed unacceptable *KMO* (.50), and internal consistency ($\alpha = .5$) values, and these items were analysed separately thereafter.

7.4.1.4 Prototypes

A PCA was also performed on the T1 scores for the 10-item, prototypical speeding driver test. Inspection of the correlation matrix revealed the presence of many coefficients $\geq .3$, and the results for the *KMO* (.8), and Bartlett's ($< .05$) tests, supported the factorability of the matrix. PCA revealed the presence of a three factor with eigenvalues exceeding 1, explaining 61% of the variance, thus these factors were rotated. Although, the rotated component matrix showed that several items loaded strongly on to more than 1 component (Table 10.32), an inspection of the scree plot suggested the presence of two dominant components (Figure 10.10). Thus, a 2-factor solution, which explained 50.1% of the variance, was imposed on the data. Component 1, which consisted of the 5 negative adjectives from the scale, was labelled Negative Prototypes, and contributed 32.8% of the variance. Component 2, which consisted of the 5 positive adjectives from the scale, was labelled Positive Prototypes, and contributed 17.3% of the variance. The internal consistencies of the Negative Prototype scale ($\alpha = .8$) and the Positive Prototype scale ($\alpha = .7$) were adequate.

As a result of these factor analyses the number of variables in this section of the study was reduced to 13, 11 of which addressed TPB and PWM constructs and two which addressed previous experience with travelling with drivers who are known for speeding.

7.4.2 Descriptive data

Sample means for the scales and for the individual items from the T1, the T2 and, the T3 tests are summarised in Table 7.3.

Table 7.3 Sample means for attitudes to speeding items and scales

Appendix / Question	Attitudes variables	Time 1*		Time 2**		Time 3***		Raw score change		
		M	SD	M	SD	M	SD	T1/T2	T2/T3	T1/T3
D/37	<u>Behavioural Beliefs</u>	2.20	0.80	2.12	0.81	2.15	1.01	-3.6%	1.4%	-2.3%
	<u>Subjective Norm items</u>									
D/38	Percentage of peers who think it's OK to travel with a speeder (descriptive norm)	3.93	1.68	4.47	1.83	3.49	1.55	13.7%	-21.9%	-11.2%
D/41	People who are close to me (significant others) think it's OK for me to travel with a speeder (injunctive norm)	2.54	1.60	2.45	1.54	2.42	1.64	-3.5%	-1.2%	-4.7%
D/44	Motivation to comply with parents' opinions	3.85	1.95	4.28	1.46	4.56	1.65	11.2%	6.5%	18.4%
D/45	Motivation to comply with peers' opinions	4.29	1.93	4.03	1.29	3.73	1.61	-6.1%	-7.4%	-13.1%
	<u>Perceived Behavioural Control items</u>									
D/42	Easy to refuse a lift with a speeder	4.48	1.78	4.52	1.72	4.59	1.76	0.9%	1.5%	2.5%
D/43	Up to me to decide whether or not to travel with a speeder	5.48	1.60	5.51	1.55	5.84	1.35	0.5%	6.0%	6.6%
	<u>Behavioural Intention item</u>									
D/40	Expectation of travelling with speeder in the next 3 months	3.15	1.20	3.25	1.20	3.42	1.23	3.2%	5.2%	8.6%
D/39	<u>Prototypes scales</u>									
	Negative	3.47	0.92	3.68	0.91	3.36	1.00	6.1%	-8.7%	-3.2%
	Positive	2.33	0.80	2.25	0.76	2.11	0.90	-3.4%	-6.2%	-9.4%
	<u>Willingness item</u>									
D/32/4	Willingness to travel with a speeder	2.56	1.06	2.57	0.98	2.51	1.01	0.4%	-2.3%	-2.0%

* n = 1880. **n = 1322. *** n = 1412.

The T1 scores for the behavioural beliefs scale ($M = 2.2$, $SD = 0.8$), indicated that the students believed that travelling in a speeding car would be somewhat of a negative experience and these beliefs changed very little in the subsequent tests.

The results for the subjective norm items revealed a disparity between parental and peer norms. On the one hand, students believed that people who are close to them (significant others) would not approve of travelling with a speeder at T1 ($M = 2.54$, $SD = 1.6$), and perceived approval for this behaviour decreased by 3.5% between the T1 and the T2 test and by a further 1.2% subsequently. On the other hand, students believed that

approximately half of their peers would approve of taking a lift with a speeder at T1 ($M = 3.93$, $SD = 1.68$), and perceived peer approval increased by almost 14% between the T1 and the T2 tests, although it decreased by almost 22% during the study as a whole. The results also suggested that the students were somewhat motivated to comply with their peers' opinions at T1 ($M = 4.29$, $SD = 1.93$). However, such motivation decreased by over 6% at T2 and by a further 7.4% in the final test. Furthermore, although, students were slightly less motivated to comply with their parents' opinions at T1 ($M = 3.85$, $SD = 1.95$), such motivation increased by over 11% in the T2 test and by a further 6.5% in the final test.

The students were 'unsure' regarding their expectations (intentions) of being a passenger in a speeding car at T1 ($M = 3.15$, $SD = 1.2$), however expectancy increased by approximately 3% between the T1, the T2 tests, and by approximately 5% subsequently.

Since the mean scores for both of the PBC items were above the mid-point in the scale, this indicates that the student tended to believe that they had some control over whether or not they travelled with speeders. Scores for the T1 test, showed that they agreed that they were in a position to decide whether or not to travel with speeders ($M = 5.48$, $SD = 1.6$), and scores for this item increased by 0.5% between the T1 and the T2 tests, and by 6.5% subsequently. However, the means with respect to refusing to take a lift from a driver who had a reputation for speeding were slightly lower (T1, $M = 4.48$, $SD = 1.78$), decreasing by approximately 1% between the T1 and the T2 tests, and by 1.5% subsequently.

The results regarding prototypical speeders indicated that the current participants had a somewhat negative impression of such drivers. The T1 scores on the positive scale were below the midpoint ($M = 2.33$, $SD = 0.8$), and these decreased by 3.4% between the T1, and the T2 tests, and by 6.2% subsequently. The T1 scores on the negative scale were above the midpoint ($M = 3.47$, $SD = 0.92$), and negativity increased by over 6% between the T1, and the T2 tests. However, negativity decreased by 8.7% subsequently.

The mean scores for willingness indicated that the students were more willing than unwilling to take a lift with a speeder at T1 ($M = 2.56$, $SD = 1.06$), and that willingness increased marginally (0.4%) between the T1. and the T2 tests, and decreased by 2.3% subsequently.

7.4.3 HLM analysis of attitudes towards speeding scores

The HLM analyses proceeded in accordance with the modelling strategy that was outlined in section 7.3.1 above; models 1 tested hypothesis 1, model 2 tested hypotheses 2 and 3, and models 3-5 tested hypotheses 4-6. Two sets of HLMs, one measuring short-term changes and the other measuring long-term changes were constructed to examine the effects of intra-student factors (i.e. time and age), of taking PLDE in general, of taking specific PLDE courses, and of between-student factors on the mean scores for the 11 attitudes to speeding variables described above. This produced a large quantity of data, and in the interest of brevity, these results will be reported on a model-by model basis, rather than on a variable-by-variable basis, as was done previously.

7.4.3.1 Unconditional models (model 1)

The results for the unconditional models for the attitudes towards speeding variables in both the IP and the IVF phases are summarised in Table 10.33. This indicates that the fixed effects coefficients for all models varied significantly around the grand mean, and chi-square goodness of fit tests indicated that there was a significant amount of variation in the IP and in the IVF scores at the between-students (level-2) and between-groups (level-3) levels, supporting hypothesis 1. Similar to the previous findings in this research, these results also indicated that the largest proportion of the variation in risk perception in this study was located at intra-student level.

7.4.3.2 Change over time (model 2)

The next set of models examined changes in attitudes as a function of time and age. The IP models indicated that there was no significant effect of age on any of the variables

(Table 10.34). However there were some changes over time, including significant increases in perceived peer approval for speeding ($\beta = 0.15$, $t(37) = 2.32$, $p < .05$, $d = 0.05$), motivation to comply with parents ($\beta = 0.36$, $t(37) = 6.0$, $p < .001$, $d = 0.11$), expectations of travelling with a speeder ($\beta = 0.16$, $t(37) = 4.53$, $p < .001$, $d = 0.11$), and negative impressions of prototypical speeders ($\beta = 0.2$, $t(37) = 5.34$, $p < .001$, $d = 0.24$). There were also significant decreases in motivation to comply with peers ($\beta = -0.31$, $t(37) = -6.24$, $p < .001$, $d = -0.2$), and in positive impressions of prototypical speeders ($\beta = -0.18$, $t(37) = -1.19$, $p < .05$, $d = -0.29$). However, there were no significant slope changes with respect to the following variables; attitude (D/37), perceived views of significant others (D/41), ability to refuse a lift with a speeder (D/42), personal control over decisions about travelling with speeders (D/43), and willingness to travel with a speeder (D/32-4). Hypothesis 2 predicted that there would be significant short-term changes in attitudes in a more risky direction, and since such changes were evidenced with respect to just two of the variables that were tested (i.e. percentage of peers who think that it is 'ok' to travel with speeders, and behavioural expectations) these results offer weak support for this proposition. In addition, the model summaries indicated that time and age in combination accounted for very little of the variance in all of these models ($pseudo-R^2 < 0.03$).

The slope coefficients for the IVF models (Table 10.35) showed that age was not a significant predictor of long-term changes with respect to any of the attitudes to speeding. However, congruent with the IP results, there were significant long-term increases in motivation to comply with parents ($\beta = 0.68$, $t(37) = 5.37$, $p < .001$, $d = 0.22$), and behavioural expectations ($\beta = 0.37$, $t(37) = 4.29$, $p < .001$, $d = 0.26$). Furthermore, whereas the increase in perceived personal control over decisions regarding travelling with speeders was non-significant in the short-term, the IVF estimates show that perceived personal control increased significantly over the longer-term ($\beta = 0.43$, $t(37) = 4.11$, $p < .001$, $d = 0.17$). Long-term declines in motivation to comply with peers ($\beta = -0.36$, $t(37) = -3.1$, $p < .001$, $d = -0.12$).

.01, $d = -0.13$), and support for positive prototypical images of speeders ($\beta = -0.18$, $t(37) = -2.66$, $p < .01$, $d = -0.29$), also reflected the pattern of decline evidenced in the IP short-term models. However, there was a significant long-term decrease in perceived peer approval for travelling with speeders ($\beta = -0.34$, $t(37) = -3.09$, $p < .01$, $d = -0.11$) and in negative prototypical images of speeders ($\beta = -0.14$, $t(37) = -1.64$, $p < .05$, $d = -0.14$), which contrasts with the increases recorded for these items during the intervention phase. Finally, there were no significant long-term changes in behavioural beliefs (D/37), perceived views of significant others (D/41), ability to refuse a lift with a speeder (D/42), and willingness to travel with a speeder (D/32-4). Since there was no significant short-term or long-term change over time with respect to these four variables they were dropped from the study. Hypothesis 3 predicted that there would be significant change in attitudes in a risky direction over the long-term, and since these results provided evidence of undesirable change with respect to just one of the variables tested, these results tend to refute that proposal. Furthermore, the model fit statistics indicate that both time and age factors accounted for a very small percentage of the variance in the overall models; the *pseudo-R*² values were $< .04$ for all variables, with the exception of item D/43 (*pseudo-R*² = .22) which was somewhat larger.

A review of the model summaries for the IP models (Table 10.34) and for the IVF models (Table 10.35) indicated that these models fitted the data significantly better than did the unconditional models, i.e. the results of chi-square goodness of fit comparisons were all statistically significant. However, given that the model deviance values remained high (> 5700), and that the inclusion of time and age as level-1 predictors had such a small effect, it appears that age and time alone were not sufficient to explain variations in the data over either the short- or the long-term.

The tau beta correlations between the intercept and slope estimates in the IP and the IVF phases provide some insight into the nature of change in the scores in the short- and the longer-term (Table 7.4).

Table 7.4 Attitude to speeding: Model 2, correlations between intercept and time slope estimates

Attitude variables	Model phase	
	<u>IP</u> <i>r</i>	<u>IVF</u> <i>r</i>
<u>Subjective norm</u>		
Peer approval	-0.99	-0.98
Motivation to comply with parents	0.33	0.04
Motivation to comply with peers	-0.99	-0.99
<u>Perceived behavioural control</u>		
Personal control over decisions	-0.89	-0.99
<u>Behavioural expectations</u>		
	0.98	0.99
<u>Prototypes</u>		
Negative prototypes	0.16	0.26
Positive prototypes	0.98	0.98

The negative tau beta correlations indicate that students with higher initial scores, tended to decrease their scores in subsequent tests at a greater rate than did those who produced lower scores at the outset. Alternatively, positive correlations suggest that students with higher initial scores tended to increase their scores at a greater rate than did those with lower initial scores. Thus, it seems that motivation to comply with peers declined more sharply in the IP and in the IVF phases in students who were more highly motivated at the outset, than it did for their less motivated counterparts. Similarly, students with riskier subjective norms initially with respect to peer approval for taking lifts with speeders, recorded steeper changes in scores for these items in the subsequent tests. Likewise, increases in perceived behavioural control were more marked in students who expressed less behavioural control at the outset. Alternatively, there was no difference in the rate of change between students with respect to motivation to comply with parents, behavioural expectations, or prototypical images of speeders.

7.4.3.3 PLDE effects (model 3)

A series of intercepts-and slopes-as-outcomes models tested for the effects of exposure to PLDE, on the 7 remaining attitudes variables, while simultaneously controlling for initial differences between scores for students who took PLDE and those for the non-PLDE controls. The results for the IP models revealed just one interesting slope-change difference between these two groups (see Table 10.36). Whereas there was a significant decline in endorsement of a positive prototypical image of speeders among students who had taken a PLDE course ($\beta = -0.07$, $t(37) = -2.56$, $p < .001$), in comparison, endorsement of positive prototypical speeders in the non-PLDE control group increased over the short-term ($\beta = 0.16$, $t(37) = 2.31$, $p < .05$, $d = .26$). This small interaction effect is depicted in Figure 7.2.

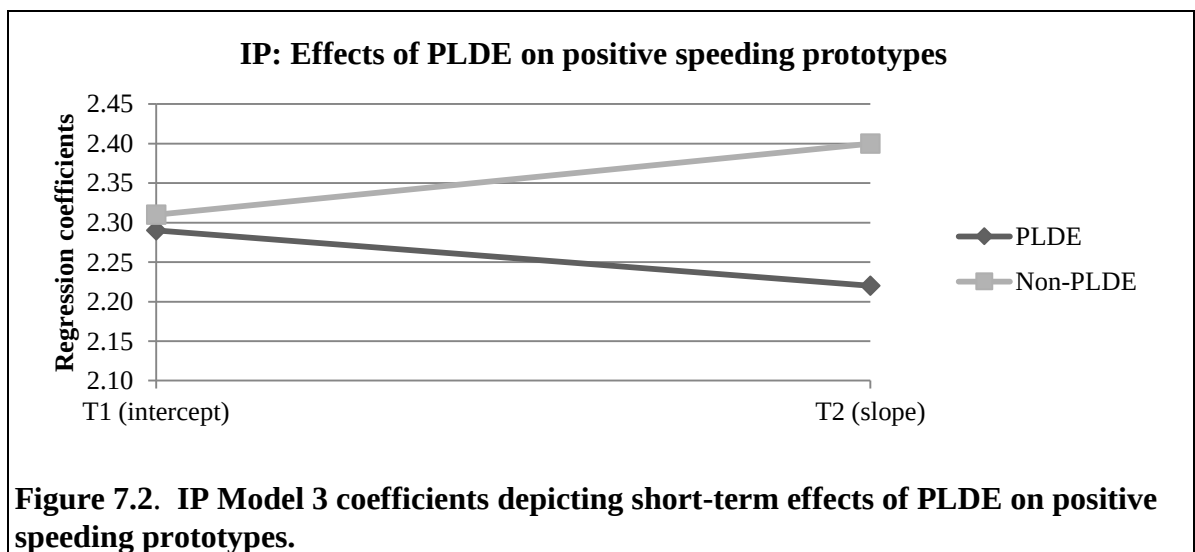


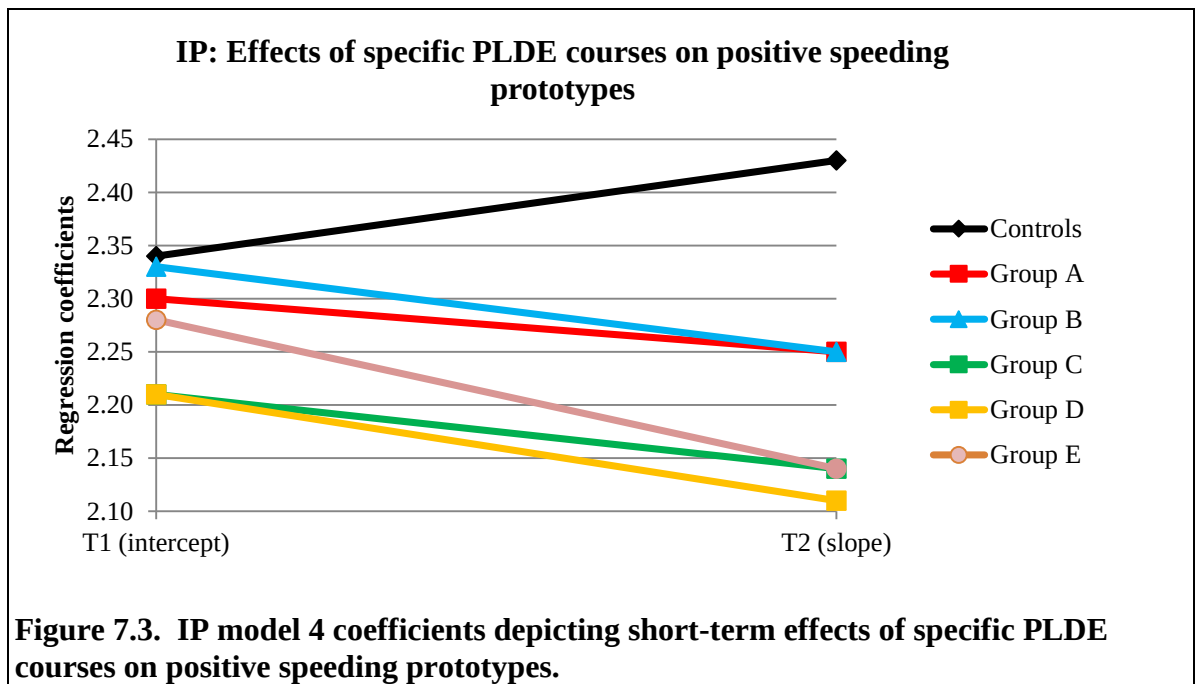
Table 10.36 also shows that there were no significant differences in the slope changes for the non-PLDE group in comparison to the PLDE group with respect to peer approval; motivation to comply with parents, or peers; perceived control over, or expectations of travelling with speeders; or negative perceptions of prototypical speeders. Furthermore, the IVF models detailed in Table 10.37 show that whereas the slope changes for the PLDE group were statistically significant for all 7 attitude variables, the slope changes for the non-PLDE controls were not statistically different to those for the active group. Since

there were no significant short-term effects of taking PLDE in relation to six of the seven attitude variables, and no significant effects of PLDE on any of the variables over the long-term, hypothesis 4 was rejected.

Furthermore, the model summaries for the IP (Table 10.36), and the IVF (Table 10.37) models showed clearly that these models did not represent a better fit for the data than did the simpler, time-only models (model 2), and that the model deviance remained high, which suggests that exposure to PLDE was not an important predictor of changes in attitudes towards speeding in this study.

7.4.3.4 PLDE course effects (model 4)

A series of intercepts-and slopes-as-outcomes models tested for the effects of exposure to specific PLDE courses, on the 7 remaining attitude variables, while simultaneously controlling for initial differences in scores between students in the each of the five PLDE groups and those of students in the control group. The IP models, which tested short-term effects, are presented in Table 10.38, and these produced just one noteworthy result: Whereas endorsement of positive prototypical images of speeders increased significantly between the T1 and the T2 tests for the control group ($\beta = 0.09$, $t(37) = 1.39$, $p < .05$), in comparison, it decreased significantly in all of the PLDE groups: A ($\beta = -0.14$, $t(1206) = -2.01$, $p < .04$); B ($\beta = -0.17$, $t(1206) = -2.02$, $p < .05$), C ($\beta = -0.16$, $t(1206) = -2.01$, $p < 0.05$), D ($\beta = -0.19$, $t(1206) = -2.09$, $p < .05$); E ($\beta = -0.23$, $t(1206) = -2.17$, $p < .05$). However, the magnitude of the differences in the slopes between the control group and groups A – E was small, $d = 0.13$, 0.08 , 0.28 , 0.15 , and 0.16 respectively. These interaction effects are depicted in Figure 7.3.



However, the results for the IVF models (Table 10.39) show that there were no significant differences in score changes for the attitude variables, between any of the active PLDE groups and the control group over the longer term. This suggests that exposure to specific PLDE programmes did not result in improvements in attitudes towards speeding, thus hypothesis 5 was rejected. The model summaries for both the IP (Table 10.38) and the IVF (Table 10.39) show that after accounting for the effects of specific PLDE courses the model deviances remained very high, and the results of the chi square goodness of fit tests indicate that the current model did not represent an improved fit for the data when compared to model 2.

7.4.3.5 *Between-student effects (model 5)*

A series of intercepts-and slopes-as-outcomes models were constructed to test for the effects of between-student predictors on attitudes towards speeding in the intervention phase. As shown in Table 10.40, a variety of demographic factors, including domicile location, and gender; experience-related factors such as exposure to aberrant driving practices, and experience with using vehicles; and personality traits, including

impulsiveness, sensation seeking, and agreeableness impacted significantly on the intercept estimates (i.e. the T1 test scores).

Exposure to aberrant driving was the strongest and the most consistent predictor of attitudes towards speeding. Students with higher levels of exposure to aberrant driving (HE) expressed riskier attitudes towards speeding in response to five of the seven test items, than did their less exposed counterparts (LE). For example, the IP intercepts for the HE students with respect to peer approval of speeding ($\beta = 0.43$, $t(1209) = 4.83$, $p < .001$), expectations of travelling with speeders ($\beta = 0.64$, $t(1207) = 10.57$, $p < .001$), and positive prototypical images of speeders ($\beta = 0.24$, $t(1208) = 7.35$, $p < .001$) were all significantly higher, and the intercepts for HE students for perceived behavioural control over decisions about travelling with speeders ($\beta = -0.38$, $t(1211) = -4.94$, $p < .001$), and for negative prototypical images of speeders ($\beta = -0.22$, $t(1209) = -5.63$, $p < .001$) were significantly lower, than those recorded for LE students.

Trait impulsiveness also influenced attitudes with some consistency. The intercept coefficients suggested that initial attitudes towards speeding among students with higher levels of impulsiveness (HI) were significantly riskier than were those among their less impulsive peers (LI) with respect to peer approval ($\beta = .04$, $t(1209) = 4.78$, $p < .001$), motivation to comply with parents ($\beta = -0.44$, $t(1210) = -4.74$, $p < .001$), expectations ($\beta = 0.28$, $t(1207) = 4.61$, $p < .001$), and prototypes, both negative ($\beta = -0.19$, $t(1209) = -4.2$, $p < .001$) and positive ($\beta = 0.18$, $t(1208) = 4.71$, $p < .001$). Sensation seeking also predicted initial attitude scores for two of the attitude variables. Students with higher levels of sensation seeking expressed riskier attitudes with respect to peer approval ($\beta = 0.33$, $t(1209) = 4.12$, $p < .001$), and positive prototypes ($\beta = 0.16$, $t(1208) = 4.08$, $p < .001$), than did those with a lower tendency towards sensation seeking. Trait agreeableness affected the initial estimates with respect to expectations of travelling with speeders: Students who

were high in agreeableness had lower expectations of travelling with speeders ($\beta = -0.14$, $t(1207) = -2.89$, $p < .001$) than did their less agreeable peers.

The intercept estimates also indicated that there were significant gender differences in attitudes towards speeding in the T1 test for some variables, whereby females expressed significantly less risky attitudes than did males. Females were significantly more motivated to comply with their parents views on travelling with speeders ($\beta = 0.31$, $t(1209) = 5.5$, $p < .001$), and expressed stronger endorsements of negative prototypical images of speeders ($\beta = 0.26$, $t(1209) = 5.5$, $p < .001$), and weaker endorsements of positive prototypical images ($\beta = -0.18$, $t(1208) = -4.36$, $p < .001$), than did their male counterparts.

Students with more initial experience with using vehicles expressed significantly stronger expectations of travelling with a speeder ($\beta = 0.31$, $t(1210) = 2.97$, $p < .01$) in the T1 test than did students with less experience in the T1. Finally, there were no significant effects of any between-student factor on slope changes in the IP models.

The IVF models, depicting the long-term effects of between-student factors are shown in Table 10.41, which indicates that factors including exposure to aberrant driving and impulsiveness significantly affected slope changes in attitudes towards speeding over the longer-term. Although LE students low exposure to aberrant driving practices (LE) recorded significant long-term increases in expectations of travelling with speeders ($\beta = 0.30$, $t(37) = 6.81$, $p < .001$), the corresponding increase for HE students was significantly greater ($\beta = 0.29$, $t(1066) = 3.85$, $p < .001$). There were significant divergences between the slope changes for HE and LE students with regards to prototypical speeders. A significant long-term decrease in support for negative images of speeders among LE students ($\beta = -0.13$, $t(37) = -3.2$, $p < .01$), was contrasted with a significant increase in support among HE students ($\beta = 0.17$, $t(1067) = 2.42$, $p < .05$). Similarly, whereas support for positive prototypical images decreased significantly among LE students ($\beta = -0.1$,

$t(1066) = -2.8, p < .05$), in comparison, it increased among HE students ($\beta = -0.2, t(1066) = -3.58, p < .001$).

Long-term differences in slope changes were also found between students with high levels of impulsiveness (HI), and those with lower levels of that trait (LI). Where there was a significant decrease in motivation to comply with peer attitudes towards speeding among LI students ($\beta = -0.77, t(37) = -9.12, p < .001$), the corresponding decrease was significantly smaller among HI students ($\beta = 0.34, t(1067) = 2.85, p < .01$). In addition, whereas perceived control over whether or not to travel with speeders increased significantly among LI students ($\beta = 0.37, t(37) = 3.48, p < .01$), the corresponding increase among HI students was significantly smaller ($\beta = -0.23, t(1067) = -2.37, p < .05$).

Thus it appeared that some of the between-student factors that were of interest in this study did have a significant effect on attitudes towards speeding. However, the model summaries for the IP models (Table 10.40) and the IVF models (Table 10.41) show clearly that although these models fitted the data significantly better than did the simpler time-only models (model 2), the model deviances remained stubbornly high and the effect sizes were very small. It is worth reiterating here that each of the between-student models tested in this part of the study were constructed initially using all of the between-student predictors listed in Table 2.3 and that non-significant predictors were subsequently trimmed from the models. These results showed that there were no significant effects of domicile location, SES, experience with RTCs or any of the Big-Five personality traits on either the intercept or slope values in any of the tests that were conducted.

7.5 Discussion

This part of the study examined speeding-related attitudes, beliefs, behavioural expectancies and willingness of TY students using a range of constructs derived from the TPB (Ajzen, 1991) and PWM (Gibbons & Gerrard, 1995). A series of HLMs, were

constructed to address the various hypotheses which were of interest in this project. The results of these analyses showed that there was a considerable amount of between-student variation in the data with respect to those constructs at the beginning of the project, supporting hypothesis 1. However, hypotheses 2 and 3 were largely unsupported, because it emerged that the speeding-related attitudes of the current sample became less risky when measured over the short- and the long- term. Likewise hypotheses 4 and 5 were rejected because the weight of evidence suggested that neither exposure to PLDE in general, nor attendance at one of the PLDE courses that featured in this study resulted in significantly greater improvements (change in a less-risky direction) in speeding-related attitudes in these active groups when compared with the changes that occurred within the control group. The results from the pre-intervention (T1) test provided some support for hypothesis 6, since they showed that a variety of between-student factors influenced pre-existing speeding-related attitudes, beliefs, expectancies and willingness in the sample.

In line with other findings in this research regarding knowledge and risk perception, the model summaries for the attitudes towards speeding measures demonstrated that the inclusion of significant predictors at intra-student, between-student and between-groups levels did not result in significant reductions in the variation in the data, which indicates that factors that were not stipulated in this study were exerting a major influence on attitudes in this research.

7.5.1 Time effects

The results from the short-term and long-term HLMs showed that there were significant changes over time in 7 of the 11 speeding-related attitudes variables that were examined in this study. However, since attitudes tended to become less risky over time, with respect to behavioural beliefs, these findings appear to be somewhat at odds with those reported in similar studies of pre-driving adolescents which were described earlier (e.g. Harré et al., 2000; Lonero et al., 2000).

7.5.2 PLDE effects

The current results also indicated that attendance at a PLDE course in TY did not produce significantly greater beneficial changes in attitudes, beliefs, expectations and willingness in TY students in either the short-term or the longer term, with one exception, i.e. socially shared prototypical images of speeders. Whereas approval for positive speeder prototypes increased significantly over the short-term in the control group, in comparison it decreased significantly among students who took PLDE, albeit that this effect did not persist over the longer-term. The general absence of short-term effects of PLDE on attitudes in the current study does not accord with findings reported in previous evaluations of PLDE programmes (see for example Deighton & Luther, 2007; Harré & Brandt, 2000b; Poulter & McKenna, 2010). It seems likely that methodological factors may partly explain this discrepancy and a detailed discussion of these factors will be provided in the latter part of this chapter. The current results also suggest that PLDE was wholly ineffective in delivering safety-related benefits over the longer term and these findings accord with those reported in previous evaluations of PLDE (Harré & Brandt, 2000a; Poulter & McKenna, 2010) and DE (see Christie, 2001; Deighton & Luther, 2007; Roberts & Kwan, 2001; Vernick et al., 1999).

7.5.3 Pre-existing attitudes towards speeding

Nevertheless, the pre-intervention (T1) test in this study did provide some insights into the speeding-related attitudes in Irish PLDs as they entered TY/year 12 of secondary school, and these may be of some interest in the road safety domain. First, the results showed that mean scores with respect to the TPB and PWM constructs were generally close to the mid points on their respective scales. This suggests that whereas the current participants did not have particularly safe attitudes towards speeding at the beginning of this project, they did not have particularly risky ones either. Thus it appeared that the scope for PLDE to affect improvements was somewhat limited. Indeed, some of the

attitudes expressed in this study were relatively low risk and thus desirable from a safety perspective. For instance, the students believed that travelling with a driver who was speeding would be a somewhat negative experience and their evaluations of speeder prototypes were more negative than they were positive. However, peer opinion with respect to speeding was perceived as being more risky than were the perceived views of significant others and motivation to comply with peers was marginally stronger than was motivation to comply with parents. The students tended to believe that they had some control over whether or not they travelled with speeders, albeit that they were slightly more willing than unwilling to do so. Nevertheless, they were unsure regarding their prospects of travelling with a speeder in the near future. However, due to their young age and thus their relative reliance on parents and other adults for transport, the extent to which these students had actual control over decisions about whether or not to travel with speeders remains uncertain. This constitutes a limitation in the present methodology.

The current findings concur broadly with those reported in Poulter and McKenna's (2010) recent study of UK PLDS, which showed that mean values for attitude, parental norm, behavioural intentions lay close to the mid-point and at the less-risky end of the scale, whereas the scores for peer norms and motivation to comply with peers occupied the more risky end of the scale. In addition, those participants believed that they had some degree of control over whether or not they would engage in speeding when they started to drive. The present findings also accord with those reported in Cestac, Paran and Delhomme's (2011) large-scale study of French novices which was described above and which found that attitudes towards speeding in that group lay mainly on the less risky end of the scales that were used. In combination, these results suggest that the scope for changing attitudes in young pre-learner, learner and novices drivers is rather limited, which may in part explain why it is so difficult to identify significant beneficial effects as a result of taking a PLDE course.

7.5.4 Factors that influenced pre-existing attitudes, beliefs, expectations and willingness

The current results also show that a number of between-student factors influenced pre-existing attitudes, beliefs, expectancies and willingness; these include previous experience of travelling with speeders, exposure to aberrant driving, impulsiveness, sensation seeking, and gender, albeit that the magnitude of these effects was quite small.

7.5.4.1 Experience and exposure

The consistency with which previous experience of travelling with speeders and/or exposure to aberrant driving was seen as having a detrimental effect on speeding-related attitudes, beliefs, expectations and willingness at the beginning of this study was noteworthy. Two-thirds of the current sample indicated that they had travelled with a speeder in the three months prior to the commencement of this study, and the main culprits were fathers, friends and other relatives respectively. Students who had recent experience of travelling as a passenger of a speeder expressed riskier beliefs and attitudes towards speeding and were more willing to travel with speeders and had stronger expectations of doing so in the near future when compared to their less experienced counterparts. Moreover, the HLM analyses showed that exposure to aberrant driving was the strongest and most consistent predictor of attitudes towards speeding in the T1 test. Students with greater exposure expressed riskier attitudes towards speeding with respect to five of the seven attitude items that were measured than did their less-exposed counterparts. They perceived greater peer approval for travelling with speeders. They judged positive speeder prototypes more leniently and assessed negative speeder prototypes less harshly. They had greater expectations of travelling with speeders in the following three months and their perceptions of having control over whether or not they travelled with speeders were lower. These results suggest that exposure to aberrant driving practices including speeding served to establish attitudinal and behavioural norms and expectations that are undesirable from a

safety perspective. Furthermore, some of these influences (e.g. expectations, undesirable evaluations of speeder prototypes) persisted over the longer-term. These results concur with previous findings which indicated that exposure to the aberrant driving practices of important role models, most notably those of parents (Ferguson et al., 2001; Miller & Taubman - Ben-Ari, 2010; Taubman - Ben-Ari et al., 2005), and of peers (Allen & Brown, 2008; Jessor et al., 1997; Scott-Parker et al., 2009; Steinberg & Monahan, 2007), has a negative impact on adolescents beliefs, attitudes, intentions and willingness with respect to risk-taking in traffic (Waller, 1975; Williams et al., 2009).

7.5.4.2 Social normative influence

This study also revealed some interesting findings regarding social normative influences on speeding-related beliefs and attitudes in this sample of Irish PLDs. First, whereas peer norms were perceived as quite risky, the norms for significant others were construed as safer in comparison. Second, whereas motivation to comply with perceived peer norms decreased consistently over the course of this study, motivation to comply with parental/teacher norms increased consistently in the same period.

Evidence presented in Chapter 4 suggested that adolescents tend to perceive the peer norm as tolerant of risk (N. Evans et al., 1995). It was also suggested that the increased tendency towards risk-taking in adolescence reflects a need to gain social acceptance among peers (Allen et al., 1990). This may help to explain findings that adolescents adopt a riskier driving style when they are accompanied by peers than they do when they carry adult passengers (Arnett et al., 1997; Baxter et al., 1990). However, abundant research based on social norms theory (Perkins & Berkowitz, 1986) posits that individuals are apt to misperceive peer norms to the extent that they assume that peer attitudes and behaviours are more risky than they actually are (see Prentice, 2008 for a comprehensive review).

Although it is acknowledged that a multitude of psychological and social processes give rise to such misperceptions, the role of descriptive norms is particularly salient in the context of this research. Social norm theory suggests that perceptions regarding the prevalence of risky driving-related attitudes and behaviour among adolescents can become distorted because the media and social programming interventions tend to focus more on depicting aberrant behaviour than they do on highlighting safe behaviour. To redress this balance, approaches such as social marketing have been developed, which concentrate on providing participants with accurate information about the social context in the form of positive group norms. A review of the extant literature conducted by Haines, Perking, Rice and Barker (2005) cited numerous examples that attest to the efficacy of the social marketing approach in reducing substance use in secondary schools.

Parents and teachers are also seen as important sources of information (and misinformation) about social norms. Whereas some studies suggest that parental influence declines and peer influence strengthens as a result of increased extra-familial socialisation during adolescence (Windle, 2000), a considerable weight of evidence also suggests that parental influence remains strong through adolescence (Deighton & Luther, 2007; Durkin & Tolmie, 2010). Indeed the results of the current study show that whereas motivation to comply with perceived peer norms with respect to travelling with speeders was stronger than was motivation to comply with parents/teachers norms in the initial test, this trend reversed during the course of this project. This result accords with findings from a study of a large and diverse sample of Americans aged between 10 and 30-years old, which found that resistance to peer influence increased linearly between the ages of 14 and 18 (Steinberg & Monahan, 2007).

When these results are viewed within the context of a social marketing strategy several recommendations emerge. First, programme developers should consider capitalizing on the effects of peer influence by providing students with accurate

information about how their peers actually think, feel and act, thereby altering the perceived norm in a less risky direction. Indeed some of the educational interventions that featured in this research do incorporate some mechanism for ascertaining peer norms and making them explicit and this aspect of the courses will be discussed in greater detail in Chapter 8. Second, there is a pressing need to educate parents about the importance of modelling safe driving attitudes and behaviours for their children from an early age. They should be reminded that they represent a significant influence in their children's lives both as role models and carriers of normative information and they need to be vigilant to guard against providing their offspring with mixed messages when it comes to road safety. For instance, it is important that parents both set a good example and also convey to their offspring that safe driving is the norm. Third, to counteract the obvious threat posed by aberrant role models, programme developers should seek to develop effective and efficient means of challenging the actions of such individuals, thereby weakening their potential to undermine road safety messages. Fourth, efforts should be made to identify adolescent and adult drivers who might act as positive role models in media campaigns and as part of educational interventions e.g. entertainers and sportspeople who espouse safe values and who behave responsibly as drivers. Research suggests that the impact of positive and negative role models may depend on an individual's goal orientation in given situations (Lockwood, Sadler, Fyman, & Tuck, 2004). For instance, a considerable body of research indicates that people are particularly sensitive to information that fits with their desire to achieve success or to avoid failure (Higgins, 2000). Apparently, individuals are particularly amenable to the influence of positive role models when they are pursuing success, whereas they are more likely to be influenced by negative role models when they are trying to avoid failure (Lockwood, Jordan, & Kunda, 2002). Thus, there is clearly a need to depict both types of role models in media and in education programmes. Finally, the current results suggest that PLDE was effective in reducing the favourability of

positive prototypical images of speeders significantly over the short-term. Some non-significant effects in the desired direction were also evidenced with respect to negative prototypes. This suggests that the prototypes represent a potentially useful concept when it comes to developing and evaluating PLDE courses. To date, this construct has received very little attention in the road safety domain; however the current results suggest that further research is warranted in this regard.

7.5.4.3 *Personality*

Personality traits also affected pre-existing attitudes towards speeding in this study. Students with higher levels of impulsiveness and/or sensation seeking perceived greater peer approval for travelling with speeders and also viewed positive speeder prototypes more favourably. Additionally, more impulsive students had greater expectations of travelling with speeders, were less motivated to comply with parents'/teachers' views on this issue and viewed negative speeder prototypes more favourably. It was also notable that high impulsiveness predicted greater motivation to comply with peer norms and less perceived behavioural control over travelling with speeders over the longer-term. By demonstrating that personality characteristics such as impulsiveness and sensation seeking influence the development of risky speeding-related attitudes in PLDs, these findings expand on the extant literature which demonstrates that such personality characteristics tend to have a negative impact on driving behaviour during adolescence (Arnett et al., 1997; Beirness & Simpson, 1988; Hoyle et al., 2002) and in adulthood (Dahlen, Martin, Ragan, & Kuhlman, 2005; Dahlen & White, 2006; Jonah, 1997).

Since personality characteristics such as impulsiveness and sensation seeking are understood to be predominantly biologically based (Roberti, 2004; Stanford et al., 1996; Steinberg et al., 2008; Zuckerman, 1996), it is unlikely that these traits can be altered by means of educational interventions. However, the GDE framework suggests that education can provide students with insight regarding their personal risky tendencies and also provide

them with strategies which will help them to ameliorate the detrimental effects that such tendencies may have on their thoughts, feelings and actions (Hatakka et al., 2002). To date however, there is no evidence to suggest that this aspect of the GDE framework is being used by course developers to address the problems that arise as a result of impulsiveness and sensation seeking in adolescent PLDs, LDs, and novices. Such developments are long overdue.

7.5.4.4 Gender effects

Whereas previous research suggests that male PLDs have riskier attitudes than do their female counterparts (Waylen & McKenna, 2002, 2008), in the present study such differences only reached statistical significance in relation to three of the seven variables that were tested in the HLM analyses. In the pre-intervention tests females expressed stronger endorsement of negative speeder prototypes and weaker endorsement of positive speeder prototypes than did males. These findings are in line with previous reports which showed that females are less likely to condone driving violations than are males (Waylen & McKenna, 2002). Females were also more motivated to comply with parents'/teachers' views about whether or not they should travel with a speeder. These findings are common in the literature and likely reflect the emergence of gender role identities, whereby masculinity is associated with risk seeking as a means of expressing autonomy and bravado (Durkin & Tolmie, 2010).

7.5.5 Strengths and weaknesses

The results from this part of the study need to be evaluated within the context of a number of methodological factors, some of which were specific to this part of the research and thus warrant immediate discussion. The main strength of this part of the research was that it used a wide range of items to measure TPB constructs (Ajzen, 1991), and these are widely regarded as reliable and valid when it comes to describing, explaining and predicting driving-related beliefs, attitudes, and expectancies in adolescents (see Poulter &

McKenna, 2010) and in adults (see Armitage & Connor, 2001). The current study also extended findings from previous research with pre-driving adolescents by examining the PWM constructs (Gibbons et al., 1998). This innovative move revealed the potential usefulness of the 'prototype' concept, both as a measurement tool and also as a target for PLDE programme developers. The present study also sought to improve the validity of TPB-based measures for pre-driving samples, by measuring behaviour that is within the current behavioural repertoire of this group (i.e. travelling with speeders), rather than to asking them to suppose what they might do when they become drivers, as is usually the case in such research. The current results indicate that this strategy represented a feasible option for future studies, since the ensuing results did not depart radically from those reported in studies that used more traditional methods (e.g. Poulter & McKenna, 2010).

One potential limitation in this study is its dependence on single-item measurement scales, which have been shown to be less reliable than longer tests (Nunnally, 1978). Although multiple items were used to measure many of the TPB constructs in this study, with the exception of behavioural beliefs, these could not be formed into scales due to problems with internal consistency. It is acknowledged that single-item scales have weaknesses, for instance McKenna and Horswill (2006), caution that the wording in single item scales may influence the result, thus producing less reliable data. Nevertheless, several studies have attested to the psychometric properties of single-item scales (see D. G. Gardner, Cummings, Dunham, & Pierce, 1998; Nagy, 2002).

In summary, the findings from this part of the research provide information about the speeding-related attitudes, beliefs, expectancies and willingness of a sample of Irish PLDs. It demonstrated that PLDE was largely ineffective when it came to effecting safety-related changes in these constructs in both the short- and the long-term. However, it did produce data that showed that social factors, including experience with speeding and exposure to aberrant driving, and also personality factors, including impulsiveness and

sensation seeking, predicted riskier attitudes, beliefs and expectancies in this sample. As such, these results may assist in the future development of educational interventions and contribute towards increasing the knowledge base in the road safety domain regarding pre-driving adolescents.

Chapter 8: Formative evaluation

8.1 Introduction

Evaluation entails ‘the systematic determination of the merit, worth or significance of an object’ (Scriven, 2003, p. 19). Since the late 1990s there has been a growing global trend towards incorporating values of accountability and greater professionalism across a wide range of social enterprises. This has led to a dramatic increase in the number and types of evaluations that are commissioned by a wide range of national and international organizations and an associated rise in the number of professional bodies that represent evaluation practitioners (Donaldson & Lipsey, 2006b). According to Scriven (2003), these developments have transformed evaluation practice into a “transdiscipline” that is concerned with conceiving and refining theories, tools and methodologies that can be used across a wide range of other disciplines, while simultaneously striving to advance knowledge about the best ways to practice evaluation.

In light of these developments, the AAA Foundation for Traffic Safety commissioned Kathryn Clinton and Larry Lonero to produce a set of guidelines for evaluating DE programmes, which incorporates best practice from across the evaluation domain (Clinton & Lonero, 2006a, 2006b, 2006c). These guidelines provide a detailed background for planning and conducting effective evaluations of learner driver education and for integrating evaluation into programme development and policy. One of the main aims of this endeavour was to promote standardisation of evaluation practice to enable researchers and other stakeholders to properly synthesise the knowledge gathered during evaluations and thereby to develop better programmes. The absence of a systematic approach to evaluation in the DE domain is often lamented in the literature (Deighton & Luther, 2007; Mayhew et al., 2002; Roberts & Kwan, 2001), because it represents a considerable impediment to the accumulation of knowledge and expertise (Levin, 2005).

Clinton and Lonero (2006b) recommend that evaluations of DE programmes should be based on evaluation theory, the key components of which are: programme description, identifying the values inherent in the programme, deciding what type of evaluation results (knowledge) are credible, meaningful and useful to programme users and other stakeholders.

8.1.1 Summative and formative evaluations

Two types of evaluations, summative and formative, are useful for informing development of educational interventions. Summative evaluations are conducted to assess the impact of a programme, thus summative assessments of DE interventions commonly seek to assess programme efficacy in terms of proximal goals such as student learning of course content (e.g. improved knowledge, skills and attitudes), and distal outcomes (e.g. decreased risk taking and crash reduction) (McKenna, 2010b; Waller, 1975). The summative evaluation that was performed as part of the present research was described in Chapters 5, 6, and 7. Formative evaluations are used to assess the effectiveness of a curriculum and to guide users as to which curriculum to adopt and how to improve it (Dylan, 2006). It is argued that gaining understanding into how an intervention promotes change, with whom and under what circumstances, is equally important as is knowing whether or not the desired change took place, especially when an intervention is designed to be implemented in a broad range of settings (WHO-European Working Group on Health Promotion Evaluation, 2008). A typical formative evaluation will examine a programme's logic model (theoretical basis), context (environment), standards, processes and products (Clinton & Lonero, 2006b).

With these considerations in mind, a formative evaluation plan was developed for this research which aimed to:

1. Describe the programmes.
2. Identify stakeholder and user needs.

3. Describe programme theory (logic model).
4. Outline programme goals and objectives.
5. Review programme products and processes (i.e. resources, activities, delivery).
6. Examine programme standards, business processes and context.

Programme descriptions are provided in Appendix A and a general overview of stakeholder and user needs, programme theory, goals and objective is provided below.

8.1.2 Stakeholder and user needs

Stakeholder and user needs with respect to traffic safety were identified as part of the literature review that formed the basis of Chapter 1 of this thesis and these have been further elaborated in subsequent chapters. To recapitulate, stakeholders and road users alike are motivated fundamentally by two somewhat competing needs; the need for mobility and the requirement for safety (Mayhew, 2007). The current Irish National Road Safety Strategy (RSA, 2007) summarises stakeholder needs in terms of reducing the incidence of RTCs in the population in general and among young drivers in particular. The results presented in Chapter 4 suggest that a large proportion of Irish adolescents want to start driving as soon as they are allowed to obtain a learner driver permit. However, it is widely accepted that the safety status of young novice drivers is compromised as a result of age, and inexperience (Drummond, 1989; L. Evans, 1991; Groeger & Brady, 2004; OECD - ECMT, 2006b). More specifically, research suggests that the excessive crash liability of young novice drivers is mainly due to a lack of basic knowledge and skills, poor understanding of factors that increase risk in traffic and inadequate insight into their limited capabilities as inexperienced drivers (Engstrom et al., 2003; Hatakka et al., 2002; McKnight & McKnight, 2003).

8.1.3 Programme theory

Previous efforts to solve the “Young Driver Problem” using educational interventions were deemed unsuccessful because they did not yield identifiable safety

benefits in terms of crash reduction (Christie, 2001; Roberts & Kwan, 2001). However, critics (e.g. Lonero, 2008; Lonero et al., 1995; Waller, 1975) argued that many of these early attempts at DE were doomed to failure because they were developed in the absence of a coherent programme theory to the extent that “The prevailing culture (was) to think that....road safety can be delivered on the basis of opinion, folklore, intuition and experience” (Hauer, 2007, p. 2). A programme theory (logic model) is a set of assumptions that guide the way that specific programmes are implemented and are expected to produce results (Donaldson & Lipsey, 2006a). It describes what is supposed to happen by specifying how the various elements in the programme are expected to induce change and thus achieve its aims (Clinton & Lonero, 2006c).

In recent times, an increasing number of researchers have come to believe that the Goals for driver education framework (GDE) (Hatakka et al., 2002) provides a theoretically sound basis for the future development of driver education (Peräaho et al., 2003). A detailed description of the GDE model was provided in Chapter 1. To recapitulate, the GDE- framework consists of a hierarchical model which identifies competencies that need to be achieved in order to become a safe driver at four operational levels (vehicle manoeuvring, mastering driving situations, goals and context of driving and goals for life / skills for living). The GDE-framework assumes that higher level operations guide and control behaviour at lower levels, thus factors that are addressed at the highest level are the ones that are most important from a safety perspective (Peräaho et al., 2003). Whereas it is recognized that basic knowledge and skills serve as a foundation for the establishment of driver competency (skill), the development of a safe driving practices (style) requires that learners a) develop safe attitudes towards driving, b) gain an understanding of risks involved, c) gain insight regarding their personal goals and motivations and how these might affect their decision making as drivers (Hatakka et al., 2002; Williams et al., 2009). Following a comprehensive review of the extant literature on

young novice driver education and training, Engstrom, Gregersen, Hernetkoski and Nyberg (2003) recommended that driver education at secondary school level should focus on the higher levels of the GDE-framework as opposed to providing training in vehicle handling and control.

It should be noted however that some experts are unconvinced regarding the feasibility of trying to mould driving styles in pre-driving populations. First, it is unlikely that PLDE programmes would be able to compensate for biological immaturity which manifests itself in the form of risk taking (Steinberg, 2004) . This issue will be discussed in greater detail in the general discussion in this thesis. Second, McKnight (1985) noted that since adolescents are motivated primarily by a desire to acquire a driving licence, they tend to focus their attention on gaining the types of knowledge and skills that will help them to satisfy that goal. However, because the prospect of independent driving is somewhat remote for pre-learner drivers, these adolescents are likely to be less motivated when it comes to learning safe driving practices. Given that there is a crucial link between the success of driver education and student motivation (see Pintrich, 2003), McKnight believes that DE courses that focus on the development of safe driving styles should be delivered after students have acquired a learner driver permit because they are more likely to be motivated to engage with material that deals with driving style when that material becomes salient i.e. when they actually need it and are in a position to use it.

8.1.4 Visions, Goals and objectives

Evaluation theory indicates that programme goals and objectives should be formulated on the basis of a programme theory (Clinton & Lonero, 2006b). Thus, on the basis of the GDE-framework (Hatakka et al., 2002), it follows that PLDE courses should aim to improve basic knowledge (e.g. knowledge about the ROTR), and also awareness of factors that increase risk, especially those that increase risk for young learner and novice drivers, and to increase self awareness with regard to risky attitudes and risky personal

tendencies. Whereas the developers of all PLDE programmes envisage that their courses will contribute towards improving the calibre of PLDs, the programmes that they produce tend to focus on different objectives in the pursuit of this goal. For example, in this study most of the courses in group D and course E2 focused on serving students' instrumental needs, i.e. on providing them with factual knowledge and skills, whereas programmes A, B and C placed a lot of emphasis on addressing students' developmental needs, in terms of increasing student awareness about the dangers of driving, or on improving students' driving related beliefs and attitudes.

8.1.5 Programme content and delivery

Whereas it is relatively easy to formulate goals and objectives for PLDE, it has proved much harder to identify suitable content and delivery methods that will help to produce the desired outcomes (Lonero, 2008). However, on the basis of the recommendations that are provided within the GDE-framework (Hatakka et al., 2002) and the accumulated findings from previous research, some of which have been cited previously in this thesis, it is clear that a comprehensive PLDE education programme should aim to address both the instrumental and developmental needs of PLDs. The main education-based (as opposed to training-based) instrumental needs of PLDs are:

- Knowledge about the ROTR
- Information regarding the driver licencing process.

Developmental needs of PLDs can be addressed by improving their awareness of state dependent and situation dependent factors that are known to increase risk for young drivers, and by providing them with strategies they will help to mitigate these risks. These factors include:

- Age-related immaturity
- Inexperience.
- Poor risk perception.

- Risky attitudes towards driving with respect to speeding, driver impairment and deliberate risk-taking.
- Risky personal tendencies including impulsiveness and sensation seeking.
- Susceptibility to social influences from peers, parents, and other negative role models.

The learning theories that were reviewed in Chapter 3 also provided some guidance with respect the ways in which the acquisition of driving-related competencies can be supported in an educational context (see sub-section 3.1.1). To recapitulate; education functions to provide students with information which is translated into knowledge, skills and attitudes (Bransford et al., 2000). The encoding, and the storage and retrieval of information in memory is facilitated when: exposure to the to-be-learned material is repeated and distributed over a period of time (Ericsson & Kintsch, 1995; Schacter et al., 2000); students are given immediate feedback regarding the accuracy of their learning (Skinner, 1974); students are given ample opportunity to think about and/or interact with the material (Craik & Lockhart, 1972; Flavell, 1979); the new information is related in some way to previously learned material (Bransford et al., 2000; Piaget et al., 1969); the material has personal importance (Symons & Johnson, 1997); the message is distinctive (Schacter et al., 2000) and finally when the information evokes an emotional reaction (Conway et al., 1994).

In addition, Kolb's Experiential Learning Theory (ELT) (Kolb, 1984) highlights the key role that reflective practice plays in the development of understanding. The importance of reflective practice (insight training) in the development of safe driving habits is acknowledged within the GDE-framework (Hatakka et al., 2002). According to ELT, four key elements are required for successful experiential learning: concrete experience, observation and reflection, the subsequent formation of new abstract concepts and the ability to test these in new situations. The theory posits that it is not sufficient to

have an experience in order to learn. It is also necessary to reflect on that experience to make generalisation and to formulate concepts which can then be applied in new situations. This suggests that educational interventions should aim to provide students with opportunities to reflect on what they have learned and to plan how they are going to enact such learning. This might involve thinking about a situation (e.g. taking a lift with a driver who is known for speeding or DWI) and trying out new coping strategies or alternative ways of behaving in that situation (e.g. refusal strategies, planning alternative means of transport).

The methods that are used to deliver safety messages also have a bearing on their effectiveness. Petty and Cacioppo's (1986), elaboration likelihood model posits that peoples' motivation and ability to process information varies as a function of situational and dispositional factors. Where motivation and ability is high, people focus on thinking about the information that is contained in a message, whereas when motivation and ability are low, they are more likely to be influenced by peripheral features of the message e.g. the credibility/attractiveness of the message source, or the way the message is presented. The peripheral route is used when the audience is unable to process the message fully because the message is too complex or because they are too immature to understand and/or appreciate the relevance of the message. The target audience for PLDE courses is quite diverse, thus it is expected that there will be wide variations in this group with respect to motivation and ability. In these circumstances, the ELM model of persuasion indicates that safety messages ought to be presented using both the direct and the peripheral routes in order to maximise the courses' potential to achieve the desired results.

An accumulation of evidence, some of which was presented in Chapter 4, demonstrates that social influence plays a significant role in the development and maintenance of safety-related attitudes, expectations, intentions and behaviours in adolescents and that parents and peers constitute the main sources of such influence. The

findings from the current research which were presented in Chapters 5, 6 and 7 also showed that exposure to the aberrant driving practices of parents and significant others had a negative impact on the participants' driving-related knowledge, risk perception skills and attitudes. However, the corollary of these findings is that students whose parents and significant others drive safely have been influenced positively as a result of exposure to these positive role models. Research also suggests that social influence can be harnessed to produce successful outcomes in social programming interventions. For example a meta-analytic review of 47 peer-based intervention programmes found that these programmes consistently produced positive effects on peoples' health-related behaviours (Posavac, Kattapong, & Dew, 1999). Yates and Dowrick (1991) developed a road safety intervention which targeted the behaviours of high-risk adolescent drivers using peer influence and social modelling. Following a three-year evaluation, it was reported that that the programme was effective in increasing knowledge about and improving attitudes towards DWI and also in reducing the incidence of DWI. These findings suggest that the inclusion of content and processes that provide students with exposure to positive social influences can improve the effectiveness of these interventions.

8.1.6 Programme standards and business processes

PLDE is a relatively new phenomenon, not just in the ROI but worldwide, therefore no recognizable operating standards exist currently for these courses. However, on the basis of what is known about programme standards for DE generally it is assumed that the main areas of concern with respect to PLDE programmes will be those related to curriculum planning and programme implementation (see Clinton & Lonero, 2006a).

8.1.6.1 Curriculum planning

A review of the TY curriculum was presented in Chapter 2. This revealed that TY is an optional feature of the secondary school cycle in the ROI which aims to promote personal, social, educational and vocational development. TY is structured such that

individual schools are responsible for setting appropriate goals and defining objectives that are necessary for achieving these aims (Second Level Support Services - Department of Education and Skills, 2013). TY coordinators who wish to provide a PLDE course for their students have to choose between an ever-increasing array of interventions which range from modular courses that are delivered over weeks or months to one-day courses. This means that there are considerable between-school variations in terms of the quantity and the quality of the PLDE programmes which are provided for TY students.

8.1.6.2 Programme implementation

Since it is anticipated that the PLDE education courses which are used in Irish secondary schools will have been developed from sound theoretical bases and programme goals and objectives will have been formulated with those bases in mind, it is important that these programmes are delivered in the manner that was intended by the developers. In the past, very few evaluations provided information about this aspect of programme delivery (CARRS-Q, 2009). A review of over 1,200 published studies showed that just 5% provided information about programme implementation (Durlak & Wells, 1997). Nevertheless, the existing research suggests that programmes are more effective when they are delivered according to the original design and that the tendency to preserve programme integrity is associated with teachers who were enthusiastic and well-prepared and who had the support and encouragement of their school principal (Rohrbach, Graham, & Hansen, 1993).

Failure to adhere to the implementation standards laid down by programme developers represents a considerable threat to validity in evaluation studies. For example, when Williams, Preusser and Ledingham (2009) conducted a study to assess the feasibility of conducting a comprehensive evaluation of the American Driver and Traffic Safety Education Association's (ADTSEA) driver education curriculum they concluded that this programme could not be evaluated in a completely scientific (valid) way because

“...individual schools (with their own guidelines) use what they want, but rarely use the whole programme” (p 17).

8.1.6.3 Programme context

Programme context refers to the political, economic and social environments in which a programme is implemented (Clinton & Lonero, 2006c). As discussed previously, there is strong political will in the ROI to improve road safety and thus school curricula at both primary and secondary level feature a number of compulsory road safety programmes which have been developed by the Road Safety Authority (RSA, 2012). However, since school staff and children are embedded in the shared school environment, an appreciation of the organisational and cultural context of schools is critical for the implementation and sustainability of such educational interventions (Ringeisen, Henderson, & Hoagwood, 2003). Evidence suggests that programme implementation is likely to be more successful where organisations have strong administration and leadership, and support the programme (Rohrbach, Grana, Sussman, & Valente, 2006).

8.1.7 Scope of current evaluation

Clinton and Lonero’s guidelines (2006b) suggest that an evaluation should aim to provide a comprehensive assessment of the DE programme(s) under review, while also taking pragmatic considerations such as the availability of time and resources into account. With this in mind, and on the basis of a brief review of the five types of programmes that were used in the schools that participated in this project, the current research aimed to comment on the PLDE provision for TY students in Irish secondary schools. Thereafter, a more detailed formative evaluation of the curriculum for programmes A and B will be conducted.

8.2 Method

8.2.1 Design

See Chapter 2, sub-section 2.1.

8.2.2 Participants

See Chapter 2, sub-section 2.2.

8.2.3 Procedure

See Chapter 2, sub-section 2.5.

8.2.4 Measures

This part of the study used both quantitative and qualitative methods to evaluate the PLDE programmes that featured in the current research. These measures were administered in conjunction with the T2 test and thus were taken shortly after the individual groups had completed their PLDE courses.

The quantitative measures consisted of two self-report questionnaires; a 34-item student survey and a 20-item TY coordinator survey. The student survey was completed by all of the students who participated in the T2 test. The survey aimed to measure students' reactions to the PLDE course that they had taken. The topics covered in this survey are summarised in Table 8.1 below and the actual survey items can be found in Appendix E. The TY coordinators in the 13 schools that had used programmes A and B completed a survey at their own convenience and returned it by post. This examined programme standards and business processes, including curriculum planning, teacher/instructor training, course materials, and course administration and evaluation (see Appendix J for survey).

Table 8.1 Summary of student questionnaire

Question Number	Description	Items	Response Scale
E/34	Has taken a PLDE course	1	Yes / No
E/35	Level of participation in course	1	1 = 76% - 100% - 4 = 0% - 25%
E/36	Satisfaction with course components ^a	11	1 = Not provided - 2 = Completely satisfied - 6 = Completely dissatisfied*
E/37	Identity of course teacher	1	1 = TY teacher – 5 = Professional instructor
E/38	Evaluation of course teacher ^a	6	1 = Completely dissatisfied - 10 = Completely satisfied
E/39	Evaluation of course ^a	10	1 = Completely disagree - 5 = Completely agree
E/40	Grade awarded for the course	1	“A” – “F”
E/41	Most enjoyable part of the course ^b	1	Open response
E/42	Most beneficial part of the course ^b	1	Open response
E/43	Things that ought to be changed ^b	1	Open response
E/44	How to make those changes ^b	1	Open response

Note: Scores for this item were transformed subsequently: Response 1 “Not provided” was dropped from the scale and the remaining scores were re-coded such that 1 = completely dissatisfied and 5 = completely satisfied and so forth.

^a Adapted from Lonero, Clinton, Persaud, Chipman and Smiley (2005)

^b Adapted from Clinton and Lonero (2006a).

A series of semi-structured interviews were also conducted to assist with the formative analysis of the programmes A and B curriculum²⁸. Although the PLDE teachers in each of the 13 schools that used this curriculum agreed to be interviewed, due to scheduling difficulties, interviews were conducted subsequently with teachers in nine of these schools. The interview schedule that was used to guide these interviews is contained in Appendix P.

8.3 Results

8.3.1 Overview of the PLDE courses that featured in this study

The course overview that is provided in Table 8.2 shows that all of the courses that featured in the current research share some common aspirations; to improve driving-related

²⁸ These programmes were based on a single curriculum

knowledge, awareness and attitudes of adolescent secondary school students. The principal methods that were used to achieve these goals were lectures, class discussions, student projects and courses A – D also used guest speakers.

Table 8.2 Overview of the PLDE course that featured in this study

Features*	<u>Programmes</u>					
	A	B	C	D	E1	E2
Type	Modular	Modular	Modular	Modular	1-day	1-day
Duration in hours	45	20	20	15-20	7	6
Location of main activity	On-site	On-site	On-site	On-site	On-site	Off-site
Teacher	School	School	School	School	Course	Course
Educational criteria						
Based on NCCA criteria	√	√	√	-	-	-
Objectives						
Increase knowledge	√	√	√	√	√	√
Increase awareness	√	√	√	√	√	√
Improve attitudes	√	√	√	√	√	√
In-car training	X	X	X	X	X	√
Activities						
Classroom tuition	√	√	√	√	√	√
Provision for class discussions**	√	√	√	√	√	√
Provision for student projects	√	√	√	√	X	X
Provision for guest speakers**	√	√	√	√	N/A	N/A
Course materials						
Teacher manual	√	√	√	N/A	N/A	N/A
Student textbook	X	X	√	X	N/A	N/A

(cont.)

Features*	<u>Programmes</u>					
	A	B	C	D	E1	E2
Additional resources						
Road safety DVDs	√	√	√	√	√	X
Provision for teaching The Rules of the Road**	√	√	√	√	√	√
Rewards/incentives						
Certificate of attendance	X	X	√	√	√	√
Discounted motor insurance	X	X	√	√	√	X

* Detailed course descriptions are provided in Appendix A.

**The extent to which these features were used varied from class to class.

The courses differed with respect to their structure and duration. Courses A – D were modular in design and were delivered over several weeks or months. Programme A was

delivered over 45 hours, programmes B and C were delivered over 20 hours and the courses that were taken by students in group D took between 15 - 20 hours to deliver. In contrast, the courses that were taken by students in group E were all delivered in a single day and involved between 6 and 7 hours of class time. It is also notable that whereas programmes A, B and C have been shown to meet the educational criteria set down by the NCCA, no evidence was found to indicate that the remaining courses met these standards.

8.3.2 Student survey – student evaluation of programme elements

Whilst it is acknowledged that students do not have the necessary expertise to judge the worth of any educational intervention in a completely fair and objective way, it is evident nonetheless that students' views with respect to the quality and usefulness of a programme will affect their motivation to engage with the educational process and thereby influence programme effectiveness (see Pintrich, 2003).

8.3.2.1 Levels of participation

The mean overall response rate in the student survey was reasonably good (59%)²⁹. Students reported high levels of participation in course activities. More than half of the students reported participation levels exceeding 75%, a further 35% of students reported participation of between 51% - 75% and just 12% reported participation of less than 50% (Figure 8.1).

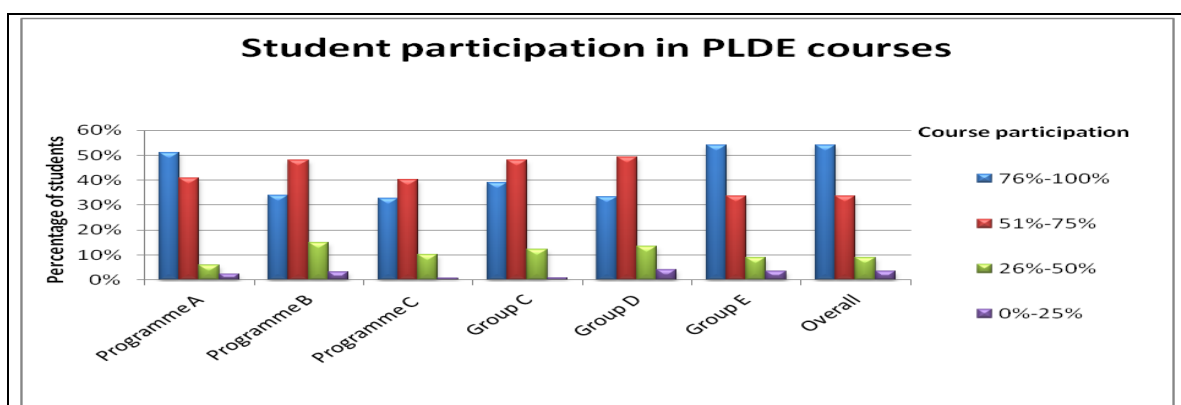


Figure 8.1. Levels of participation in PLDE courses by programme group

²⁹ This was calculated by dividing the total number of participants who took a PLDE course by the average number of responses that were provided for entire survey, of which this section formed one part. .

8.3.2.2 *Satisfaction with the course materials*

Whereas student satisfaction with course materials was measured using an 11-item scale, four items (i.e. CD interactive exercises, in-car instruction, in-car log, and in-car supervision) were dropped subsequently because very few of the respondents had used these features as part of their PLDE course. Thereafter, item means and scale means were calculated for the individual PLDE groups and for the overall sample (Table 8.3).

The group means for the individual items ranged from 4.28 for video presentations (e.g. DVDs) to 3.81 for course workload/assignments. The sample mean for the scale was 4.08 ($SD = 1.02$) and the internal consistency of this scale was adequate ($\alpha > .7$) (Cronbach, 1990). These results suggest that the current participants were somewhat satisfied with the materials that were used as part of their courses.

Table 8.3 Satisfaction with PLDE by programme group

Item descriptions	Programme A			Programme B			Programme C			Programme D			Programme E			Overall		
	Students	M	SD	Students	M	SD	Students	M	SD	Students	M	SD	Students	M	SD	Students	M	SD
Textbooks	-	-	-	-	-	-	215	4.12	0.97	-	-	-	-	-	-	215	4.12	0.97
Course handouts	138	3.91	0.98	256	3.97	0.96	217	4.20	0.85	116	3.92	0.98	47	4.30	0.88	774	4.06	0.93
Classroom lectures	183	4.15	1.05	269	4.07	1.02	208	4.41	0.95	134	3.89	1.06	66	4.29	0.86	860	4.16	0.99
Group work	190	4.03	1.10	285	3.85	1.05	216	3.99	1.05	171	4.03	0.98	86	4.01	0.90	948	3.98	1.02
Guest speakers	142	4.20	1.12	213	4.19	1.06	122	3.96	1.13	115	4.08	1.11	62	4.39	0.88	654	4.16	1.06
Video presentations	175	4.19	1.23	271	4.36	0.99	209	4.60	0.80	127	4.16	1.12	42	4.07	0.97	824	4.28	1.02
Workload/Assignments	167	3.75	1.12	221	3.83	1.05	193	3.77	1.11	90	3.89	1.26	40	3.82	1.11	711	3.81	1.13
Overall mean scores	166	4.04	1.10	253	4.05	1.02	197	4.15	0.98	126	4.00	1.09	57	4.15	0.93	712	4.08	1.02

8.3.2.3 Evaluation of main course instructor

Item and scale means were calculated for the 6-item course instructor evaluation scale for each of the PLDE groups and for the overall sample (Table 8.4). An inspection of the item means suggested that the students were most satisfied with respect to item 1 “The instructor knew the subject matter ($M = 8.04$, $SD = 2.2$), next came item 4 “The instructor answered the students’ questions satisfactorily ($M = 7.59$, $SD = 2.35$), then came item 5 “The instructor provided a good combination of lecture and discussion” ($M = 6.73$, $SD = 2.6$), The students were least satisfied with respect to item 2 “The instructor seemed to be concerned as to whether or not the students learned the material” ($M = 6.49$, $SD = 2.71$), and item 3 “The instructor recognized individual differences in the students’ abilities” ($M = 6.31$, $SD = 2.6$), The scale mean was 6.97 ($SD = 2.5$). The internal consistency of this scale was adequate ($\alpha > .7$) (Cronbach, 1990). Since all of these means above the mid-point on the scale that was used, this indicates that the students were more satisfied than dissatisfied with their course instructors.

Table 8.4 Evaluation of main course instructor by programme group

Item*	<u>Programme A</u>			<u>Programme B</u>			<u>Programme C</u>			<u>Group D</u>			<u>Group E</u>			<u>Overall</u>		
	n	M	SD	n	M	SD	n	M	SD	n	M	SD	n	M	SD	n	M	SD
1	194	8.36	1.97	296	7.80	2.29	220	8.68	1.81	169	6.92	2.71	100	8.46	2.24	979	8.04	2.20
2	194	6.91	2.73	297	6.83	2.67	220	7.20	2.47	170	5.12	2.88	100	6.40	2.79	981	6.49	2.71
3	194	6.32	2.76	296	5.87	2.64	220	6.81	2.33	169	5.63	2.66	100	6.94	2.59	979	6.31	2.60
4	194	8.10	2.24	296	7.49	2.34	220	8.38	1.85	167	6.39	2.90	100	7.59	2.41	977	7.59	2.35
5	169	7.35	2.66	283	6.67	2.67	220	7.78	2.34	169	5.26	2.70	86	6.60	2.61	927	6.73	2.60
6	169	6.84	2.47	283	6.45	2.62	220	7.59	2.29	168	5.69	2.79	86	6.70	2.45	926	6.65	2.52
Overall means	186	7.31	2.47	292	6.85	2.54	220	7.74	2.18	169	5.84	2.77	95	7.12	2.51	962	6.97	2.50

* Item Key

1. The instructor knew the subject matter.
2. The instructor seemed to be concerned as to whether or not the students learned the material.
3. The instructor recognized individual differences in the students' abilities.
4. The instructor answered the students' questions satisfactorily.
5. The instructor provided a good combination of lecture and discussion.
6. The instructor was a better-than-average teacher.

8.3.2.4 Evaluation of PLDE courses

Similarly, mean scores were calculated for the 10-item course evaluation scale. The sample means for the individual items are summarised in Table 8.5 below. This table shows that, with the exception of item 3, all of these scores were above the scale midpoint, and this suggests that the students believed that the courses that they attended had been of some benefit in preparing them for their future as drivers. The scale mean was 3.58 ($SD = 10.7$) and the scale had good internal consistency ($\alpha > .8$) (Cronbach, 1990). The group means showed that students in group C ($M = 3.77$, $SD = 1.02$) seemed most satisfied regarding course benefits, and these were followed in descending order by groups A ($M = 3.65$, $SD = 1.03$), E ($M = 3.6$, $SD = 1.07$), B ($M = 3.53$, $SD = 1.1$) and finally group D ($M = 3.36$, $SD = 1.15$).

Table 8.5 Evaluation of PLDE course by programme group

Item*	Programme A			Programme B			Programme C			Group D			Group E			Overall		
	n	M	SD	n	M	SD	n	M	SD	n	M	SD	n	M	SD	n	M	SD
1	194	4.21	0.95	296	3.92	1.11	220	4.14	1.01	169	3.77	1.1	100	4.12	1.02	979	4.03	1.04
2	187	3.50	1.02	292	3.36	1.12	220	3.59	1.01	169	3.16	1.1	99	3.28	1.11	967	3.38	1.07
3	194	2.82	1.05	296	2.90	1.11	220	3.10	1.15	168	2.69	1.23	100	2.98	1.19	978	2.90	1.14
4	194	3.54	1.04	296	3.51	1.13	220	3.55	1.05	169	3.19	1.15	100	3.71	1.04	979	3.50	1.08
5	194	3.97	0.94	297	3.82	1.04	220	4.07	0.96	170	3.54	1.19	100	3.49	1.11	981	3.78	1.05
6	169	3.40	1.16	296	3.33	1.09	220	3.70	1.02	167	3.30	1.09	86	3.71	1.01	938	3.49	1.07
7	194	3.80	1.12	283	3.74	1.15	220	4.18	0.94	169	3.70	1.18	100	3.83	1.08	966	3.85	1.09
8	194	3.96	0.97	296	3.81	0.97	220	4.10	0.88	167	3.57	1.12	100	3.72	0.97	977	3.83	0.98
9	194	3.89	0.85	296	3.69	1.01	220	3.90	0.95	169	3.40	1.06	95	3.51	1.04	974	3.68	0.98
10	188	3.43	1.19	283	3.24	1.26	220	3.33	1.19	168	3.32	1.23	86	3.69	1.16	945	3.40	1.21
MEAN	190	3.65	1.03	293	3.53	1.10	220	3.77	1.02	169	3.36	1.15	97	3.60	1.07	968	3.58	1.07

* Item key

1. The programme that I took is valuable for educating future drivers.
2. I think that people who take this course are more skilled than those who do not take the course.
3. If I hadn't taken this course, I think I would have more accidents once I get my license.
4. If I knew a secondary school student who was planning to get a drivers' license soon, I would recommend that he/she should take this course.
5. I think that people who take this course have more knowledge about road safety than those who do not take the course.
6. This course has increased my confidence as a road user.
7. I think that taking this course has been a good preparation for taking my driver license THEORY test.
8. I think this course will help me to be a more cautious driver.
9. I think that people who take this course have attitudes that reflect a better understanding of the factors that influence risk taking on the roads than those who do not take the course.

8.3.2.5 Course grade

Students graded their PLDE courses on the same basis that their own school work is evaluated in state examinations (see State Examinations Commission, 2012), because they would be familiar with this system. These results are graphed in Figure 8.2.

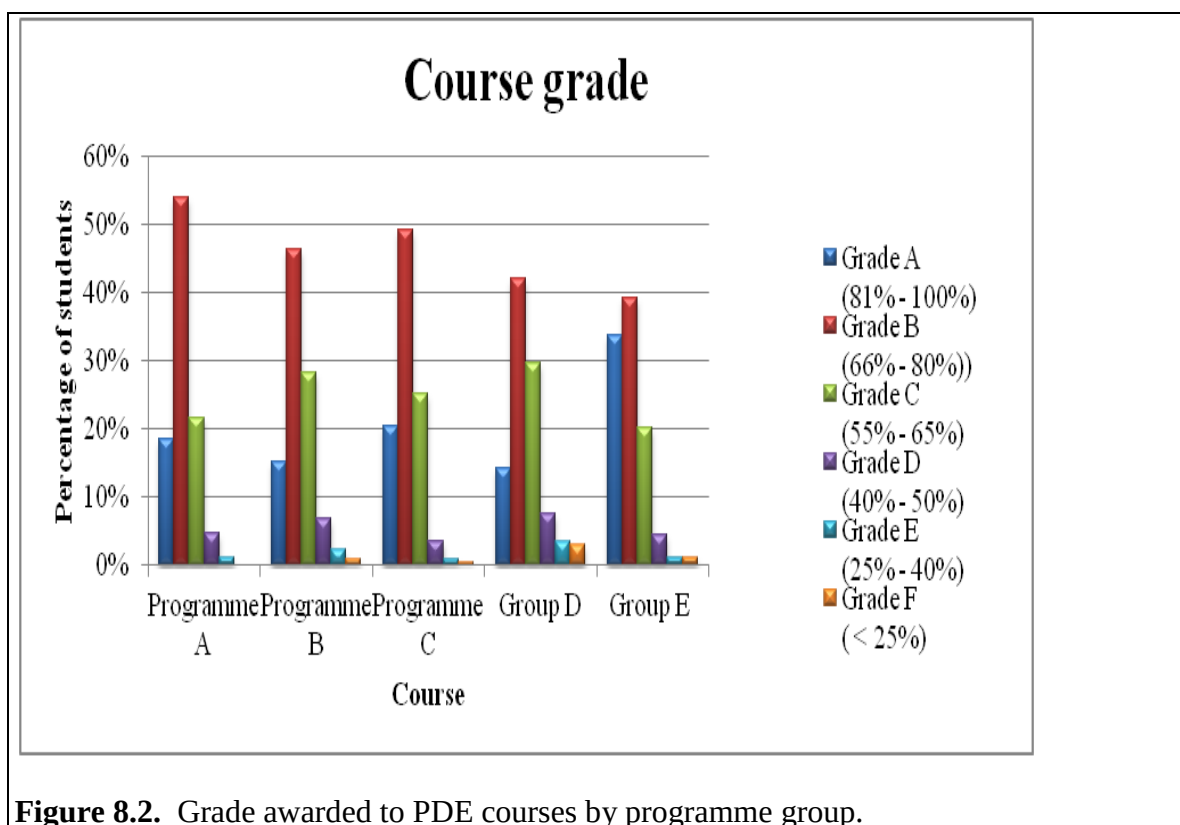


Figure 8.2. Grade awarded to PDE courses by programme group.

Overall grade scores were also calculated and these showed that 21% of the students believed that their PLDE course merited an “A” grade and grades ranging from B – E were awarded by 46%, 25%, 5%, 2% and 1% of students respectively. Thus, it appears that the overwhelming majority of the students believed that the course that they had taken was of a high standard.

8.3.2.6 Most enjoyable and beneficial aspects of the courses

Students were asked to list the parts of their courses that they found most enjoyable and most beneficial. Since there was a good deal of overlap in the responses to these questions, these responses were combined subsequently to form a single list. The ten most popular responses are shown in Table 8.6. The response rate for these questions was quite

high, amounting to 73% of the overall T2 sample and to, 68.1%, 71.6%, 91.4%, 71% and 66.7% for groups A – E respectively.

Table 8.6 Course elements that students found most enjoyable and/or beneficial by course group

Course element	Courses				
	Programme A	Programme B	Programme C	Group D	Group E
DVDs	28.4%	37.2%	34.4%	13.6%	13.9%
Guest speakers	26.2%	9.7%	12.3%	3.2%	N/A
Project work	14.2%	9.7%	N/A	N/A	N/A
Group discussions	13.5%	11.7%	10.8%	5.2%	12.7%
Lectures	12.8%	13.8%	10.5%	9.7%	3.8%
Learning about risk/safety	10.6%	12.6%	2.8%	7.8%	0.0%
Learning the ROTR	10.6%	8.1%	3.8%	9.7%	6.3%
Actual driving (off-road/simulator)	5.7%	5.7%	7.1%	5.2%	45.6%
Practical hands-on work	3.5%	3.6%	2.8%	2.6%	22.8%
Quizzes/tests	0.0%	0.0%	15.4%	14.1%	3.8%
Response rate	68.1%	71.6%	91.4%	71.0%	62.7%

Note1: The element scores were calculated as a percentage of the number of students who nominated these course features.

Note 2: The response rate was calculated as a percentage of the number of students who took the T2 test.

Note 3: The extent to which these programme elements were either provided as part of the course curriculum, or used by individual teachers varied from group to group and also within groups.

Amongst the students who took modular programmes (i.e. groups A – D) watching DVDs about driver/road safety was the most popular activity. Students said that they found the DVDs “interesting”, “entertaining” and “educational”, in that order. Students in groups A, B, C and E also liked the guest speakers, mainly because they were “entertaining.” A substantial proportion of the students remarked that these presentations had made a big impression on them (48%) and some stated what they had seen and heard would influence their behaviour in the future (27%). Project and group work were also popular with groups that engaged in these activities. Students suggested that these activities increased their awareness of road safety issues (53%) and allowed them to gain insight into other student’s views regarding safety and risk (33%). The students also liked learning the ROTR, mainly because it provided immediate and tangible benefits in terms of

preparing them to take the Driver Theory Test (72%). Students in groups C and D believed that they benefitted from taking part in quizzes and tests, for the same reason (80%). Students in groups C and E enjoyed the practical aspects of their courses i.e. the in-car demonstrations and inspecting engines and tyres etc., and where applicable, actual driving.

8.3.2.7 Aspects of the course that should be changed

The students were also asked to list three aspects of their PLDE course that they would like to see changed and to suggest ways in which these changes might be made. Whereas the overall response rate to the first question was quite good (60.6%), very few students answered the second question, thus that question was dropped from the study. The 10 most popular suggestions are listed in Table 8.7.

Table 8.7 Suggestions for improving PLDE courses by course group

Suggested improvement	<u>Courses</u>			Group D	Group E
	Programme A	Programme B	Programme C		
Introduce/extend practical elements	45.3%	40.6%	61.3%	77.4%	35.2%
Introduce a textbook	25.4%	20.6%	N/A	6.5%	0.0%
No changes needed	30.3%	24.9%	25.4%	4.8%	20.2%
Increase/improve teaching of the ROTR	14.9%	14.5%	0.0%	12.9%	10.2%
Improve existing textbook/handouts	9.0%	6.1%	22.0%	4.8%	N/A
Have more guest speakers	8.2%	8.5%	4.2%	6.5%	N/A
Have more group work/discussions	8.2%	6.7%	10.7%	0.0%	N/A
Show more DVDs	4.5%	10.3%	0.0%	6.5%	6.3%
Use scare/shock tactics less	8.5%	9.7%	4.8%	1.6%	0.0%
Make the course longer	0.0%	5.5%	0.0%	14.5%	65.3%
Response rate	54.9%	66.8%	79.2%	40.3%	62.0%

Note1: The element scores were calculated as a percentage of the number of students who nominated these course features.

Note 2: The response rate was calculated as a percentage of the number of students who took the T2 test.

Note 3: The extent to which these course elements were either provided as part of the course curriculum, or used by individual teachers varied from group to group and also within groups.

This shows that the students wanted to see more emphasis placed on the practical aspects of driving (52% of respondents on average): Students who took courses that had no practical work recommended that this element be included in the future and those who attended courses that featured some hands-on activities wanted to do more of this type of activity. Students in groups A and B favoured the introduction of a course textbook and the students in group C suggested that their existing text needed some improvement. More than two-thirds of students who took one-day courses (group E) wanted their PLDE course to be longer. Interestingly, almost 5% of respondents requested that “scare” or “shock” tactics be used less. Notwithstanding these criticisms, 21% of the respondents were satisfied with the course that they had taken and saw no need for change.

8.3.3 Administrator survey

The results for the TY coordinator survey (n = 13), which measured programme standards with respect to the curriculum, teaching, course materials, administration and course evaluation are presented in Table 8.8.

Regarding curriculum standards, all of the TY coordinators reported that they had a curriculum guide and that the PLDE teacher was using this guide. However it also appeared that traffic safety education was not considered as an integral part of the school curriculum in over half of the schools surveyed. Notwithstanding this, almost 70% of the respondents indicated that other teachers in their schools integrate traffic safety concepts into their classes. The majority of the respondents believed that the course stipulated appropriate performance objectives for all lessons and that it included activities that enabled students to achieve these objectives. However, none of the TY coordinators agreed that the PLDE curriculum that they were using included tests which measured student achievement with respect to all of the course objectives. The results also indicated

that the majority of schools (77%) did not provide their students with written information regarding the criteria for the successful completion of the course.

Table 8.8 TY coordinator survey

Item	Topic	Yes	No
<u>CURRICULUM STANDARDS</u>			
1	Does the school have a curriculum guide for the TY pre-learner driver course?	100%	0%
2	Does the course teacher have a copy of the curriculum and follow it?	100%	0%
3	Is traffic safety education considered as an integral part of the school curriculum?	46%	54%
4	Does the course stipulate appropriate performance objectives for all lessons?	62%	38%
5	Does the curriculum include tests which measure student achievements with respect to all of the course objectives?	69%	31%
6	Does the curriculum include tests for all of the course objectives?	0%	100%
7	Do teachers of other subjects integrate traffic safety concepts into their classes?	69%	31%
8	Are written criteria for successful completion of the course given to all students?	23%	77%
<u>TEACHING STANDARDS</u>			
9	Are course teachers selected on the basis of their academic achievements and/or their experience with teaching traffic safety education?	46%	54%
10	Have teachers/instructors received any certification before teaching the course?	77%	23%
11	Is the course-related performance of the teacher/instructor assessed regularly?	0%	100%
<u>COURSE MATERIAL STANDARDS</u>			
12	Does the course contain sufficient amounts of quality instructional materials to help students achieve the course objectives?	77%	23%
13	Are supplementary teaching materials, lectures demonstrations etc. related to driver and traffic safety education used? (i.e. elements that are not part of the main road safety course)	69%	31%
14	If so, are these critically reviewed before use by school authorities?	54%	46%
<u>ADMINISTRATION AND EVALUATION STANDARDS</u>			
15	Do students receive academic credit for the successful completion of the course?	54%	46%
16	Are academic standards maintained on a par with those of other courses?	62%	38%

(cont.)

Item	Topic	Yes	No
17	Are parents involved in the educational process?	23%	77%
18	Is written information concerning all aspects of the programme provided for all parents?	38%	62%
19	Is the program evaluated annually at school-level i.e. by administrators, TY coordinators, and/or instructional staff?	100%	0%
20	Are student performance recorded and maintained as a guide for program evaluations and to indicate students achievement?	77%	23%

Regarding teaching standards, the results suggest that the majority had received some certification before they taught the course. However, they also suggested that course teachers had not been selected on the basis of their academic achievements and/or experience with teaching traffic safety education in over 50% of the schools surveyed. In addition, there appeared to be no mechanism in place for the regular assessment of the course-related performance of PLDE teachers in any of the schools that were using this programme.

Regarding course materials, whereas 77% of the TY coordinators believed that course materials were sufficient to allow students to satisfy the course objectives, almost 70% reported that they supplemented their existing PLDE programme using materials, lectures and/or demonstrations that they had sourced independently. Of these, 46% reported that these supplementary elements had not been critically reviewed by school authorities before they were used.

Students received academic credit for completing the course in just over half of the schools surveyed and only 62% of the TY coordinators believed that academic standards in relation to the PLDE course were maintained on a par with those of other school courses. It also appeared that students' course-related performance was not monitored in a small number of schools. However, all of the respondents reported that an in-school evaluation of the PLDE course was conducted annually. The results also suggest low levels of

parental involvement with the PLDE course (23%) and the majority of the schools (62%) do not provide parents with detailed written information about the course.

8.3.4 Teacher interviews

The semi-structured interviews that were conducted with the class teachers in nine schools that had delivered programmes A (schools 1, 3, 4, and 5; $n = 4$) and B (schools 6, 9, 10, 11, and 13; $n = 5$). These interviews were conducted in private in either empty classrooms or visitors' reception rooms, during normal school hours, and lasted for 45 minutes on average. Since the main purpose of these interviews was to gather information about the running of these courses the narrative that follows was based on a simple content analysis of these interviews.

8.3.4.1 Course scheduling and implementation

All of the teachers thought that TY was the most suitable time for the delivery of PLDE programmes such as programmes A and B. Details of scheduling arrangements in the schools from which the interviewees were drawn are contained in Table 8.9.

Table 8.9 Example of course delivery schedules - Programmes A and B

School ID	Programme	Course duration	Class time	Class periods per week
1	A	Entire year	45	1 X Single
3	A	Entire year	45	1 X Single
4	A	Entire year	45	1 X Single
5	A	Entire year	45	1 X Single
6	B	12 weeks	20	2 X Single
9	B	8 weeks	20	1 X Single; 1 X Double
10	B	12 weeks	20	2 X Single
11	B	6 weeks	20	2 X Double
13	B	12 weeks	20	2 X Single

Programme A consists of 45 hours of tuition, which was delivered over the entire school year in the groups that participated in this part of the study. Programme B consists of 20 hours of tuition, and schools varied as to how this time was planned. Teachers using programme A expressed satisfaction with the course schedule and believed that this course was neither too short nor too long. However, all of the programme B teachers mentioned

that they struggled to cover the entire course in the allotted time. Furthermore, all teachers reported that course delivery had been disrupted as a result of competing demands from other school and TY activities. The way that such conflict were typically resolved was summarised by teacher 5, “Ah, it’s only road safety; let’s take them out of that”. Teacher 3 also noted “It’s very hard to get continuity, because they are doing such a wide range of subjects here and a lot of them (students) are involved in sports and are off playing matches when some of the classes are being held.....Then throughout the year we have work experience, so they are gone for 4 weeks....It’s just a myth that there is loads of time in TY to get things done” (teacher 3). Other activities that intruded on PLDE class time included school trips, concerts and plays.

Given that teaching schedules were commonly disrupted, teachers liked the fact that programmes A and B were designed to provide them with some degree of flexibility with regard to the parts of the courses that are actually delivered and also with respect to the amount of time that individual teachers spend focussing on the various aspects of the course. There was unanimous agreement that this arrangement helped to ensure that their students gain the maximum amount of exposure to the most important elements in the courses. However, since the teachers were provided with no clear guidelines as to which parts of the courses are most important in terms addressing the road safety needs of adolescents; they had to rely on their own judgement in this regard. In school 1 for instance “..what we do is pick and choose.....what we think is relevant....to the girls....where the dangers are and what should be highlighted”. Sometimes, however the agenda was driven by student interests “...often you go in (to the lesson) with an agenda....but very often somebody will put their hand up and say that they read a story in the newspaper last week....or that their aunt had a crash, and this takes us in a different direction...That’s the beauty of the course, it doesn’t have to be fixed” (teacher 3). All of the teachers reported that they spent a lot of time focussing on programme section 2 -

“Killer Behaviours”, especially lessons 8 and 9 “Speed and Speeding” and lessons 9 and 10 “Alcohol and Driving”. All teachers covered lesson 23 “The driving test, motor tax and insurance” and many reported that students were very interested in this lesson and were somewhat surprised at the costs involved in motoring. All of the teachers recognized the value of the various exercises contained in lessons 1 and 2, which seek to ascertain and challenge student attitudes towards safe driving, “I spend a lot of time dealing with peer pressure, the temptation of getting a lift home from the pub with a mate....” (teacher 3). Nevertheless, the interviews revealed that some teachers had not completed all of these exercises. “I saw the ‘moving debate’ being demonstrated during the in-service training day, and I thought that it was a good idea, but we never actually got around to doing this in class” (teacher 13). Eight of the nine teachers said that they spent little or no time on lessons 26 and 27 “Driving abroad” because they believed that these had very little immediate or practical relevance for their students. “That kind of stuff probably wouldn’t appeal to them now.....they just want to get in and start driving from A to B” (teacher 3). Lessons 6 and 7 “Safety belts/Child restraints/Airbags/Loose objects” was also skipped by more than half of the teachers. Some reported that they spent very little time on lessons 3 and 4 “Pedestrians and Cyclists”, because “...the kids have had lots of classes on this before now...” (teacher 13). Lessons 28 – 31 covers the ROTR, with the aim of preparing students sufficiently to take the “Driver Theory Test” (RSA, 2008). This part of the course is supported by a CD containing over 1,000 power point slides depicting theory test questions and a template for testing student knowledge. However, the amount of time that the teachers devoted to using these resources varied considerably across all 13 schools that were delivering programmes A and B³⁰. Irrespective of whether they were delivering programme A or B, it appeared that some teachers adopted a systematic and thorough approach when it came to covering the ROTR (30%), others preferred to “dip in and out”

³⁰ This information was derived on the basis of the teacher interviews and also personal communications with the teachers who did not participate in the interviews.

of this material (55%) and the remainder (15%) spent little or no time on this part of the course. For instance, two teachers said that they didn't cover anything related to the theory test because they assumed (incorrectly – see footnote 4) that the students were too young to benefit from this aspect of the course. “The material is there, but a lot of them are 16, they're not ready, so I'm open to correction, if you do get your theory test, you have to apply for your driving test within 6 months”³¹ (teacher 1).

8.3.4.2 Programme materials, activities and recourses

All of the teachers who were interviewed were satisfied that the curriculum for programmes A and B goes a long way towards addressing the needs of PLDs with respect to driving-related knowledge, risk awareness and attitudes. Several teachers said that they would like to see a student textbook introduced as part of these courses. They opined that this would eliminate the “hassle” and the wastefulness involved in photocopying worksheets and other course materials for every student in their classes. Teacher 6 also noted that “If they (the students) had a textbook, then at least they would have something physical, so that they see a progression, and have something to refer back to in the future.” All of the teachers suggested that the students should receive some form of official certificate to show that they had attended the course which could then be included as part of their TY portfolios.

Although all of the interviewees said that they had done some of the group exercises and project work that was outlined in the course manual, none of them had completed all of these course elements. For example, whereas lessons 1 and 2 include very valuable group exercises i.e. a moving debate, which is designed to identify student misperceptions about road safety and a group discussion about the consequences of an RTC, just 2 of the teachers that were interviewed said they used the former and only 5 had used the latter.

³¹ In actual fact, adolescents are allowed to take the Driver Theory Test at 16-year-of-age and the outcome remains valid for two years (RSA, 2012).

Whereas all of the teachers agreed that the DVD resources for these courses are of a good standard and that students liked watching them, many teachers reported that they had also accessed and used additional audio-visual materials in order to reinforce the road safety messages that are contained in programmes A and B. “What works really well is my supplementary material; the stuff I use to reinforce the point. You can get clips from the Rehabilitation Centre and clips with parents who have lost a child in a crash. Stuff that shows real people, telling real stories about their experiences and its real hard-hitting....There’s no substitute for this kind of stuff. You can show them three or four times a year and they (the students) are still glued to it” (teacher 6). All of the teachers mentioned that they wanted the course providers to make more resources available and some suggested that this could be done online, using a web portal.

Programmes A and B also contain some provision for inviting guest speakers. For instance a Garda speaker can be invited to deliver the “It Won’t Happen to Me” presentation, which deals with the causes and consequences of RTCs, and challenges perceptions of personal invulnerability. A visit can also be arranged from National Car Testing Service (NCTS) personnel, who talk about preparing for the NCT test and the driving test. However, whereas all of the teachers that were interviewed were interested in inviting these guest speakers to their schools, only three of them actually succeeded in arranging a visit from the Gardaí and just one had managed to arrange a visit from the NCTS. Teachers noted the difficulties involved in scheduling such visits, e.g. difficulty in contacting the relevant individuals and arranging a mutually acceptable time for the presentations to take place. Thus it appears that these resources are under-utilised. However, it emerged that some teachers had used their own initiative and sourced alternative guest speakers and some even provided supplementary courses. For instance, teachers in schools 1, 3, 5, 6, and 10 reported that they had used the car and road safety demonstration that is listed in Appendix A (p. 407) as part of their course. Schools 3 and 6

had provided course E1 (see Appendix A) in addition to their main PLDE programme.

Students in schools 5 and 6 also attended a driver training session, the former using a driving simulator and the latter attended course E2 (see Appendix A).

8.3.4.3 Programme context

Three of the teachers commented on the issue of programme context. They spoke about the efforts that had been made to integrate road safety into the broader second-level curriculum in their schools. “I think it’s critical to have the science people (teachers) on board. They can demonstrate important principles such as the effects of speeding, stopping distances, reaction times....” (teacher 6). The teacher in school 10 spoke about the culture of road safety that had been developed in that school. “I don’t think it’s a subject, it’s a moral issue, It is part of what we are, part of our being....I suppose, in tandem with all the theory, we try to put out awareness and I find it’s the awareness that brings them into the whole notion of being safe, of knowing.....of a basic understanding”.

8.4 Discussion

This discussion will begin by providing some general observations regarding the PLDE provision for TY students, placing particular emphasis on the five types of courses that were delivered in the schools that participated in this research. Thereafter the focus will shift towards reviewing the curriculum that formed the basis for programmes A and B.

8.4.1 Review on the provision of PLDE for Irish adolescents

TY is an optional feature of second level education in the ROI and during 2008, when this research was being planned, the TY curriculum was being delivered in 71% of secondary schools. However, since not all schools provide TY and since some of those who do provide TY do not deliver PLDE as part of that curriculum, it was noted that a sizeable proportion of Irish secondary school students are not provided with the opportunity to attend a PLDE course during their last two years in secondary school.

Current thinking within the road safety research community (e.g. Christie, 2001; Fuller & Bonney, 2004; McKenna, 2010b) suggests that the benefits of taking road safety education accrue from regular and frequent attendance at these courses. It was noted in Chapter 5 that the RSA have developed a range of road safety programmes which serve to provide regular and frequent exposure to road safety messages as part of their educational strategy. Thus, the failure of some schools to provide PLDE courses for adolescents in the latter part of their secondary schooling, and at a time when many of these students will be considering learning to drive, could be regarded as something of a departure from this strategy.

In addition, since TY curriculums are decided at school level rather than at national level, there is very little uniformity with respect to the quantity or the quality of the PLDE that is provided for TY students who do take these courses. As a result, there are wide variations in what PLDE means from one school to the next. Moreover, whereas the course manuals for programmes A, B and C state clearly that these programmes comply with NCAA criteria for second level courses, it remained unclear as to whether the developers of the remaining courses had taken these criteria into account when compiling their courses. Thus, there appears to be a need to develop an oversight mechanism whereby courses that are provided for TY students are examined by the relevant authorities to ensure that better and more uniform curriculum standards are applied in this area. Lonero (2008) suggests that the development of such standards would serve to help schools to become more successful in providing and administering uniform PLDE courses that use the most up-to-date content and delivery techniques. This in turn would help to ensure that TY students get the best available PLD education as part of their secondary schooling.

The PLDE courses that featured in the current research are used widely in the ROI, and thus can be considered as reasonably representative of these types of interventions. However, there were notable differences between these courses with respect to their

structure and durations. For instance whereas programme A was delivered across the entire school year and involved 45 hours of class time, programmes B C and D were delivered in one school term and involved 15 -20 hours of tuition and those taken by students in group E were completed in just one day. Whereas many students in this study were satisfied with the course that they had taken, it was notable that over two-thirds of the students who had taken the one-day courses indicated that they wanted to receive more PLDE. Although no between-groups comparisons were conducted to test for the effects that these differences might have had on student outcomes, because this was beyond the scope of the current research, it is clear nonetheless from a theoretical perspective that longer courses provide the students with more opportunity to interact with course materials and processes and for this reason alone they might be more likely to produce desirable changes in terms of increased knowledge and awareness than are shorter courses (see for example Ericsson et al., 1993; Kolb, 1984).

The results of the student survey indicated that a substantial proportion of the students surveyed rated the course that they had taken quite highly. Moreover, the course evaluation scores suggest that the students believed that the PLDE course that they had attended was of some value in terms of providing them with the types of driving-related knowledge, skills and attitudes which would enable them to become good drivers in the future. However, it was also clear that many students wanted PLDE to address their instrumental needs more directly by providing content that deals with the practical side of driving and that would help them to study the ROTR. Empirical evidence suggests that PLDE courses should focus on addressing student's developmental needs rather than on satisfying their instrumental needs because the latter encourages earlier licensure which increases exposure to risk, and thereby defeats the purpose of such education (Roberts & Kwan, 2001). Encouragingly, the current results showed that very little, if any practical hands-on experience was provided as part of the PLDE courses that featured in this study.

However, it is clear that student expectations regarding the provision of instruction in the ROTR were reasonable, given that 80% of the students in this study expressed an intention to obtain a learner driver permit as soon as they could do so legally (i.e. at 17-years-old) and that passing a Driver Theory Test is a fundamental requirement for obtaining this licence. Students were enthusiastic about learning the ROTR and partaking in other activities that they believed provided immediate benefits, e.g. passing the driver theory test. A review of syllabuses for the modular courses that featured in this study (A-D) indicated that these did in fact provide reasonably comprehensive coverage of the ROTR, albeit that the extent to which this material was covered by individual classes varied substantially between school groups. This issue will be dealt with in more detail shortly.

The students also reported that they had benefitted from participating in group and project work, mainly because it provided them with insight into peer opinion regarding risk taking and road safety generally. They also enjoyed attending presentations by guest speakers, who seem to have made such a strong and enduring impression on some students, they reported that what they had seen and heard during these presentations would influence their future behaviour.

8.4.2 Formative evaluation of programmes A and B

A more detailed analysis of the curriculum that formed the basis of programmes A and B was conducted. Since these courses differed only in terms of their duration, in the interest of brevity these will be referred to collectively as “the programme” for most of this discussion. The review that follows was based on the data from the student surveys, the TY coordinator surveys and the teacher interviews. All references to TY coordinators, teachers and students in this part of the discussion are applicable to individuals who used programmes A and B. It should also be noted that in the absence of an official programme curriculum, the teacher manual for these programmes served as a *de facto* curriculum for the purpose of this review.

8.4.2.1 Aims, goals and objectives

The stated mission of the body that developed these programmes is “To make roads safer for everyone.....to save lives and prevent injuries by reducing the number and severity of collisions on the road”, and education is regarded as a “key pillar” in achieving these aims (RSA, 2013a). A detailed inspection of the curriculum, revealed that whereas a clear set of learning objectives have been provided for the individual lessons, no attempt has been made to describe the overall aims, goals and objectives of the programme. Further enquires established that such overall aims, goals and objectives are not communicated explicitly to course teachers at any stage (i.e. during in-service training or in the form of supplementary materials) (personal communication with Christine Hegarty, Education Officer, RSA, on 18/1/2013). Clinton and Lonero (2006c) suggest that good programmes are developed on the basis of a programme theory, i.e. a set of assumptions that direct the way the programme is implemented and expected to produce results. This theory is best expressed in the form of a graphical representation (a logic model) which shows what is supposed to happen by specifying how the various elements in the programme are expected to combine to produce change and thus achieve its goals. Such logic models are also useful for communicating the goals and objectives to stakeholders and thereby help to develop a common understanding of the programme and its intended outcomes. Since the current findings indicate that there is a lack of clarity about the ways in which the activities of this course are expected to improve road safety, it is recommended that a logic model be developed for this course. This should be included as part of the course introduction and a copy of this should be provided for all students and stakeholders (e.g. parents, school authorities, the NCCA).

8.4.2.2 Addressing student and stakeholder needs: programme content and activities

The review of curriculum and the attendant DVD resources revealed that these contain materials and activities that have been designed to provide for students' instrumental and developmental needs within the context of the higher levels of the GDE-framework (see Hatakka et al., 2002). They incorporate content and activities that aim to increase factual knowledge (e.g. the ROTR and procedural information regarding driver licencing, motor tax and insurance); to improve awareness of factors that increase risk for drivers, and to improve attitudes towards driving. When interviewed, the teachers reported that they were satisfied that this curriculum has the capacity to address student needs as stated above. However, whereas the students expressed a clear interest in studying the ROTR to prepare themselves for taking the Driver Theory Test, and some expected that the course would help them to do so, the majority of the teachers reported that they did not cover this aspect of the course thoroughly. Nevertheless, all teachers reported that they covered the material pertaining to driver testing, and motor tax and insurance. Thus, whereas the course is theoretically capable of addressing students' instrumental needs in terms of providing knowledge about the ROTR and information about the practical aspects of motoring, the results from this study shows that student needs with respect to the ROTR were not always satisfied in practice.

The curriculum review found that the programme also included a variety of materials and activities that were relevant to addressing the developmental needs of PLDs. For instance, it places a lot of emphasis on increasing students' awareness with respect to a range of important state- and situation-dependent factors that are known to increase risk for drivers generally (the so-called "Killer Behaviours" such as speeding, driving after drinking or taking drugs, driver fatigue). However, given that it is well-established that inexperience, immaturity, and gender constitute the primary state dependent risk factors

for young learner and novice drivers (Arnett et al., 1997; L. Evans, 1991; McKnight & McKnight, 2003; OECD - ECMT, 2006b; Twisk & Stacey, 2007), it was surprising to find that the programme does not deal with any of these topics directly i.e. as topics in their own right. Findings reported in Chapter 6 of this study and also from previous research (e.g. Ginsburg et al., 2008) show clearly that adolescents do not have a proper appreciation of what it means to be inexperienced as a driver, thus it is reasonable to expect that a good PLDE course would address this issue. Likewise, whereas the GDE-framework (Hatakka et al., 2002) suggests DE programmes ought to include content and processes that have been designed to help students to gain insight into their personal risk-increasing tendencies (e.g. impulsiveness, sensation seeking) and should provide them with strategies to help them to control such motivational states, the issue of personal tendencies is not dealt with directly in this course. Finally, since it is widely-accepted that young males are more likely than young females to engage in unsafe driving behaviours, such as speeding, and DWI (Harré et al., 1996), and that the risk of crashing for young male drivers is higher than it is for all other groups (Twisk & Stacey, 2007), the failure to address this topic directly as part of a PLDE programme represents a significant omission. Evidence suggests that in comparison with young females, young males tend to lack awareness of their risk status as learner and novice drivers (DeJoy, 1992). For example, in a study conducted by Gormley and Fuller (2008) with 734 young male drivers, 32 respondents challenged the veracity of some of the questions that were asked, saying that did not believe that young male drivers are at the most risk of crashing. This suggests that there is a need to convince young male students about their actual risk status as learner and novice drivers. Petty and Cacioppo's ELM theory (1986) suggests that persuasive materials should be presented through central and peripheral routes. The programme curriculum appears to rely heavily on the peripheral method when informing students about the dangers involved in driving (i.e. showing DVDs of RTCs and their

consequences). However, the direct route should also be used to provide students with factual information about the types of risks that they face as young, inexperienced and where applicable, male drivers. For instance, students should be provided with a detailed account of where, when, how and most importantly why they are more likely to have an RTC than are older, more experienced drivers.

The GDE-framework (Hatakka et al., 2002) highlights the importance of reflexive practice in the development of safe driving habits. Furthermore, Kolb's ELT (1984) proposes that students learn best when reflexive practice is combined with the formulation of enactment strategies. In this regard, it espoused in psychological research that behavioural intentions, as described within the TPB (Ajzen, 1991), constitute reasonably reliable predictors of behaviour (Armitage & Connor, 2001). According to Gollwitzer (1999) the formulation of an implementation strategy helps to crystallize intentions by specifying when, where and how an intended goal can be achieved. For example, an implementation intention with respect to speeding might take the form of "When I start driving, I will adhere to the speed limit." It is assumed that as a result of having already formed a mental representation of this situation, the desired response will occur with some degree of automaticity subsequently (Bargh & Williams, 2006).

A recent meta-analysis of the results of 94 studies involving implementation intentions indicated that the formulation of implementation intentions had a medium-to-large positive effect ($d = .65$) on goal attainment (Gollwitzer & Sheeran, 2005). Research conducted in the traffic domain also supports the utility of implementation intentions for improving driver behaviour. Delhomme, Kreel, Ragot (2008) studied 624 of convicted speeders who attended a rehabilitation training course, some of whom made a public commitment to observe the speed limits in the future and some who did not. Their results showed that the incidence of speeding decreased significantly in the active 'commitment' group, in comparison to the 'no commitment' controls in the short-term and this effect was

still evident five months after the intervention ceased. These studies suggest that the inclusion of mechanisms which encourage students to formulate implementation intentions in relation to key course objectives is likely to increase the effectiveness of PLDE programmes. Thus the feasibility of developing such mechanisms and including them as part of the programme curriculum should be investigated.

Encouragingly, this review found that the curriculum incorporates many elements that are known to facilitate student learning, some of which were outlined in the introduction to this chapter. The programmes are delivered over an extended period of time and the safety messages that they aim to convey are reiterated in a variety of ways during that time. Since the programmes are relatively long, students are given ample time to think about the material and to discuss it with their classmates. Some of the materials and processes (e.g. the DVDs and the media tracking exercise) have the potential to evoke emotional reactions and students are provided with opportunities to explore these as individuals and as part of a peer group. Notably however the course does not provide clear and consistent mechanisms whereby student performance can be assessed in relation to the course objectives. This apparent failure to produce timely feedback constitutes a significant weakness in the course structure because it is known that student learning is improved when they receive regular and timely feedback on their performance (Bransford et al., 2000; Skinner, 1974).

8.4.3 Programme standards, business processes and context

The results of the part of the study that focussed on programme standards, business process and context revealed a number of problems, the most notable of which was the lack of proper programme implementation standards.

For instance, one would have to question the rationale for basing two programmes, one of which involves more than twice the amount of class time than does the other, on a single curriculum, when that curriculum provides no guidelines as to how class time ought

to be spent. The curriculum was designed such that that the teachers and administrative staff are given a considerable amount of latitude regarding the way in which the programme is implemented. In the absence of a programme logic model and clear guidelines about which parts of the course are central for addressing the driving-related needs of PLDs and which are more peripheral, teachers are forced to make subjective judgements about which parts of the programme they should include and which parts they should leave out. During the teacher interviews it emerged that teachers were in favour of this arrangement, because it helped them to ensure that their students received maximum exposure to important content. Whereas it is acknowledged that teachers do have the required expertise to deliver the programmes, it is clear that few, if any, teachers are sufficiently expert in the area of road safety to make independent decisions regarding programme implementation.

The current results also indicate that programme implementation was also disrupted due to competition for classroom time from other school activities. Research suggests that such problems are commonplace in the U.K (MVA Consultancy, 2009) and across Europe (European Commission, 2005). Research also indicates that disputes regarding programme implementation are more likely to arise where the administrative authority within an organization is weak and is less supportive of the programme (Rohrbach et al., 2006). The results of the current study suggest that, in some schools, road safety education is judged as less important than are other school activities. They show that, in some schools, PLDE is not regarded as an integral part of the school curriculum and that the standards that are applied with respect to the content, delivery and assessment of the PLDE curriculum are lower than those that are commonly applied to other second level courses. None of the schools in the current research conducted regular evaluations of their PLDE teachers' course-related performance, which is somewhat worrying, because the results also showed many schools do not take academic performance or experience with teaching traffic safety

courses into account when they appoint a teacher to deliver PLDE. Furthermore, although the all of the TY coordinators reported that their schools evaluate the programme on an annual basis, it appeared that the use of supplementary (non-course) materials was condoned in the majority of the schools and that such materials were not always critically reviewed by school authorities. These results indicate that contextual factors can have a major effect on the operation of these PLDE programmes. This suggests that there is a need to develop proper programme standards for these courses.

The failure to develop programme standards for programmes A and B and the subsequent findings that there was no real uniformity in the ways that the schools in this study implemented these programmes, severely limits the ability of the current research to reach wholly reliable and valid conclusions with respect to the efficacy and effectiveness of these programmes. This issue will be discussed in more detail in the next chapter.

The main strength of this part of the study was that it used both quantitative and qualitative methods to examine student reactions to their PLDE courses and also the approaches that school management and staff took to implementation and delivery of the curriculum that formed the basis of programmes A and B. Whereas the schools that participated in this research can be considered as being reasonably representative of schools in the ROI, it is acknowledged nonetheless that due to operational constraints the school-level sample in this research was quite small and the sample for the teacher interviews was smaller still.

8.4.3.1 Recommendations

The following recommendations are made on the basis of the findings from this part of the study:

1. Standards and guidelines should be devised for overseeing courses that are provided for TY students to ensure programme quality with respect to content,

delivery, and monitoring and also programme administration and teacher/instructor qualifications.

2. A study should be conducted to examine the feasibility of providing PLDE for all adolescents during the senior cycle of secondary school.
3. A review of the programme A and B curriculum should be conducted with a view to developing separate curriculums for these two programmes. This needs to be done so that adequate programme standards can be devised.
4. A programme theory should be developed for programmes A and B; this should include a logic model, which clearly demonstrates the relationship between programme objectives, goals and aims. This will help programme users and other stakeholders to understand how the programme is supposed to work to produce safety-related outcomes.
5. School is an ideal setting for learning the ROTR and student expectations with regard to the provision of ROTR training should be met as part of their PLDE course.
6. PLDE courses should aim to address important state-dependent factors that are affect the driving-related cognition, affect and behaviour of adolescents i.e. immaturity, inexperience, and gender.
7. New content and activities should be developed which have a sound basis in theory and a proven record of success in the field. Such activities might include work around implementation intentions, the use of social influence and modelling and greater parental involvement in course activities.
8. Tests of learning outcomes should be developed and used at various intervals during the course. The results from such tests will provide students with timely feedback about their progress and will allow teachers and school authorities to monitor programme effectiveness.

9. The feasibility of producing a course textbook should be examined.
10. A web portal should be developed where teachers can access approved supplementary materials, up-to-date information about road safety issues that are relevant to the course and course updates.

Chapter 9: General discussion

The aim of this research was to evaluate road safety interventions which have been designed for PLDs and which are delivered as part of the TY curriculum in secondary schools in the ROI. This chapter serves to summarise key findings from this project and to consider the possible theoretical, educational, research, and policy-related implications of those findings.

The theoretical framework for the current research was formulated on the basis of a review of empirical and theoretical evidence pertaining to driver behaviour, to human behaviour generally, and to driver education which was presented in Chapter 1. This was influenced by three behavioural models; the TCI (Fuller, 2005), which exemplifies motivational models of driving behaviour; the TPB (Ajzen, 1991), which is a widely used socio-cognitive model of general behaviour and the PWM (Gibbons & Gerrard, 1995), which focuses on the social reactive route to risk taking. In addition, the GDE-framework (Hatakka et al., 2002) was used to provide a strong theoretical basis for defining appropriate goals and targets for driver education. The evaluation strategy that was used was based on best practice guidelines developed for the AAA Foundation for Traffic Safety (Clinton & Lonero, 2006a, 2006b, 2006c). Thus informed, the current research used hierarchical linear modelling techniques (HLM) with the objective of explaining variations in driving-related knowledge, risk perception skills and attitudes in Irish adolescents as a function of intra-student (age and time), between-student (demographics and individual differences) and between-groups factors (differential exposure to PLDE).

9.1 Summary findings from the summative evaluation

The following review of the main findings from the summative evaluation will be discussed in terms of the research hypotheses. First however, a summary of the findings from the baseline test will be presented, since these serve to contextualise the research findings. A review of the item and scale means from the initial test revealed that the

students in this sample possessed a moderate amount of declarative knowledge regarding the ROTR at the start of TY/year 13 in secondary school (mean age approximately 16-years). Likewise, since the means for risk perception were close to the mid-points on the relevant scales, it appeared that the students were somewhat capable of perceiving driving-related risk. Similarly, mean scores for the tests that measured attitudes towards speeding with respect to behavioural beliefs and subjective norms were close to the scale mid-points which indicated that the students did not have particularly risky attitudes towards speeding. The results also suggested that the students perceived that they had some degree of control when it came to travelling with drivers who have a reputation for speeding, albeit that they were marginally more willing than unwilling to do so. Moreover, the students' mental representations (prototypical images) of drivers who speed were more negative than they were positive. Taken as a whole, these findings suggests that although there was some scope for PLDE to work to produce improvement in knowledge, risk perception and attitudes towards speeding during the course of this study, such changes were likely to be small in magnitude. Nevertheless, since this information serves to increase our understanding of PLDs it should be of interest to stakeholders, traffic safety researchers and programme developers.

Hypothesis 1, which posited that there would be significant variations in driving-related knowledge, risk perception skills and attitudes of participating students at intra-student, between-student and between-groups levels, was supported. A review of the model fit indices for the null model estimates supported the latter two predictions. In addition, a review of the plausible values ranges in these models showed that on average, the intra-student variation estimates were more than double those of the between-student estimates and over four times greater than the between-group estimates, supporting the first prediction.

Hypotheses 2 and 3 predicted that there would be significant changes in driving-related knowledge, risk perception skills and attitudes in the sample in both the short-term (i.e. in the intervention phase) and the long-term (i.e. in the interim between the initial and the final test). The results derived from the model 2 estimates demonstrated that there was a small, significant increase in knowledge proficiency in this sample in both the short-term and the long-term. Small significant improvements in risk perception were also evidenced in the short-term but not over the longer-term. However, whereas previous research suggested that attitudes towards driving among adolescents tend to become riskier over time (Harré et al., 2000; Lonero et al., 2000), the results from this study did not wholly support this conclusion. While small short-term increases were seen with respect to perceptions that the peer norm favoured speeding and expectations of travelling with speeders, motivation to comply with this norm waned and motivation to comply with parental perceived parental norms strengthened, as did tendencies to view prototypical speeders negatively. Although many of these effects did not persist over the longer-term, small significant decreases in motivation to comply with peers and in positive impressions of prototypical speeders were evidenced between the initial and the final test in this study. As a result of these findings it is recommended that PLDE programme developers should aim to support the positive trends evidenced by these data. This issue will be discussed in due course.

Hypothesis 4 predicted that students who attended a PLDE course during TY would gain significantly more driving-related knowledge, better risk perception skills and better attitudes towards driving than would students in the non-PLDE control group. Likewise, hypothesis 5 posited that students who attended any of the specific PLDE courses that featured in this study (i.e. courses A – E) would achieve significantly greater improvements with respect to driving-related knowledge, risk perception skills and attitudes than would those in the controls. Regarding knowledge, it was found that

students who attended a PLDE course gained significantly more knowledge than did the controls in the short-term but not over the longer-term. This concurs with previous findings (e.g. Elkington, 2005; Harré & Brandt, 2000a; Poulter & McKenna, 2010) and thus lends additional support to the assertion that PLDE is effective in providing students with driving-related declarative knowledge in the short-term. The present research also showed that students who attended popular modular PLDE programmes (i.e. programmes A, B and C) gained significantly more knowledge over the short-term than did the controls. Furthermore, those who attended programme B gained significantly more knowledge over the longer-term than did the controls. However, since it was also shown that the amount of time that was devoted to studying the ROTR by the individual groups in this sample varied considerably, no firm conclusion could be reached regarding the efficacy of individual programmes in increasing driving-related knowledge. Predictably, groups that devoted more attention to studying the ROTR gained significantly more knowledge in the short-term, albeit that some of this knowledge was lost over the longer term. It was also noted that the trend in the data with respect to the control group reflected that of the active PLDE groups, which suggested that the control students were studying the ROTR independently in order to prepare themselves for the Driver Theory Test.

The results from the current study indicated that attendance at PLDE did not result in significant changes in driving-related risk perceptions or attitudes towards speeding in the desired (less-risky) direction for the majority of the analyses that were conducted. These results do not support the findings from previous studies, which reported small short-term improvements in attitudes as a result of exposure to PLDE (e.g. Elkington, 2005; Harré & Brandt, 2000a). On the one hand, the present study used a far more extensive range of predictor and outcome variables than did previous PLDE evaluations, and thus probably constituted a more valid measure of driving-related risk perception and attitudes. On the other hand however, the possibility that the present study was somewhat

underpowered cannot be ruled out entirely. Whereas the overall sample size was very large, the number of school groups from which the sample was derived fell just short of the criteria suggested by (Kreft, 1996). This issue was discussed in detail in Chapter 2.

Interestingly, the current findings indicated that attendance at PLDE resulted in significant improvements in the availability and accessibility of some types of negative outcomes in response to a vignette depicting a high risk scenario over the short-term but not over the longer-term. Furthermore, attendance at PLDE was also associated with a significant deterioration in positive sentiment towards prototypical speeders in both the short- and the long-term. When taken as a whole however, these results suggested that PLDE was not particularly effective in improving driving-related knowledge, risk perception skills and attitudes in this sample.

Hypothesis 6 predicted that initial levels of, and changes in, knowledge, risk perception skills and attitudes in this study would be influenced by a range of distal and proximal between-student factors. Although 14 between-student variables were examined as part of this research, only five of these predictors, three distal factors (gender, impulsiveness and sensation seeking) and two proximal factors (exposure to aberrant driving practices and experience with using vehicles) were shown to impact significantly on students' knowledge, risk perception skills and attitudes. Moreover, the effects were evident mostly in the pre-intervention tests and were small in magnitude. No significant effects of SES, the Big-Five personality traits, domicile location or direct and indirect experience with crashing were found in any of the tests. Contrary to expectations, no significant interaction effects were found between the between-student and the between-groups factors.

9.2 Summary findings from the formative evaluation

Formative evaluations are conducted to ensure that the goals of educational interventions are being achieved and to help to further the development of such

interventions by identifying problematic aspects of these interventions and suggesting possible improvements (Clinton & Lonero, 2006b). The results from the current student evaluation survey showed that students who had attended PLDE were generally satisfied with these courses. However, many students requested that PLDE be improved to ensure that their instrumental needs were catered for more fully to address, through the inclusion of more content relating to the practical aspects of driving (e.g. in-car driver training, improved coverage of the ROTR). However, since research suggests that the provision of driver training promotes early licensure (Roberts & Kwan, 2001) it was encouraging to note that the majority of the courses in the current research did not provide in-car training as part of their curricula. However, it was recommended that coverage of the ROTR be introduced or improved where necessary. Students also reported that they had benefitted from attending guest speaker presentations (the topic of positive role models will be discussed in more detail below). Since the courses that featured in this study differed considerably in terms of structure, duration and content, no attempt was made to make direct comparisons between these courses. Instead, the detailed formative analysis was conducted on two programmes of the featured programmes (i.e. programmes A and B), the results of which were described in detail in Chapter 8. In sum, it was concluded that these programmes incorporated many of the features that are suggested in the higher levels of the GDE matrix (Hatakka et al., 2002). It was recommended that the feasibility of developing new and improved content and processes be investigated e.g. implementation intentions. Concerns were raised about the policy of basing two programmes, which differed substantially in terms of duration on a single curriculum, without providing teachers with a clear indication of programme goals and detailed instructions about how the programmes should be implemented. The negative consequences of this policy were evidenced in the teacher interviews, which showed that teachers routinely made subjective judgements regarding programme implementation. It was acknowledged that this situation posed a

serious threat to the internal validity of the current research (see Onwuegbuzie & McLean, 2003), to the extent that no firm conclusions could be reached regarding the efficacy of these programmes at this time. It was recommended that separate curricula be developed for these programmes and that logic models should be developed in order to communicate programme aims, goals and objectives to school authorities, teachers, students, parents and other interested stakeholders. It was noted that some schools do not regard PLDE as an integral part of the curriculum and that the standards applied regarding programme content, delivery and assessment are inferior to those that are commonly applied to other second-level courses, especially with respect to course evaluation, student and teacher assessment and the use of extracurricular materials that have not been evaluated by school authorities. All of these problems serve to reduce programme effectiveness and need to be addressed by the developer of these programmes.

9.3 Theoretical implications

Despite the inclusion of a wide range of relevant predictors as part of the model construction process, attempts to explain variations in the driving-related knowledge, risk perception skills and attitudes of the students in this research were largely unsuccessful. Although this result was somewhat disappointing, it was not entirely unexpected, given the epistemological complexity of the subject matter. Nevertheless, the present research went further than did previous evaluation studies of DE (e.g. Stock et al., 1983) and of PLDE (e.g. Elkington, 2005; Harré & Brandt, 2000a; Poulter & McKenna, 2010) by attempting to account for some of this complexity by using HLM techniques and by controlling for a wide range of proximal and distal antecedents which are believed to influence human behaviour generally and driver behaviour specifically (see Ajzen, 1991; Fuller, 2005). As a result, a consistent pattern emerged from within these data which suggested that the main source of the unexplained variation in all of the models that were constructed was located at the intra-student level, rather than at the between-student or the between groups-levels,

and thus was likely to be age/time-related (e.g. biological maturity). Although these findings are novel in the context of DE research, they accord well with previous findings which showed that 40% of the reduction in the crash risk for adolescent drivers over time can be attributed to increasing age Valkveld (2005: as cited in Wegman & Aarts, 2006).

9.3.1 Biological development

Recent research suggests that intra-individual factors, such as neurobiological development, play a significant role in adolescent cognition, affect and behaviour (Casey, Getz, & Galvan, 2008; Durkin & Tolmie, 2010; Steinberg, 2005). The dual-systems model of adolescent development (Steinberg, 2008) posits that adolescent behaviour is contingent on interactions between changes in two neurobiological systems; a socio-emotional system and a cognitive control system. Whereas the former becomes activated rather abruptly around the time of puberty, giving rise to increased reward (sensation) seeking, the development of cognitive control is characterised by increasing self-regulation and impulse control, which differs from individual to individual and takes many years to complete (Paus, 2005). Moreover, whereas research indicates that adolescents have similar intellectual capabilities to adults (Reyna & Farley, 2006), studies also show that adolescents lack the capacity to override impulses in emotionally charged situations (Steinberg, 2005). This suggests that risk-taking in adolescents is less a question of poor decision making than it is one of poor judgement (Steinberg, 2003).

It is widely accepted within the traffic domain, that the temporal gap between the development of procedural skills (e.g. vehicle handling) and higher-order cognitive skills (e.g. state and situational awareness) represents a major source of risk for adolescent drivers (Beyth-Marom et al., 1993; Finn & Bragg, 1986; Machin & Sankey, 2008; Matthews & Moran, 1986). In response, the GDE-framework (Hatakka et al., 2002) posits that driver education programmes ought to include content and processes (e.g. activities) that facilitate the development of metacognitive knowledge (i.e. self-awareness) and

metacognitive skills (i.e. skills for self-evaluation and self-regulation), and thereby support the accurate calibration of learner drivers (Peräaho et al., 2003). Although this approach has been welcomed by traffic safety researchers (e.g. Engstrom et al., 2003; Lynham & Twisk, 1995), the above findings from neurobiological research highlight a potential flaw in the logic that underpins this strategy when it comes to educating young pre-learner, learner and novice drivers. Specifically, whereas GDE model assumes that the development of metacognitive knowledge and metacognitive skills can be accelerated by means of driver education, given that the development of cognitive control functions appear to be largely contingent on biological maturational processes, it seems unlikely that the acquisition of driving-related metacognitive skills can be accelerated any great extent through exposure to brief educational interventions. The global trend towards the adoption of graduated driver licencing systems over the past decade suggests that many experts and policy makers have come to a similar conclusion (see Keating & Halpern-Felsher, 2008; Lonero et al., 2005; Williams, 2006). However, this does not mean that work on the development of content and processes related to the remaining aspects of the GDE-framework should be discontinued.

9.3.2 Psychosocial development

The most consistent findings in the current research were those which indicated that previous exposure to aberrant driving had a negative effect on driving-related knowledge, risk perception skills and attitudes in the pre-intervention test. Although the size of this effect was small, the robustness of this effect across most of the analyses that were conducted was remarkable, especially since the sample mean (1.75, $SD = 0.54$) was quite low on the 5-point scale that was used to measure this predictor. These results support previous findings which indicated that the development of some driving-related competencies begins long before youngsters are old enough to drive and occurs predominantly as a result of observational learning (M. A. Elliott & Baughan, 2004; Harré

et al., 2000; Waylen & McKenna, 2008). They also accord with results from previous studies which showed that exposure to risky role models, most notably parents (Taubman - Ben-Ari et al., 2005), peers (Arnett et al., 1997) predicts the development of risky styles of driving. However, since relatively little is known currently about the ways in which antecedent influences affect the development of driving-related competencies in PLDs, these findings make a noteworthy contribution to the literature and more research along these lines is warranted.

Whereas these findings are compatible with assumptions that are implicit in behavioural models such as the TCI (Fuller, 2005) and the TPB (Ajzen, 1991), and are also concur with the social cognition model of learning (Akers, 1973; Bandura, 1989), some researchers have come to believe that the role that contextual factors play in adolescent development needs to be explicated more comprehensively in terms of a broader ecological framework. For instance, Johnson and Jones (2011) recently developed an ecological model for understanding adolescent development and risk of injury, which situates the individual within a system of relationships ranging from micro-level (individual), meso-level (family/peers), community level (locality), and macro-level (socio-political/cultural) which are reciprocal and therefore “mutually shaping” (Figure 9.1).

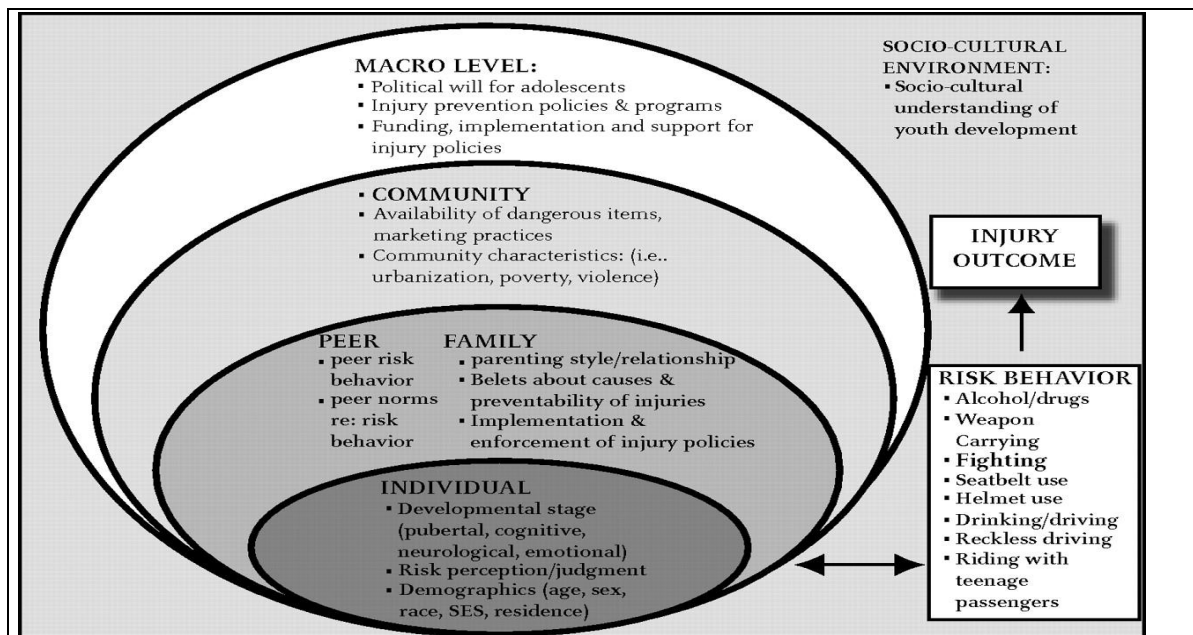


Figure 9.1. An ecological model of adolescent development and risk of injury.

(S. B. Johnson & Jones, 2011, p. 21). Reprinted with permission.

The recent emergence of a global trend in favour of the adoption of a “safe systems” approach in the traffic domain suggests that policy-makers, stakeholders and traffic safety professionals have begun to acknowledge that there is a need to adopt a more holistic approach when trying to understand the complex aetiology of risk taking and RTCs. The safe systems approach aims to build on existing road safety interventions but to reframe the way that road safety is perceived and managed in the community which “requires acceptance of shared responsibilities and accountability between system designers and road users” (OECD - International Transport Forum, 2008, p. 5). This implies that efforts to improve the human factor within the traffic system need to address problems that pertain to micro-, meso- and macro-levels of operation within the human ecological sub-system.

In this regard, it is widely acknowledged that driver behaviour is influenced strongly by driving culture (see Ward, Linkenbach, Keller, & Otto, 2010; Williams & Haworth, 2007), i.e. “the common practices, expectations, and informal rules that drivers learn by observation from others in their communities” (Lonero, 2007, p. 7). This

definition pertains not only to behaviours that increase or decrease crash risk but also to cognitive affective and behavioural responses related to the acceptance or rejection of road safety interventions (Ward et al., 2010). Much effort has been expended in developing interventions that focus on altering the perceptions of individual road users regarding the social norms related to risk taking and driving risk (Berkowitz, 2005; Haines et al., 2005). Whereas this approach assumes that actual societal norms are oriented predominantly in the direction of safety, the available evidence does not wholly support such an assumption. For instance, at a societal level, it is evident that driving culture is negatively impacted by high-profile role models that “valorise” assertiveness and superiority in drivers such as the Top Gear presenters, James Bond, etc. (Christmas, 2008). The idea that individuals cannot be abstracted from the social context is fundamental to social ecological theory (Bronfenbrenner, 2005). Since cultural influences operate across all levels of the social sphere, there is a growing realization within the road safety community that continuing efforts to improve road safety will necessitate the development of intervention strategies designed to target all levels of the social eco-system (see Ward et al., 2010). Such efforts would entail addressing the beliefs and attitudes of individual road users, and also intervening to promote and support the development of safe driving norms among parents/peers, at community level and in society as a whole. Without such changes, it is inevitable that the road safety messages that are contained in interventions such as the ones that featured in this research will be overwhelmed by strong and enduring social influences which do not reinforce the safety messages contained in these interventions consistently (for discussions on this point see McKenna, 2010a; Williams et al., 2009). The results from the current research lend further support to this view because they show that whereas exposure to aberrant driving had a negative effect on driving-related knowledge, risk perception and attitudes in the pre-intervention test, attendance at a PLDE course did little to remedy this problem.

An abundance of empirical evidence attests to the role that parents and peers and prototypical role models play in the psychosocial development of children and adolescents (Bianchi & Summala, 2004; Miller & Taubman - Ben-Ari, 2010; Ouellette et al., 1999). Regarding parents, research has shown that whereas parents with adolescent offspring are acutely aware of their role and responsibilities when their children were learning to drive, the majority of parents are oblivious to the fact that they play an equally important role in modelling good and bad driving-related behaviours for their children (Christmas, 2008). This suggests that there is a pressing need to develop a social marketing campaign to raise awareness of this issue amongst parents. Regarding peers, the results from this research supports previous findings which showed that adolescents tend to perceive peer norms as risky (N. Evans et al., 1995). It is also known that exposure to peers who engage in deviant behaviours increases the likelihood of such behaviour in adolescents (Jessor et al., 1997). However, research has also shown that positive peer influence can be harnessed to produce successful outcomes in social programming interventions and that the inclusion of content and processes that provide students with exposure to positive social influences can improve programme effectiveness (Posavac et al., 1999; Yates & Dowrick, 1991). Regarding prototypes, studies suggest that where young novice drivers have favourable socially shared images of risky driver prototypes (e.g. speeders) they are more likely to engage in risky driving, circumstances permitting (Ouellette et al., 1999). Much more work remains to be done by PLDE programme developers to capitalise on positive peer influence.

Since all of the available evidence suggests that individuals begin to acquire driving-related knowledge, cognitive skills and attitudes an early age on the basis of what they observe as car passengers (e.g. Harré et al., 2000; Waylen & McKenna, 2008), one obvious way to counteract the detrimental effects of such experiences would be to teach adolescents to become good passengers. For example, Christmas (2008) suggested that

pre-driver education provides a unique opportunity to improve young passengers' skills in observing and evaluating the driver behaviour of their parents and significant others. The current results showed that students with recent experience of travelling with speeding drivers were more likely to have a positive impression and less likely to have a negative impression of such drivers. Encouragingly, the current research also indicates that PLDE was somewhat effective in reducing positive sentiment towards speeder prototypes, although it should be noted that it was not equally successful in increasing negative appraisals of such drivers. Nevertheless, this suggests that the concept of driver prototypes, both positive and negative, may prove useful in the future development of PLDE programmes. The challenge for programme developers is to identify suitable positive driver role models /prototypes who would be willing to participate in such a project.

9.4 Implications for PLDE

The results of the current research contribute to an ever-increasing body of findings which suggest that driver education is largely ineffective, because it produces minimal and inconsistent improvements in the safety-related cognitions, affect and behaviours of pre-drivers (see Christie, 2001; Deighton & Luther, 2007; Mayhew et al., 2002; Roberts & Kwan, 2001; Stock et al., 1983; Vernick et al., 1999) and of pre-learner drivers (see Elkington, 2005; Harré & Brandt, 2000a; Poulter & McKenna, 2010; H. Simpson et al., 2002). Nevertheless, the continued popularity of driver education amongst stakeholders arises from a socially-shared intuition that DE cannot but help to improve road safety at some level (McKenna, 2010a). For example, research indicates that DE functions to make students more amenable to subsequent safety-related messages (O'Brien et al., 2001). It has also been suggested that the beneficial effects of road safety education most likely accrue as a result of regular and repeated exposure to programme content (Christie, 2001; Lonero et al., 1995; Lonero & Mayhew, 2010; Siegrist, 1999). Moreover, it has been

proposed that driver education may operate at a cultural level by functioning to improve public sentiment towards other, more obviously successful road safety interventions (McKenna, 2010a). If these suppositions are indeed correct, then it would seem that the effects of road safety interventions are likely to be subtle and therefore difficult to detect. This represents something of a dilemma for policy makers, since they clearly want to be seen to be taking action to improve road safety, but they also need to ensure that the actions that they do take produce tangible results and thereby justify the expenditure of time, effort and other resources (see Christie & Harrison, 2003). For instance, whereas McKenna (2010a) proposed that educational interventions could be designed and evaluated on the basis of their efficacy in changing the perceived legitimacy of policy-related action (e.g. changes in legislation, stricter enforcement of existing rules), it is unlikely that such a radical shifts in the focus of DE would receive the support of stakeholders and policy makers. Nevertheless, the results from the SARTRE studies which were cited in Chapter 1 (e.g. Fuller & Gormley, 1998; Gormley & Fuller, 2005), suggest that work remains to be done here in Ireland to improve public perception of road safety policy and legislation. Thus efforts to improve the perceived legitimacy of traffic safety policy-related actions using road safety initiatives, including PLDE, should be encouraged and supported.

There are a number of good reasons for supporting the provision of PLDE as part of the secondary school curriculum and for funding its future development. First, the current findings suggest that the vast majority of PLDs are interested in obtaining an LDP sooner rather than later, and the secondary school system has a proven track record in addressing students' instrumental needs by providing them with the wherewithal to pass knowledge-based tests. Second, since PLDs will have been exposed to factors (e.g. individuals and/or circumstances) that served to shape their driving-related knowledge, risk perception skills and attitudes over time, and since the benefits of education tend to accrue

over time, clearly road safety education should be delivered at regular intervals as part of the primary and secondary school curriculum right through to year 14. Third, since the vast majority of Irish adolescents complete their second-level education, the inclusion of PLDE as part of the national curriculum would ensure that most Irish adolescents would continue to be exposed to road safety messages at a crucial juncture i.e. when many of them are becoming actively interested in driving. Thus, whereas there is a temptation to focus on traffic safety policies which yield visible results over the short-term (e.g. engineering, enforcement) the well-being of society may be served better by taking a long-term approach and by investing in the development of more effective road safety education initiatives.

9.4.1 Improving PLDE

Many traffic safety professionals support the drive to develop more effective DE and believe that this might be achieved by broadening the scope of DE (as discussed previously) and by focussing more intensely on the core problems that confront adolescent learner and pre-learner drivers (see Christie & Harrison, 2003; Lonero et al., 2005). Since all of the available evidence suggests that faulty calibration is the root cause of the young driver problem (Arnett, 1996; Deery, 1999; Finn & Bragg, 1986; McKnight & McKnight, 2003), there is general agreement that driver education should focus on providing students with insight into the limitations of their capabilities, and also into the actual complexity of the traffic task, thereby enabling them to assess the difficulty of the driving task with greater accuracy (de Craen, 2010; Hatakka et al., 2002; Lonero et al., 1995). It has long since been established that inexperience, age and (male) gender function to reduce task capability in younger drivers (OECD - ECMT, 2006b). However, one important insight that was gained from this research was that, in common with their U.S. counterparts (see Ginsburg et al., 2008), Irish adolescents have a poor appreciation of the magnitude of the threat that inexperience poses to their safety as drivers. Yet the formative evaluation that

was conducted as part of this research noted that the amount of attention that is devoted to the topic of inexperience in the programmes that featured in this study was in no way commensurate with the importance of this topic in terms of catering for adolescent students' developmental needs as drivers. Whereas it is acknowledged that all of the programmes reviewed as part of this study did indeed address issues related to inexperience, age and gender, these issues were normally addressed in the context of other, more generic safety issues (e.g. speeding, DWI, driver fatigue) rather than as topics in their own right. Thus, it is recommended that the future development of PLDE should involve the provision of programme units/lessons that focus specifically on inexperience, age and gender in order to make PLDs more aware of the effects that these factors have on their capability as drivers. Adolescents need to know how, where, when and most importantly why these factors pose a threat to their safety as learner and novice drivers.

The results obtained from the vignettes that were used in this research also provided some unique insights into the cognitive functioning of PLDs. These suggested that attendance at a PLDE course increased the accessibility of mental representations of crashing in response to a high-risk scenario. Intriguingly, since the results showed that although over 80% of the students surveyed listed "crashing" as a possible consequence of these scenarios, over 25% of these did not also list attendant consequences such as "injury" or "death, which suggests that mental associations between these outcomes need to be strengthened in some PLDs, especially males. Moreover, the current results also indicated that PLDE may function in some way to improve the accessibility of serious consequences. Although these results were encouraging, much more work needs to be done to progress this potentially useful line of enquiry and this issue was discussed in greater detail in Chapter 6.

The simple descriptive and univariate analyses produced as part of this study provided valuable information about Irish PLDs, revealing them as diverse, in terms of

their personal characteristics, and their previous experiences with driving and being a passenger. These findings may be of some interest to researchers, programme developers and policy makers. The results in Chapter 3, which focussed on measuring personality traits, suggested that relatively short inventories e.g. BIS-15 test of impulsiveness (Spinella, 2007) and the IPIP-50 test of Big-Five personality factors (Goldberg, 2011) were suitable for use with adolescents in the 15 – 17-year age group. However, the present research supported previous findings (e.g. Roth & Hertzberg, 2004) regarding the inadequacy of the AISS (Arnett, 1994). Given that the research community has been aware of this problem for some time, and given that the validity of the best-known alternative i.e. Zuckerman's Sensation Seeking Scale, Form V (Zuckerman 1996) for adolescent populations has also been challenged, and given that sensation seeking is a significant predictor of risk taking in adolescents, it is very surprising that no apparent effort has been made thus far to develop an improved, adolescent-friendly sensation seeking scale. This should be done as a matter of urgency. Over 80% of the students who participated in this research reported that they intended to obtain an LDP as soon as this was possible, thus the inclusion of PLDE as part of the senior cycle curriculum in secondary school appears timely. The current research also suggested that there was an unacceptably high incidence of un-licenced driving and of driving without proper supervision in the current sample. Such problem should be addressed as part of PLDE interventions.

9.5 Methodological strengths and limitations

Although issues pertaining to reliability and validity were discussed according as they arose in the preceding chapters, the following serves to summarise these strengths and weaknesses for ease of reference.

9.5.1 Strengths

Viewed in the context of previous investigations into DE, the current research was innovative to the extent that it employed a number of sophisticated data analysis techniques, including IRT and HLM analyses, which served to improve the reliability and validity of the findings.

IRT analysis employs sophisticated methodology to calculate peoples' ability to responding to test items (DeMars, 2010). Evidence presented in Chapter 5 suggested that IRT analysis is useful for identifying items that do not differentiate between or which discriminate against testees (Lord, 1980). Research has shown that this method is better able to produce valid achievement scores than are more traditional scoring mechanisms, especially where tests that have not been validated previously (see Hambleton et al., 1991), as was the case in the current research. The results of the IRT analysis in this research provided information about the strengths and weaknesses in students' knowledge. This should assist programme developers to orient their courses to better suit students' needs and thereby to improve the efficiency and effectiveness of their courses. For instance, the current results suggested that students were quite knowledgeable about issues such as impaired driving (e.g. DWI, drowsiness), but knew considerably less about speed limits and driving manoeuvres which pose problems for young novice drivers.

Researchers in a wide range of disciplines, most notably the educational sphere (e.g. Flannery et al., 2003; Kreft, 1993) routinely employ multilevel modelling techniques such as HLM to account for variations in their data whilst simultaneously controlling for clustering effects (Raudenbush & Bryk, 2002). Clustering occurs when research participants are nested in groups (e.g. school classes) or where research is based on a repeated measures design. Although the vast majority of DE research involves the testing of nested groups, often using longitudinal designs, this researcher was unable to find a single DE study which reported that steps had been taken to test for and where necessary to

control for clustering effects. This suggests that the statistical requirement to control for clustering is poorly understood in the traffic safety community (see Dupont & Martensen, 2007 for a good description of how multilevel modelling can be used in traffic research). The various advantages and disadvantages associated with HLM methodology in general and in its application in the current research were discussed in detail in Chapter 2. In sum, the main advantage of HLM is that it allows researchers to investigate the inter-relationships between a wide range of variables which are associated with multiple levels of analyses (e.g. intra-individual, between-individuals and between-groups factors). The main disadvantages of this methodology are that the use of these techniques reduce the likelihood of obtaining statistically significant results and that relatively large samples are required to provide HLM studies with sufficient statistical power to reveal significant results where these exist. For example, whereas it is acknowledged that the current study came very close to satisfying power requirements outlined by Raudenbush (2008), the possibility that this study did not have sufficient power to detect significant results cannot be ruled out conclusively. Despite the difficulties that are involved in implementing multilevel modelling techniques such as HLM, it is nevertheless clear that such techniques provide mechanisms whereby researchers can make progress in examining the complex array of factors that influence human cognition, affect and behaviour. Thus, it is recommended that the traffic research community should embrace the new methodologies, such as multilevel modelling and IRT analyses in situations where their use is warranted.

9.5.2 Limitations

Despite these strengths, the current results need to be considered in the context of a number of procedural, conceptual and methodological limitations.

9.5.2.1 Procedural limitations

Although a number of steps were taken to increase reliability and validity in this research there were some limitations as to what could be done for operational reasons e.g.

the availability of human resources, time and funding. First, it is acknowledged that the ability of the current research to produce results that were generalizable to the PLDE population as a whole was somewhat constrained since it used a quasi-experimental design and used opportunity based population sampling methods. Second, although efforts were made to recruit a large sample of students which would be reasonably representative of the Irish PLD population in terms of gender, SES and PLDE education status, it should be acknowledged that the resulting sample did contain some imbalances in these demographics. Furthermore, because testing was conducted in a large number of schools where the delivery schedules for PLDE differed considerably, it was not possible to standardise the between-test intervals in a completely rigorous way. However, every effort was made to reduce sampling bias through the provision of matched active/control groups where possible and by ensuring that incidences of attrition were random and low. All of these issues were discussed in more detail in Chapter 2.

Whereas evaluations of social programming interventions typically involve the assessment of individual programmes, the current research adopted a broader approach by including five different programmes in the research design. Despite the obvious advantage of this strategy in terms of gaining a better understanding of the effects of PLDE on Irish adolescents, the limitations associated with this approach, which have been outlined previously, need to be reiterated. First, whereas programme evaluation usually involves assessing the extent to which programme objectives have been met (Clinton & Lonero, 2006a), since this research involved multiple programmes, each with their own objectives, this type of assessment was not feasible in the current circumstances. Instead, the various tests that were used in this research were formulated on the basis of theoretical considerations with respect to the type of content that should (ideally) be part of a good PLDE course. Since it is acknowledged that these ideal standards were bound to differ from the standards adopted by individual course developers, the current results cannot be

construed as reflecting positively or negatively on any of the individual programmes that featured in this research. However, since a wide range of tests, incorporating many test items were used as part of the summative evaluations in this research it is reasonable to suggest that the current results represent a reasonably fair and accurate reflection of driving-related knowledge, risk perception skills and attitudes in the current sample over time and as a function of PLDE status. It is also argued the content of these tests addressed important driving-related criteria and that these ought to have been included as part of a good PLDE course. The educational and policy implications of the apparent heterogeneity in the PLDE provision for TY students with respect to course content and delivery were discussed in greater detail in Chapter 8.

9.5.2.2 Conceptual limitations

Although current efforts to explain variations in driving-related knowledge, risk perception skills and attitudes were unsuccessful the results of the HLM analyses suggested that a large proportion of the variance in these models was attributable to intra-student time-dependent factors. Since the inclusion of age and time as predictors did very little to reduce variations in these models, it was concluded above that the remaining variations were most likely due to maturational factors. Although it is difficult to see at present how currently emerging findings with respect to neurobiological development might be used to develop the kinds of measures that could be applied in the field, it is nevertheless acknowledged that the lack of such measures represented a considerable limitation in this research. However, some steps could be taken to begin to address maturational influences in future research. For example, although measures of trait impulsiveness and sensation seeking were included as part of the current research, these were measured just once, because it was not expected that such influences would change perceptibly within the 18-month period when testing in this project was taking place. Nevertheless, since previous research suggests that some changes do occur in

impulsiveness and sensation seeking during adolescence (Steinberg et al., 2008) it would be interesting to see if such changes might account for some of the variation in driving-related outcomes in PLDS at intra-student level. This would necessitate the inclusion of measures to test these traits at each stage in longitudinal studies.

9.5.2.3 Methodological limitations

This study relied entirely on self-report questionnaires, because this approach was particularly suited to measuring driving-related knowledge, risk perception skills and attitudes in this large sample of PLDs. Nevertheless, it is widely-acknowledged that the validity self-report data can be negatively impacted by confounds, such as social desirability (Crowne & Marlowe, 1960). Two factors contribute to incidences of socially desirable responding; impression management and self-deception (Paulhus, 1984). Impression management occurs where individuals deliberately attempt to present a favourable image and thus tends to be problematic in group testing sessions. Self-deception occurs where individuals provides subjectively honest, but positively biased self-descriptions (Paulhus, 1984). Although research suggests that adolescents may be more susceptible to the problem of social desirability than adults (J. D. Brown, 1986), it has also been found that school-going adolescents tend to report their behaviours and attitudes with reasonable accuracy (Killen & Robinson, 1988). Furthermore, the results from the present research in relation to the DBQ (Reason et al., 1990) items showed that students' evaluations of their principal driver were broadly in line with the findings in other DBQ studies (Åberg & Rimmö, 1998; Lajunen et al., 2004), which supports the validity of the current findings. Research also indicates that the validity of self-report data can be improved through the provision of assurances of confidentiality, the establishment of good rapport and by focussing on relatively recent events (Brener, Billy, & Grady, 2003) and all of these safeguards were included as part of this research. Moreover, the current students were provided with regular and timely reminders to refrain from interacting with their

classmates and also to respond accurately and openly to the questionnaire items. Although it is notoriously difficult to address problems associated with self-deception bias, this research made some attempt to do so by including one item which served as a measure of implicit cognition (i.e. the vignette) and thus was not subject to self-deceptive influences.

9.6 Concluding remarks

The current results contribute towards an ever-increasing body of evidence which demonstrate that biological antecedents and subsequent social factors play a defining role in the establishment and maintenance of driving-related knowledge and cognitions, against which current forms of driver education remain relatively ineffective. The strongest conclusion that can be drawn from this research is that educational initiatives that focus on developing driving-related knowledge, cognitive skills and attitudes in individual PLDs are unlikely to succeed unless they are supported by initiatives that focus on changing driving culture at all levels of the society. Nevertheless, by using a broad psychosocial framework, sophisticated methodologies and a longitudinal design, this research provided unique insights into the driving-related knowledge, risk perception skills and attitudes of Irish PLDs and that these can be used to inform the future development of road safety policy for this age group and also to improve the efficiency and effectiveness of PLDE programmes.

Whereas the current incidence of RTCs and the resulting toll of death and injury, particularly amongst young novice drivers is socially, morally and financially unacceptable, it should be remembered that road safety has become a great public health success story in recent years. In the relatively short lifespan of this project (i.e. from 2009 to 2012), there was a 32% reduction in RTC-related deaths here in Ireland. However, the sustainability of this downward trend will likely depend on the continued application of a safe systems approach and attendant efforts to improve engineering, enforcement, education and evaluation (RSA, 2013b). Hopefully, this research has made some small contribution with respect to these latter.

9.7 References

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Chapter 10: Appendices

10.1 Appendix A. Details of pre-learner driver education courses

The details of the PLDE courses that were used by the school groups who participated in this study are provided below. However, the names of these courses have been withheld, for reasons of commercial sensitivity.

10.1.1 Programmes A and B

Programmes A and B were based on a single curriculum and this was developed for specifically for TY students in collaboration with the NCCA (National Council for Curriculum Assessment), the Department for Education and Science and the Transition Year Support Service. It includes lesson plans that were prepared by a multi-agency team which consisted of teachers, and personnel from the Road Safety Authority (RSA), the National Ambulance Training Centre, Bus Éireann, An Garda Síochána, the National Car Test and the Health and Safety Authority. The programme was designed to build on the work of the Civic, Social and Political Education resource “Streetwise”.

Although both programmes are identical in design, programme A involves forty five hours of tuition, whereas programme B involves just twenty hours of tuition. Although the majority of the activity is class-room based there is some degree of flexibility in the way that time can be used. Suggested timetable arrangements for programme A are;

- Across the full school year – 1 x double class period per week
- 26 hours class time + 9 hours self-directed learning
- 15 Weeks – 2 x double class periods per week
- 30 hours class time + 15 hours of self-directed learning

- 10 Weeks – 1 x double plus 1 x single class periods per week
- 27 hours class time + 18 hours of self-directed learning

Suggested timetable arrangements for programme B are;

- 15 weeks – 1 x double class period per week
- 20 hours class time

10.1.1.1 Materials and resources

Lesson plans and support materials (including a DVD) are contained in the course manual, which is supplied to teachers who have completed in-service training. These materials include programme instructions, a description of learning outcomes, worksheets, and time management tools. There is no student textbook for these courses; instead teachers are encouraged to reproduce worksheets and other study materials using the teaching manual. A list of approved guest speakers is also provided including:

- Garda Síochána presentation “It Won’t Happen to Me” (90 minutes).
- National Car Testing Service (90 minutes)
- Interactive presentation on the Driving Test.
- Health Service Executive, National Ambulance Service (90 minutes)
- A DVD covering first aid at the scene of a road crash is also provided.

10.1.1.2 Contents

The course is divided into 4 main sections, each containing a number of lessons

Section 1: About Road Safety

1. Introduction to Road Safety
2. Who’s Who in the Road Safety Business
- 3 - 4. Pedestrians and Cyclists
5. Motorcyclists
- 6 - 7. Safety Belts/Child Restraints/Airbags/Loose Objects

Section 2: Killer Behaviour

- 8 - 9. Speed and Speeding
- 10 - 11. Alcohol and Driving
- 12 - 13. Drugs and Driving
- 14 - 15. Hazard Perception
- 16 - 17. Driver Fatigue

Section 3: The Emergency Services

- 18 - 19. Garda presentation – “It Won’t Happen to Me”
- 20 - 21. Action in an Emergency – Road Sense at a Traffic Collision
- 22. Living with the Impact of Road Traffic Collisions

Section 4: Getting Ready to Drive

- 23. The Driving Test, Motor Tax and Insurance
- 24 - 25. The NCT Test
- 26 - 27. Driving Abroad
- 28-31. Driver Theory Test

Teachers are given a considerable amount of latitude with regard course presentation. They are advised that they do not necessarily need to present these study units in any particular order and that they should also adapt the course to suit local contexts since there may not be enough time to complete all activities outlined in the manual. Teachers can use their own discretion and choose the most appropriate activities for each class. For instance, the teacher manual also states that the relevant Driver Theory Test learning can be included at the end of each module.

10.1.1.3 Costs and Benefits

- There are no financial costs to either schools or individual pupils who participate in this course.

- Students receive no accreditation or financial incentives.

10.1.2 Programme C

The course design incorporates 3 phases of driver instruction:

- Education Course - 20 hours classroom based driver education
- Driving Instruction - 10 hours of driving tuition
- Structured Driving Practice - 40 hours of structured practice with a mentor

10.1.2.1 Course content

The present research focused solely on the Education Course element of this programme. This 20 hour module was developed specifically to address the needs of Irish pre-drivers. It focuses on knowledge development in relation to road systems, laws, rules and regulations. It is structured around NCCA criteria for transition year, targeting attitudes, motivations and behaviour, which are widely acknowledged as crucial elements in reducing road related death and injury. Students do no hands-on driving as part of the course.

10.1.2.2 Course Delivery

The course can be delivered in two different ways:

Staff teachers can be trained to deliver the programme:

- Staff teacher deliver the programme during normal school hours
- No course fee for Students
- Students only pay the value of their textbooks

Course developers deliver the course:

- School offers course as an option to students
- School provides classroom during or after school hours
- Student pays course fee

10.1.2.3 Materials and resources

Course teachers are provided with a course manual, a driver theory test CD, DVD and computer presentations, a workshop activity guide and two sets of review quizzes. The students receive a student manual, a drivers' log book, a mentors guide, a driver theory test CD and manual and an application form for a learner driver permit.

10.1.2.4 Costs and Benefits

Fees when staff teachers deliver the course:

- €750 one-off payment for teacher training including teaching resources
- €50 per capita fee for each student to cover the cost of student resources.

Fees when course developers deliver the course the fees are;³²

- €190 per capita for a class of 11-15 students
- €155 per capita for a class of 16-20 students
- €125 per capita for a class of 21-25 students

On successful completion students receive

- €100 voucher off their 1st Motor Insurance Policy with most of Leading Irish Insurance companies
- Students are awarded an attendance certificate for their TY portfolio

10.1.3 Group D – Programmes developed by individual schools

Students in group D participated in one of a variety of pre-driver education programmes that were developed within their own schools, usually on an ad-hoc basis. Although the contents of these courses varied slightly from school to school, they each bore a close resemblance to programmes A, B and C in terms of both content and method of delivery: They were modular in design, and were delivered in the classroom during a single school term, by a transition year teacher and occasional guest speakers. Similarly,

³² These details were correct at the beginning of the study i.e. September, 2009.

students also watched road safety DVDs, participated in class discussions, and learned the Rules of the Road. Students in group 21, who took programme D5 (see Appendix B) used an additional computer-based hazard perception test on several occasions during the course and progress was monitored by the class teachers.

10.1.4 Group E – One day courses

10.1.4.1 Programme E1: One-day driver education module

This course was developed to educate young adults about the dangers of driving before they get behind the wheel, and consists of two three-and-a-half hour sessions, During the first session students are shown the consequences of road traffic crashes and the later session focuses on demonstrating safer strategies and procedures. Parts of the programme are interactive and the students are encouraged to participate as much as possible. The course is delivered by the course developers during school hours, on school premises.

Materials and resources

The course is delivered via Multi-media including

- Video
- DVD
- PowerPoint

Content

Session 1 consists of graphical depictions of what can happen when a vehicle is in the hands of an irresponsible driver.

Topics areas covered by the programme include:

- The consequences of dangerous driving.
- Adopting the correct attitude.

- Speed Kills
- Anticipation and hazard awareness.
- Vulnerable road users.
- Seat belts.
- Mobile phones and driving.
- Practical advice on learning to drive and insurance.
- Correct procedures for learning how to drive
- Picking a driving instructor i.e. how to pick a driving instructor
- Mock Driver Theory Test

Costs and Benefits

- Cost for the presentation is €370 per day for the entire class.
- Students receive a folder with practical advice relating to
 - The Rules of the Road
 - The Driving Test
- Graduates receive a certificate of attendance
- On production of this certificate, plus evidence of completion of a series of driving lessons from a recognized driving instructor, students will receive the equivalent of their first year's 'no claims' bonus' immediately from a range of motor insurers.

10.1.4.2 Programme E2: Driver education and training module

This one-day course was specially designed for TY students, and consists of a one-day education/training module.

Course Delivery

The course is delivered by programme staff at a specially designed facility and

includes;

- Classroom education
- Behind-the-wheel driver training

Education and training sessions alternate between groups, which means that some students take the education session first and others take the training session first.

Contents

The following issues are covered by the course

- Rules of the Road
- Recognizing Road Signs
- Anti-Drink/Drugs/Speeding
- Motoring Skills
- Lane Discipline and Road Rage
- Real accident scenarios
- Accidents/insurance
- Risk Perception Skills
- Car Familiarization

Costs and benefits

- No details of costs available at the time of printing
- Students receive a certificate for participation

10.1.4.3 Car and road safety demonstration

This involved a 3-hour structured lecture and demonstration using a car that has been modified so that the internal mechanisms were easily visible. Students then received hands on practice with the various components in the car, while it remained in a stationary position. This course was delivered in school groups 1, 3, 5, 6, 10, 21, 22, 25, 26 and 27.

Contents

- Various crash scenarios are explained in detail.
- The importance of the adjustment of the head restraint to avoid serious neck injury in a crash is another safety measure examined.
- Proper positioning of the safety belt, dash-board symbols and engine management lights are examined.
- How to identify worn tyre tread depth and worn brakes are also shown.

Costs/Benefits

- Cost per day ranges from €350 to €500 per school.
- Students are awarded an attendance certificate for their TY portfolio

10.3 Appendix B. Information/consent form (Schools)



Information/ Consent Letter for all TY Schools



'Trinity College Dublin – Transition Year Driver Education Study' Did you know...?

- *Traffic crashes are the No 1 Killer of teenagers in the developed world.*
- *279 people were killed on Irish roads in 2008.*
- *One third of those killed were between 16 and 25.*

Source: Road Safety Authority (2008)OECD (2006).

The Road Safety Authority is supporting research being conducted by the School of Psychology, Trinity College, Dublin, which aims to evaluate educational interventions being delivered to Irish adolescents during transition year and compare these to a variety of interventions which are currently available both nationally and internationally. The research will be questionnaire-based and will commence in September 2009. The study will examine the impact of transition year education programmes on the road safety-related knowledge, skills, attitudes, decision-making and consequent behaviour of adolescent students.

It will identify which specific characteristics of the programme's content and delivery facilitate or inhibit the assimilation of safety information, and what alternative content, structures and methodology would improve the rate of transfer of knowledge, skills and attitudes in adolescent road users. Additionally, it will examine the influence of proximal and distal human factors present during adolescence on: attention to programme content, retention of knowledge, skills learned and subsequent reproduction of behaviours conducive to safe road use and responsible citizenship.

There are tangible benefits in participating in this study for your pupils, your school and also the wider community:

- The evaluation should enable us to pinpoint those facets of driver education and training which appear to be most effective in improving drivers' knowledge, skills and attitudes. Subsequent focus on these elements will help save time, effort and resources for your students, school and community.
- Schools will have an opportunity to play an active part in the accumulation of scientific evidence that will serve to inform best practice in the domain of pre-driver education in Ireland and internationally.
- Students will gain valuable experience of participating in socially relevant research

Confidentiality is assured for all participating schools and their students. If you would consider allowing your school to participate in this research please complete and return the form attached below at your earliest convenience.

Driver Education Evaluation

Schools' Consent Form

School Name: _____

Address: _____

Telephone: _____
 TY Coordinator Name: _____
 Tel/Mobile: _____
 E-mail: _____

School Catchment	Mainly Rural	Mainly Urban
Area (please tick)		

Driver Education Programme(s) on TY curriculum (Please tick)

RSA "Your Road to Safety" (Full Programme)	
RSA "Your Road to Safety" (Fast-track Programme)	

Other programmes

Name	Provider	Contact Details

TY Class 2009-2010 Details	Female	Male
Students		
Under 16 Yrs		
Total		

School Facilities	Yes	No
Students have access to Computers		
Students have access to Internet		
We would consider participating online		

Students participating in this research will be asked to complete a questionnaire designed to measure their driving-related knowledge, skills and attitudes on three separate occasions; once in Sept '09, then again in Apr/May '10 and finally in Jan/Feb '11. Sample questionnaires will be available from August 2009 and can be forwarded on request.

Please tick the box to indicate that you agree to facilitate this research by providing a venue for testing and also by recommending participation to your students.

Your Name: _____ ☐
 On behalf of _____
 School Name

Principal Researcher
 Margaret Ryan,
 School of Psychology,
 Aras an Phiarsaigh,
 Trinity College,
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10.4 Appendix C. Participating schools by location and PLDE course.

School ID	County	School gender	Course code	Participants
1*	Kildare	Female	A	73
2	Louth	Mixed	A	58
3	Carlow	Male	A	47
4	Dublin	Male	A	44
5	Dublin	Mixed	A	22
Sub-total A				244
6*	Cork	Mixed	B	84
7	Dublin	Female	B	76
8*	Wexford	Mixed	B	71
9	Wicklow	Female	B	65
10*	Limerick	Mixed	B	56
11	Cork	Mixed	B	45
12	Cavan	Male	B	19
13	Dublin	Mixed	B	13
Sub-total B				429
14	Dublin	Mixed	C	68
15	Dublin	Mixed	C	58
16	Dublin	Female	C	47
17	Dublin	Mixed	C	37
18	Dublin	Female	C	30
19*	Dublin	Male	C	25
Sub-total C				265
20	Dublin	Male	D (1)	90
21	Mayo	Male	D (2)	89
22*	Limerick	Male	D (3)	46
23	Kilkenny	Mixed	D (4)	24
24	Dublin	Female	D (5)	20
Sub-total D				269
25	Cavan	Mixed	E (1)	24
26	Cavan	Female	E (1)	16
27*	Kerry	Mixed	E (1)	53
28	Meath	Female	E (2)	27
29	Mayo	Male	E (2)	41
Sub-total E				161
30	Cork	Female	Dropped out	117
31	Cork	Male	Dropped out	71
32	Clare	Mixed	Dropped out	33
Sub-total dropouts				221
(cont.)				

School	County	School gender	Course code	Participants
33	Dublin	Female	Controls	89
34	Dublin	Male	Controls	20
35	Dublin	Male	Controls	91
36	Kerry	Mixed	Controls	21
37	Wexford	Mixed	Controls	19
38	Cork	Mixed	Controls	19
39	Limerick	Male	Controls	17
40	Limerick	Mixed	Controls	8
41	Kildare	Female	Controls	7
Sub-total Controls				291
Overall total				1880

* These schools provided participants for both the active PLDE groups and for the control group

10.5 Appendix D. Time 1 (T1) - Pre-intervention questionnaire³³

TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T1

1. PARTICIPANT INFORMATION & CONSENT.

1. The school that you attend has agreed to participate in this research project, designed at TCD, to evaluate pre-driver education in Ireland.

This survey aims to measure the impact of pre-driver / road safety education programmes, on students' knowledge, skills, attitudes and behaviour, over time. It will also examine some factors that are thought to influence the ways in which students engage with these programmes. The research will be conducted using questionnaires that should take you around 50 minutes to complete. You will be asked to do this on 3 separate occasions: Once in Autumn 2009, then again in April/May 2010 and finally in January/February 2011.

Participants must be under 21 years old at the outset and students who are under 16 years old must have their parent' approval before joining in the study. If you agree to participate, any information that you provide will remain CONFIDENTIAL. All questionnaires will be securely stored in the School of Psychology TCD. Only the researchers listed below will have access to these records. You will be at liberty to withdraw from the study at any time without prejudice. Your rights under the Freedom of Information Act 1977 (amended 2003) will be respected at all times.

This project is being conducted by researchers from the School of Psychology, TCD, Dublin 2.

Margaret Ryan (Principal Researcher). E-mail: ryanf1@tcd.ie.

Dr. Michael Gormley (Supervisor).

E-mail: michael.gormley@tcd.ie. Tel: 01-8963093.

Dr. Kevin Thomas (Supervisor).

E-mail: kthomas@tcd.ie. Tel: 01-8963237.

Please click here to indicate that you have read and understood the above and that you agree to participate in this study.
Then press "NEXT" to go to the next page.

*

C

³³ The original surveys were worded to suit on-line participation. Since subsequent testing was conducted in person, students were told verbally to apply these instructions to suit that format.

TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T1

2. PERSONAL DETAILS & BACKGROUND

To begin with, we would like to know a little bit about your background and your previous experiences as a road user.

Please use your mouse to point and click on your choices (unless you are directed to do otherwise). If you make a mistake or change your simply click again in the correct place, ensuring that your original tick mark has been deleted.

When you have completed this part of the survey, please press "NEXT" at the end of the page to go to the next section.

Although we do not want to be able to identify you personally, we would like to be able to match this questionnaire with others that you will be completing for us in the future. The best way to do this is to label the questionnaires with information that won't mean anything to us, but which will allow us to group your responses over time.

***2. Therefore, please type your MOTHER'S INITIALS and the MONTH and DAY of her birth in the spaces provided below.**

Mother's INITIALS	
Mother's Birth MONTH	
Mother's Birth DAY	

3. Where do you live? (Choose 1 option)

- ☐ 1.City / Town ☐ 2.Rural Area

***4. Gender. (Choose 1 option)**

- ☐ 1.Male ☐ 2.Female

***5. Age. (Choose 1 option)**

- ☐ 14 ☐ 15 ☐ 16 ☐ 17 ☐ 18 ☐ 19 ☐ 20

6. Parents' (Guardians') Education.

(Choose ONLY the HIGHEST qualification that EACH of your parents/guardians have achieved)

	1.Father (Male Guardian)	2.Mother (Female Guardian)
1.No recognized qualification	☐	☐
2.Junior Cert (or equivalent)	☐	☐
3.Leaving Cert (or equivalent)	☐	☐
4.Trade Qualification (City & Guilds etc.)	☐	☐
5.3rd Level (degree, diploma, certificate)	☐	☐
6.4th Level (masters, doctorate)	☐	☐

TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T1

7. Will you be taking any of these driver education/training programmes in the next 12 months? (Choose 1 option for each programme)

	Yes in 2009	Yes in 2010	No	Not sure / don't know
1. Your Road to Safety - Full 40 hour programme (RSA)	☐	☐	☐	☐
2. Your Road to Safety - Fast-track 20 hour programme (RSA)	☐	☐	☐	☐
3. Steer Clear	☐	☐	☐	☐
4. Drive for Life	☐	☐	☐	☐
5. Irish School of Excellence	☐	☐	☐	☐
6. Think Awareness	☐	☐	☐	☐
7. School of motoring driver training	☐	☐	☐	☐
8. Sim2Learn Driving simulator training	☐	☐	☐	☐

Other (please specify)

8. When do you intend to apply for a Learner Permit to drive?

(Choose 1 of these options)

☐ 1. When I am 17
 ☐ 2. When I am 18
 ☐ 3. When I am 19
 ☐ 4. No plans at present

9. Have you "driven" any of these vehicles in the past 12 months?

(Choose 1 option for each vehicle)

	1. Never	2. A few times	3. Once a month	4. Once a week	5. Several times weekly	6. Every day
1. Bicycle	☐	☐	☐	☐	☐	☐
2. Motor Bike/Scooter	☐	☐	☐	☐	☐	☐
3. Car	☐	☐	☐	☐	☐	☐
4. Farm/Industrial Machinery	☐	☐	☐	☐	☐	☐

10. Have you ever driven a car? (Choose 1 option)

☐ 1. No
 ☐ 2. Yes

11. If you have driven a car since, who was with you?

(Choose ONE option on EACH row)

	1. Always	2. Sometimes	3. Never
1. Professional Driving Instructor	☐	☐	☐
2. Parent with full driving license	☐	☐	☐
3. Other Adult with full license	☐	☐	☐
4. Friends with full license	☐	☐	☐
5. Friends with Learner Permit	☐	☐	☐
6. Friends without license	☐	☐	☐
7. I was alone	☐	☐	☐

TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T1

12. Have you been involved in any of these types of Road Traffic Crashes in the past 5 YEARS? (Choose 1 option for each item)

	1.Never	2.Once	3.Twice	4.Three times or more
1.Minor Property Damage Crash	☐	☐	☐	☐
2.Minor Injury / Moderate Property Damage Crash	☐	☐	☐	☐
3.Severe Serious Injury / Loss of Life Crash	☐	☐	☐	☐

13. Apart from crashes that you were also involved in, has anyone close to you been involved in any of these types of Road Traffic Crashes in the past 5 YEARS? (Choose 1 option for each item)

	1.Never	2.Once	3.Twice	4.Three times or more
1.Minor Property Damage Crash	☐	☐	☐	☐
2.Minor Injury / Moderate Property Damage Crash	☐	☐	☐	☐
3.Severe Serious Injury / Loss of Life Crash	☐	☐	☐	☐

TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T1

3. PERSONALITY (AISS)

Now we would like you to tell us something about yourself, as a person.

When you have completed this part of the survey, please press "NEXT" at the end of the page to go to the next section.

14. Please read the following statements and choose the response opposite each one, that best describes you.

	1.Describes me very well	2.Describes me somewhat	3.Does not describe me very well	4.Does not describe me at all
1. I can see how it would be interesting to marry someone from a foreign country	☐	☐	☐	☐
2. When the water is very cold, I prefer not to swim even if it is a hot day	☐	☐	☐	☐
3. If I have to wait a long time, I am usually patient about it	☐	☐	☐	☐
4. When I listen to music, I like it to be loud	☐	☐	☐	☐
5. When taking a trip, I think it is best to make as few plans as possible and just take it as it comes	☐	☐	☐	☐
6. I stay away from movies that are said to be frightening or highly suspenseful	☐	☐	☐	☐
7. I think its fun and exiting to perform or speak before a group	☐	☐	☐	☐
8. If I were to go to an amusement park, I would prefer to ride the roller coaster or other fast rides	☐	☐	☐	☐
9. I would like to travel to places that are strange and far away	☐	☐	☐	☐
10. I would never like to gamble with money, even if I could afford it	☐	☐	☐	☐
11. I would have enjoyed being one of the first explorers of an unknown land	☐	☐	☐	☐
12. I like a movie where there are a lot of explosions and car chases	☐	☐	☐	☐
13. I do not like extremely hot and spicy food	☐	☐	☐	☐
14. In general, I work better when I am under pressure	☐	☐	☐	☐
15. I often like to have the TV on while I am doing something else, such as reading or cleaning up	☐	☐	☐	☐
16. It would be interesting to see a car accident happen	☐	☐	☐	☐
17. I think it is best to order something familiar when eating in a restaurant	☐	☐	☐	☐
18. I like the feeling of standing next to the edge on a high place and looking down	☐	☐	☐	☐
19. If it were possible to visit another planet or the moon for free, I would be among the first to sign up	☐	☐	☐	☐
20. I can see how it must be exciting to be in a battle during a war	☐	☐	☐	☐

TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T1

4. PARENT'S (GUARDIAN'S) DRIVING STYLE

We would like to know something about your parent's (guardian's) driving style.

Please try to answer as fully and honestly as you possibly can. Remember, the information you give here will remain confidential.

When you have completed this part of the survey, please press "NEXT" at the end of the page to go to the next section.

15. Do your parents (guardians) follow the rules of the road?

(Choose 1 option for each parent / guardian)

	1.Never	2.Hardly Ever	3.Occasionally	4.Quite Often	5.Most of the time	6.Always
Father (Male Guardian)	☐	☐	☐	☐	☐	☐
Mother (Female Guardian)	☐	☐	☐	☐	☐	☐

16. Do your parents (guardians) stick to the speed limit?

(Choose 1 option for each parent/guardian)

	1.Never	2.Hardly Ever	3.Occasionally	4.Quite Often	5.Most of the time	6.Always
Father (Male Guardian)	☐	☐	☐	☐	☐	☐
Mother (Female Guardian)	☐	☐	☐	☐	☐	☐

17. Do your parents (guardians) drive even though he/she realizes that she/he may be over the legal alcohol limit?

(Choose 1 option for each parent/guardian)

	1.Never	2.Hardly Ever	3.Occasionally	4.Quite Often	5.Most of the time	6.Always
Father (Male Guardian)	☐	☐	☐	☐	☐	☐
Mother (Female Guardian)	☐	☐	☐	☐	☐	☐

18. Do your parents (guardians) wear a seatbelt when they travel in cars?

(Choose 1 option for each parent/guardian)

	1.Never	2.Hardly Ever	3.Occasionally	4.Quite Often	5.Most of the time	6.Always
Father (Male Guardian)	☐	☐	☐	☐	☐	☐
Mother (Female Guardian)	☐	☐	☐	☐	☐	☐

19. Do your parents (guardians) use a mobile phone while driving?

(Choose 1 option for each parent/guardian)

	1.Never	2.Hardly Ever	3.Occasionally	4.Quite Often	5.Most of the time	6.Always
Father (Male Guardian)	☐	☐	☐	☐	☐	☐
Mother (Female Guardian)	☐	☐	☐	☐	☐	☐

TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T1

20. Now think about the driver with whom you travel most frequently. How often does he/she do any of the following: (Choose 1 option for each item)

1 = Never:::::: 2 = Hardly Ever:::::: 3 = Occasionally:::::: 4 = Quite Often:::::: 5 = Frequently:::::: 6 = Most of the Time

	1	2	3	4	5	6
1. Cross a junction knowing that the traffic lights have already turned against her/him	☐	☐	☐	☐	☐	☐
2. Sound the horn to indicate his/her annoyance with another road user	☐	☐	☐	☐	☐	☐
3. Stay in a motorway lane that she/he knows will be closed ahead until the last minute before forcing his/her way into the other lane	☐	☐	☐	☐	☐	☐
4. Overtake a slow driver on the inside.	☐	☐	☐	☐	☐	☐
5. Travel especially close to the car in front as a signal to its driver to go faster or get out of the way.	☐	☐	☐	☐	☐	☐
6. Have an aversion to a particular class of road user (e.g. older people, women, non-nationals) and indicates their hostility by whatever means they can.	☐	☐	☐	☐	☐	☐

TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T1

5. ATTITUDES & KNOWLEDGE

The questions in this part of the survey focus mainly on your knowledge about and attitudes towards road safety issues.

When you have completed this part of the survey, please press "NEXT" at the end of the page to go to the next section.

21. What are your views on each of these driving-related issues?

(Choose 1 option for each statement)

1 = Strongly Agree :::: **2 = Agree** :::: **3 = Neither** :::: **4 = Disagree** :::: **5 = Strongly Disagree**

	1	2	3	4	5
1. Learning to drive will be easy for me	☐	☐	☐	☐	☐
2. Avoiding accidents over a long period is basically down to luck	☐	☐	☐	☐	☐
3. I will find it very difficult to follow the rules of the road all of the time	☐	☐	☐	☐	☐
4. Even with all the thousands of cars on the roads, there's a lot I can do by myself to avoid an accident	☐	☐	☐	☐	☐
5. If we just do what our teachers, parents and the authorities tell us we will go through life like robots, never fully enjoying things	☐	☐	☐	☐	☐
6. Lots of drivers are careless. I can't do anything about it if they crash into me	☐	☐	☐	☐	☐
7. The government/authorities are mainly responsible for improving road safety	☐	☐	☐	☐	☐

22. How many people were killed on the roads in the Republic of Ireland in 2008? We are merely interested in your best estimate as opposed to the correct answer.

Please enter YOUR ESTIMATE in this box

23. Here are some common driving manoeuvres. Which ones are known to be particularly problematic for young learner drivers.

(Choose as many as you wish)

☐ 1. Taking right hand turns	☐ 4. Overtaking
☐ 2. Changing lanes	☐ 5. Rear-end shunt of car in front
☐ 3. Negotiating bends	☐ 6. Negotiating roundabouts

24. What are the chances that a TYPICAL (AVERAGE) ROAD USER will be involved of these types of traffic crashes in the next 5 years?

(Choose 1 option for each item)

	1. Very Unlikely	2. Unlikely	3. 50/50 Chance	4. Likely	5. Very Likely
1. Minor Property Damage	☐	☐	☐	☐	☐
2. Moderate Property Damage / Minor Injury	☐	☐	☐	☐	☐
3. Severe Serious Injury / Loss of Life	☐	☐	☐	☐	☐

TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T1

25. What is the fastest speed a driver could safely go, under good conditions, on each of these road types? Speeds are listed in kilometers per hour.

(Choose 1 option for each item)

	30	40	50	60	70	80	90	100	110	120	130
1. Motorway	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
2. Town / City Road	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
3. National Road	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4. Local Road	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

26. How much driving experience do you think you will need to have, before your chances of having a crash are the same as those of the average mature driver?

(Choose 1 of these options)

☐ 1. Less than 1 year	☐ 3. Between 3 & 5 Years	☐ 5. Between 7 & 9 Years
☐ 2. Between 1 & 3 Years	☐ 4. Between 5 & 7 Years	☐ 6. More than 9 years

27. In your opinion, could a driver, through personal skill alone, AVOID crashing or becoming injured while engaging in the following activities?

(Choose 1 option for each item).

	1. Always	2. Often	3. Rarely	4. Never
1. Exceeding the speed limit by 10 km/h in a 50 km/h zone	☐	☐	☐	☐
2. Driving after drinking 4 units of alcohol	☐	☐	☐	☐
3. Driving after using prescription drugs	☐	☐	☐	☐
4. Travelling in a car where people are not wearing seatbelts	☐	☐	☐	☐
5. Exceeding the speed limit by 10 km/h in a 100 km/h zone	☐	☐	☐	☐
6. Driving after using illegal drugs	☐	☐	☐	☐
7. Driving while texting / playing computer games	☐	☐	☐	☐
8. Driving while talking on a mobile phone	☐	☐	☐	☐

28. What should you do if you become drowsy while driving?

(Choose 1 of these options)

☐ 1. Increase your speed to shorten the journey time	☐ 3. Play some loud music
☐ 2. Stop and take a break	☐ 4. Open a window or turn on the air conditioning

29. Imagine that you are driving on a rural road and the vehicle in front of you is going very slow and is causing an obstruction. What should you do?

(Choose 1 of these options)

☐ 1. Overtake the vehicle as quickly as possible	☐ 3. Drive close behind the vehicle and flash your headlights
☐ 2. Sound the horn to encourage the driver to pull in	☐ 4. Stay back until you think you can overtake safely

TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T1

30. What are the chances that YOU AS A ROAD USER will be involved in these types of traffic crashes in the next 5 years?

(Choose 1 option for each item)

	1.Very Unlikely	2.Unlikely	3.50/50 Chance	4.Likely	5.Very Likely
1.Minor Property Damage	☐	☐	☐	☐	☐
2.Moderate Property Damage / Minor Injury	☐	☐	☐	☐	☐
3.Severe Serious Injury / Loss of Life	☐	☐	☐	☐	☐

31. Purely from a safety perspective, is it ever OK to drink and drive?

(Choose 1 of these options)

☐ 1.It's OK provided you keep below the legal blood/alcohol limit	☐ 3.It's OK to drive after a few drinks provided you have also had a meal
☐ 2.It's never OK drink alcohol when you intend to drive	☐ 4.It's OK to sometimes drive over the limit provided you drive carefully

32. How willing would you be to do each of the following things?

(Choose 1 option for each item)

	1.Very Unwilling	2.Unwilling	3.Neither	4.Willing	5.Very Willing
1.Cross a busy road from between parked cars	☐	☐	☐	☐	☐
2.Cycle without a helmet	☐	☐	☐	☐	☐
3.Ride a motor cycle without a helmet	☐	☐	☐	☐	☐
4.Take a lift with someone who speeds regularly	☐	☐	☐	☐	☐
5.Refrain from wearing a seat belt when travelling in a car	☐	☐	☐	☐	☐
6.Take a lift with a driver who has been drinking	☐	☐	☐	☐	☐
7.Refrain from wearing a seat belt when using the school bus	☐	☐	☐	☐	☐
8.Drive your parent's car without their permission	☐	☐	☐	☐	☐

33. What are the chances that YOU, AS A DRIVER, will be involved in these types of traffic crashes before you have held a full license for 1 YEAR?

(Choose 1 option for each item)

	1.Very Unlikely	2.Unlikely	3.50/50 Chance	4.Likely	5.Very Likely
Minor Property Damage	☐	☐	☐	☐	☐
Moderate Property Damage / Minor Injury	☐	☐	☐	☐	☐
Severe Serious Injury / Loss of Life	☐	☐	☐	☐	☐

TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T1

34. Please read the following statements and choose the response opposite each one, that best describes you.

	1.Rarely/never	2.Occasionally	3.Often	4.Almost always
1. I act on impulse	☐	☐	☐	☐
2. I am a careful thinker	☐	☐	☐	☐
3. I am easily bored solving thought problems	☐	☐	☐	☐
4. I save regularly	☐	☐	☐	☐
5. I do things without thinking	☐	☐	☐	☐
6. I don't pay attention	☐	☐	☐	☐
7. I buy things on impulse	☐	☐	☐	☐
8. I plan for job security	☐	☐	☐	☐
9. I concentrate easily	☐	☐	☐	☐
10. I am restless during classes or lectures	☐	☐	☐	☐
11. I say things without thinking	☐	☐	☐	☐
12. I plan for the future	☐	☐	☐	☐
13. I act on the spur of the moment	☐	☐	☐	☐
14. I squirm during classes or lectures	☐	☐	☐	☐
15. I plan tasks carefully	☐	☐	☐	☐

**35. Which of these groups of road users is most likely to be involved in a traffic crash?
(Choose 1 of these options)**

☐ 1.Under 15 year olds	☐ 4.35-44 year olds	☐ 7.Over 65 year olds
☐ 2.15-24 year olds	☐ 5.45-54 year olds	☐ Over 75 year olds
☐ 3.25-34 year olds	☐ 6.55-64 year olds	

TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T1

36. A How much of a difference do you think each of the factors listed below makes in whether or not teen drivers are safe in cars?

(Choose 1 option for each item).

	1.No Difference	2.Some Difference	3.A Lot of Difference	4.Not Sure / Don't Know
1.The driver is feeling strong emotions like being angry or stressed	☐	☐	☐	☐
2.The driver has been drinking alcohol	☐	☐	☐	☐
3.The roads are in bad condition	☐	☐	☐	☐
4.There are other teenagers in the car	☐	☐	☐	☐
5.The driver is inexperienced with driving	☐	☐	☐	☐
6.The driver is text messaging, playing a video game or using some other hand held electronic device	☐	☐	☐	☐
7.It is cold or wet and the roads are slippery	☐	☐	☐	☐
8.Other drivers on the road are driving unsafely	☐	☐	☐	☐
9.The passengers in the car are trying to get the driver to speed or perform illegal manoeuvres	☐	☐	☐	☐
10.It's dark outside	☐	☐	☐	☐
11.The driver is talking on a hand-held mobile phone	☐	☐	☐	☐
12.The driver and passengers are not wearing seat belts	☐	☐	☐	☐
13.The traffic is very heavy	☐	☐	☐	☐
14.The driver is tired	☐	☐	☐	☐
15.The driver is talking on a hands-free mobile phone	☐	☐	☐	☐
16.The driver is in a hurry	☐	☐	☐	☐
17.The car can go really fast and the driver is testing it out or showing it off	☐	☐	☐	☐
18.The driver is paying attention to the passengers because they are being "rowdy"	☐	☐	☐	☐
19.The driver is racing other cars	☐	☐	☐	☐
20.The driver has been taking drugs or smoking dope	☐	☐	☐	☐

TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T1

6. SPEED

Now we would like to know about your attitude to speeding. Speeding is defined as "Driving too fast for the prevailing conditions". Please try to be as honest as possible. There is no need to worry about projecting a good image because the answers you give in this survey are confidential.

When you have completed this part of the survey, please press "NEXT" at the end of the page to go to the next section.

37. What do you think it would be like to be a passenger in a car when the driver is speeding? Please choose one option for each row.

For example, in row A, choose box 1 or 2 if you think it would be Pleasant in some way: Choose box 4 or 5 if you think it would be Unpleasant in some way: Choose box 3 if you are Undecided.

	1 Very	2 Somewhat	3 Neither	4 Somewhat	5 Very
(A) 1 OR 2 = Pleasant:: 4 OR 5 = Unpleasant	☐	☐	☐	☐	☐
(B) 1 OR 2 = A bad thing:: 4 OR 5 = A good thing	☐	☐	☐	☐	☐
(C) 1 OR 2 = Safe:: 4 OR 5 = Risky	☐	☐	☐	☐	☐
(D) 1 OR 2 = Harmful:: 4 OR 5 = Beneficial	☐	☐	☐	☐	☐

38. What percentage of people who are just like you would think it is OK to take a lift from a driver who is known for speeding?

(Type a number between 0% and 100% in this box)

39. Please take a moment to think about the type of motorist who speeds. Now look at the characteristics listed below, and choose the option opposite each one, that best describes that person, in your opinion.

	1.Not at all	2.Somewhat	3.Neutral	4.Quite	5.Very
1.Cool	☐	☐	☐	☐	☐
2.Impatient	☐	☐	☐	☐	☐
3.Immature	☐	☐	☐	☐	☐
4.Popular	☐	☐	☐	☐	☐
5.Responsible	☐	☐	☐	☐	☐
6.Risky	☐	☐	☐	☐	☐
7.Smart	☐	☐	☐	☐	☐
8.Skillful	☐	☐	☐	☐	☐
9.Selfish	☐	☐	☐	☐	☐
10.Unrealistic	☐	☐	☐	☐	☐

TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T1

40. In the next 3 months do you expect to be a passenger in a car being driven by someone who is speeding? (Choose 1 of these options)

- ☐ 1. Definitely will ☐ 2. Probably will ☐ 3. Unsure ☐ 4. Probably won't ☐ 5. Definitely won't

41. "People who are important to me think that it is OK for me to take a lift with a driver who is known for speeding" How much do you agree or disagree with this statement?

- ☐ 1. Strongly Disagree ☐ 2. Disagree ☐ 3. Mildly Disagree ☐ 4. Neither ☐ 5. Mildly Agree ☐ 6. Agree ☐ 7. Strongly Agree

42. "For me, to refuse to take a lift with a driver who is known for speeding would be...." (Choose 1 of these options)

- ☐ 1. Very Easy ☐ 2. Easy ☐ 3. Slightly Easy ☐ 4. Neutral ☐ 5. Slightly Difficult ☐ 6. Difficult ☐ 7. Very Difficult

43. "It is mainly up to me whether or not I take a lift with a driver who is known for speeding" How much do you agree or disagree with this statement?

- ☐ 1. Strongly Disagree ☐ 2. Disagree ☐ 3. Mildly Disagree ☐ 4. Neither ☐ 5. Mildly Agree ☐ 6. Agree ☐ 7. Strongly Agree

44. When it comes to travelling with a driver known for speeding, how much do YOU want to comply with what your PARENTS/TEACHERS think? (Choose ONE of these options)

- ☐ 1. Totally ☐ 2. Very Much ☐ 3. Moderately ☐ 4. Somewhat ☐ 5. Slightly ☐ 6. Very Little ☐ 7. Not at all

45. When it comes to travelling with a driver known for speeding, how much do YOU want to comply with what "PEOPLE WHO ARE JUST LIKE YOU" think? (Choose ONE of these options)

- ☐ 1. Totally ☐ 2. Very Much ☐ 3. Moderately ☐ 4. Somewhat ☐ 5. Slightly ☐ 6. Very Little ☐ 7. Not at all

46. In the past 3 months have you travelled in a car where the driver was speeding? (Choose one option)

- ☐ 1. Never ☐ 2. Rarely ☐ 3. Occasionally ☐ 4. Often ☐ 5. Many times

47. If you have been in such a car, who was driving? (Choose as many of these options as you need)

- ☐ 1. Mother ☐ 3. Brother/Sister ☐ 5. Friend
☐ 2. Father ☐ 4. Other relative ☐ 6. Other

7. SCENARIO

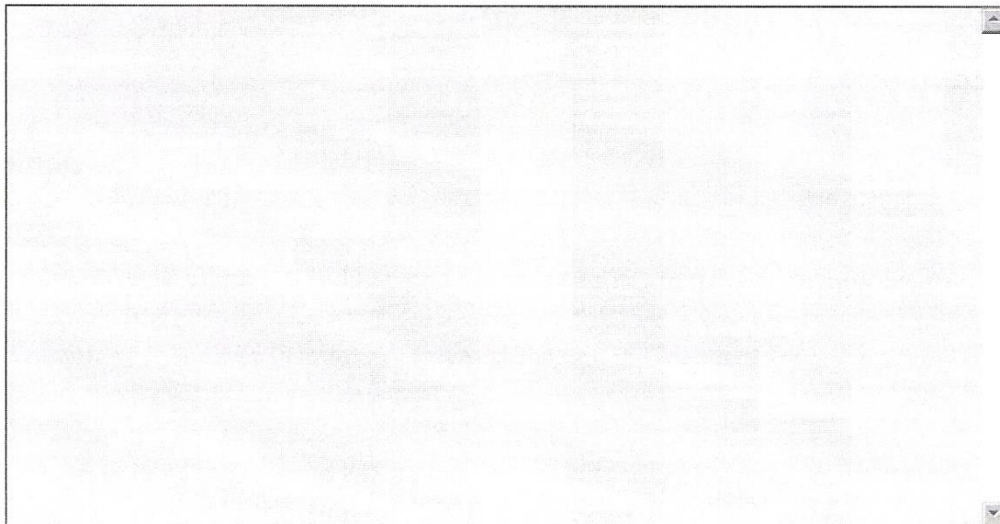
We would like you to consider the situation described below and then answer the question as fully and honestly as you possibly can. There is no need to worry about projecting a good image because the answers you give in this survey are totally confidential.

When you have completed this part of the survey, please press "NEXT" at the end of the page to go to the next section.

48. Mark is 17 years old and has had a learner permit to drive for 6 months. One Saturday night while his parents are away he decides to use his dad's car to take some of the lads to a disco in a nearby town. The disco finishes at 2am and on their way home Mark decides to see how fast the car can go.

What are the possible consequences of this?

Please type as many things as you can think of in this box, numbering them as you go along, starting with the number 1.



TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T1

8. FINISH

You have now completed the survey and stage one of this project. Thank you for participating and we look forward to meeting you again in Spring 2010!

This questionnaire was designed to measure certain aspects of your personality, and some of your knowledge and attitudes towards risk taking. You also told us about your past experience, your present behaviour and your intention to engage in risky behaviour in the future. By comparing the responses that you gave here with those that we hope you will give in the future, the study aims to:

- Measure the effects of the pre-driver education programmes that some students attend during Transition Year, on their subsequent knowledge, skills, attitudes and behaviour.
- See whether factors such as age, gender, personality, learning style and past driving-related experiences, influence students' willingness and ability pay attention to programme content and then adopt safe road user practices.
- Provide information for organizations concerned with road safety to help them to develop more effective methods of providing education and training for young people.

Please press "DONE" at the bottom of this page to exit the survey. Your answers will be saved on this site automatically, you do not need to save this file on your computer.

Further information and interim results can be obtained by contacting the principal researcher
Margaret Ryan,
School of Psychology, TCD., Dublin 2.
e-mail: ryanf1@tcd.ie.

This study is being supervised by
Dr. Michael Gormley,
School of Psychology, TCD., Dublin 2.
E-mail: michael.gormley@tcd.ie.
Tel: (01)8963909.
&
Dr. Kevin Thomas,
School of Psychology, TCD., Dublin 2.
E-mail: kthomas@tcd.ie.
Tel: (01) 896237.

Should you have been affected by any of the issues touched upon in this study, the following services are available to you:

Road Safety Authority.
<http://www.rsa.ie>. Tel: Lo-Call 1890 506080.

Aware.
<http://www.aware.ie>. Tel: Lo-Call 1890 303302.

Samaritans.
jo@samaritans.org. Tel: Lo-Call 1850 309090.

10.6 Appendix E. Time 2 (T2) - Post-intervention questionnaire

TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T2

1. PARTICIPANT DETAILS & INFORMATION (P1)

Earlier in the school year you agreed to participate in a study that aims to measure the impact of pre-driver / road safety education programmes, on students' knowledge, skills, attitudes and behaviour, over time. The research is being conducted using questionnaires and this one should take you around 50 minutes to complete.

Any information that you provide will remain CONFIDENTIAL. All questionnaires will be securely stored in the School of Psychology TCD. Only the researchers listed below will have access to these records. You will be at liberty to withdraw from the study at any time without prejudice. Your rights under the Freedom of Information Act 1977(amended 2003) will be respected at all times. This project is being conducted by Margaret Ryan and is supervised by Dr. Michael Gormley and Dr. Kevin Thomas from the School of Psychology, TCD, Dublin 2. Full contact details for these researchers are provided at the end of the survey.

Please answer the questions in this survey by placing a TICK in the box of your choice (unless you are directed to do otherwise). If you make a mistake or change your mind, cross out your original mark and put a tick in the correct place.

To begin with, we would like to recap a little in relation to your background and some of your previous experiences as a road user. Although we do not want to be able to identify you personally, we would like to be able to match this questionnaire with others that you will be completing for us in the future. The best way to do this is to label the questionnaires with information that won't mean anything to us, but which will allow us to group your responses over time.

1. Therefore, please enter your MOTHER'S INITIALS and the MONTH and DATE of her birth in the spaces provided below. If you used your own date of birth during the earlier study, please give these details here again.

Mother's INITIALS

Mother's Birth MONTH

Mother's Birth DATE

Your Birth MONTH

Your Birth DATE

2. Gender. (Choose ONE option)

- ☐ 1. Male ☐ 2. Female

3. Age. (Choose ONE option)

- ☐ 14 ☐ 15 ☐ 16 ☐ 17 ☐ 18 ☐ 19 ☐ 20

4. When do you intend to apply for a Learner Permit to drive? (Choose ONE option)

- ☐ 1. When I am 17 ☐ 2. When I am 18 ☐ 3. When I am 19 ☐ 4. No plans at present ☐ 5. I have a Learner Permit already

5. Have you driven a car since September 2009? (Choose ONE option)

- ☐ 1. Never ☐ 2. A few times ☐ 3. Once a month ☐ 4. Once a week ☐ 5. Several times weekly ☐ 6. Every day

TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T2

6. If you have driven a car since September 2009, who was with you?

(Choose ONE option on EACH row)

	1. Always	2. Sometimes	3. Never
1. Professional Driving Instructor	☐	☐	☐
2. Parent with full driving license	☐	☐	☐
3. Other Adult with full license	☐	☐	☐
4. Friends with full license	☐	☐	☐
5. Friends with Learner Permit	☐	☐	☐
6. Friends without license	☐	☐	☐
7. I was alone	☐	☐	☐

7. Have you been involved in any of these types of Road Traffic Crashes since September 2009? (Choose ONE option for EACH row)

	1. Never	2. Once	3. Twice	4. Three times or more
1. Minor Property Damage Crash	☐	☐	☐	☐
2. Minor Injury / Moderate Property Damage Crash	☐	☐	☐	☐
3. Severe Serious Injury / Loss of Life Crash	☐	☐	☐	☐

8. Apart from crashes that you were also involved in, has anyone close to you been involved in any of these types of Road Traffic Crashes since September 2009? (Choose ONE option on EACH row)

	1. Never	2. Once	3. Twice	4. Three times or more
1. Minor Property Damage Crash	☐	☐	☐	☐
2. Minor Injury / Moderate Property damage Crash	☐	☐	☐	☐
3. Severe Serious Injury / Loss of Life Crash	☐	☐	☐	☐

PLEASE PROCEED TO THE NEXT PART OF THE SURVEY.

TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T2

2. ATTITUDES & KNOWLEDGE

The questions in this part of the survey focus mainly on your knowledge about, and attitudes towards, road safety issues.

9. What are your views on each of these driving-related issues?

(Choose ONE option for EACH statement)

1 = Strongly Agree: 2 = Agree: 3 = Neither: 4 = Disagree: 5 = Strongly Disagree

	1	2	3	4	5
1. Learning to drive will be easy for me	☐	☐	☐	☐	☐
2. Avoiding accidents over a long period is basically down to luck	☐	☐	☐	☐	☐
3. I will find it very difficult to follow the rules of the road all of the time	☐	☐	☐	☐	☐
4. Even with all the thousands of cars on the roads, there's a lot I can do by myself to avoid an accident	☐	☐	☐	☐	☐
5. If we just do what our teachers, parents and the authorities tell us we will go through life like robots, never fully enjoying things	☐	☐	☐	☐	☐
6. Lots of drivers are careless. I can't do anything about it if they crash into me	☐	☐	☐	☐	☐
7. The government/authorities are mainly responsible for improving road safety	☐	☐	☐	☐	☐

10. How many people do you think were killed on roads in the Republic of Ireland in 2008? We are merely interested in your best estimate as opposed to the correct answer. Please enter YOUR ESTIMATE in this box.

11. Which of the following driving manoeuvres are known to be particularly problematic for young learner drivers?

(Choose as many options as you wish)

☐ 1. Taking right hand turns	☐ 4. Overtaking
☐ 2. Changing lanes	☐ 5. Rear-end shunt of car in front
☐ 3. Negotiating bends	☐ 6. Negotiating roundabouts

12. What are the chances that a TYPICAL (AVERAGE) ROAD USER will be involved in these types of traffic crashes in the next 5 years?

(Choose ONE option on EACH row)

	1. Very Unlikely	2. Unlikely	3. 50/50 Chance	4. Likely	5. Very Likely
1. Minor Property damage	☐	☐	☐	☐	☐
2. Moderate Property damage / Minor Injury	☐	☐	☐	☐	☐
3. Severe Serious Injury / Loss of Life	☐	☐	☐	☐	☐

TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T2

13. What is the fastest speed a driver could safely go, under good conditions, on each of these road types? Speeds are listed in kilometers per hour. (Choose ONE option on EACH row)

	30	40	50	60	70	80	90	100	110	120	130
1.Motorway	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
2.Town / City Road	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
3.National Road	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4.Local Road	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

14. How much driving experience do you think you will need to have before your risk of having a crash is the same as that of the average mature driver? (Choose ONE of these options)

☐ 1.Less than 1 year	☐ 3.Between 3 & 5 Years	☐ 5.Between 7 & 9 Years
☐ 2.Between 1 & 3 Years	☐ 4.Between 5 & 7 Years	☐ 6.More than 9 years

15. In your opinion, could a driver, through personal skill alone AVOID crashing or becoming injured while engaging in the following activities? (Choose ONE option on EACH row).

	1. Always	2. Often	3. Rarely	4. Never
1.Exceeding the speed limit by 10 km/h in a 50 km/h zone	☐	☐	☐	☐
2.Driving after drinking 4 units of alcohol	☐	☐	☐	☐
3.Driving after using prescription drugs	☐	☐	☐	☐
4.Travelling in a car where people are not wearing seatbelts	☐	☐	☐	☐
5.Exceeding the speed limit by 10 km/h in a 100 km/h zone	☐	☐	☐	☐
6.Driving after using illegal drugs	☐	☐	☐	☐
7.Driving while texting / playing computer games	☐	☐	☐	☐
8.Driving while talking on a mobile phone	☐	☐	☐	☐

16. What should you do if you become drowsy while driving? (Choose ONE of these options)

☐ 1. Increase your speed to shorten the journey time	☐ 3. Play some loud music
☐ 2. Stop and take a break	☐ 4. Open a window or turn on the air conditioning

17. Imagine that you are driving on a rural road and the vehicle in front of you is going very slow and is causing an obstruction. What should you do? (Choose ONE of these options)

☐ 1. Overtake the vehicle as quickly as possible	☐ 3. Drive close behind the vehicle and flash your headlights
☐ 2. Sound the horn to encourage the driver to pull in	☐ 4. Wait until an opportunity to overtake presents itself

TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T2

18. What are the chances that YOU will be involved in these types of traffic crashes in the next 5 years? (Choose ONE option on EACH row)

	1. Very Unlikely	2. Unlikely	3. 50/50 Chance	4. Likely	5. Very Likely
1.Minor Property Damage	☐	☐	☐	☐	☐
2.Moderate Property Damage / Minor Injury	☐	☐	☐	☐	☐
3.Severe Serious Injury / Loss of Life	☐	☐	☐	☐	☐

19. Purely from a safety perspective, is it ever OK to drink and drive? (Choose ONE of these options)

☐ 1. It's OK provided you keep below the legal blood/alcohol limit	☐ 3. It's OK to driver after a few drinks provided you have also had a meal
☐ 2. It's never OK to drink alcohol when you intend to drive	☐ 4. It's OK to sometimes drive over the limit provided you drive carefully

20. What are the chances that YOU, AS A DRIVER, will be involved in these types of traffic crashes before you have held a full license for 1 YEAR? (Choose ONE option on EACH row)

	1. Very Unlikely	2. Unlikely	3. 50/50 Chance	4. Likely	5. Very Likely
1.Minor Property Damage	☐	☐	☐	☐	☐
2.Moderate Property Damage / Minor Injury	☐	☐	☐	☐	☐
3.Severe Serious Injury / Loss of Life	☐	☐	☐	☐	☐

21. In your opinion, could a driver, through personal skill alone, AVOID crashing or becoming injured while engaging in the folowing activities? (Choose ONE option for EACH item).

	1. Very Unwilling	2. Unwilling	3. Neither	4. Willing	5. Very Willing
1.Cross a busy road from between parked cars	☐	☐	☐	☐	☐
2.Cycle without a helmet	☐	☐	☐	☐	☐
3.Ride a motor cycle without a helmet	☐	☐	☐	☐	☐
4.Take a lift with someone who speeds regularly	☐	☐	☐	☐	☐
5.Refrain from wearing a seatbelt when travelling in a car	☐	☐	☐	☐	☐
6.Take a lift with a driver who has been drinking	☐	☐	☐	☐	☐
7.Refrain from wearing a seatbelt when using the school bus	☐	☐	☐	☐	☐
8.Drive your parent's car without their permission	☐	☐	☐	☐	☐

22. At what age are road users most at risk of becoming involved in a traffic crash? (Choose ONE of these options)

☐ 1. Under 15 year olds	☐ 5. 45-54 year olds
☐ 2. 15-24 year olds	☐ 6. 55-64 year olds
☐ 3. 25-34 year olds	☐ 7. Over 65 year olds
☐ 4. 35-44 year olds	

TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T2

23. How much of a difference do you think each of the factors listed below makes in whether or not TEEN DRIVERS are safe in cars?

(Choose ONE option on EACH row)

	1. No Difference	2. Some Difference	3. A Lot of Difference	4. Not Sure / Don't Know
1.The driver is feeling strong emotions like being angry or stressed	☐	☐	☐	☐
2.The driver has been drinking alcohol	☐	☐	☐	☐
3.The roads are in bad condition	☐	☐	☐	☐
4.There are other teenagers in the car	☐	☐	☐	☐
5.The driver is inexperienced with driving	☐	☐	☐	☐
6.The driver is text messaging, playing a video game or using some other hand held electronic device	☐	☐	☐	☐
7.It is cold or wet and the roads are slippery	☐	☐	☐	☐
8.Other drivers on the road are driving unsafely	☐	☐	☐	☐
9.The passengers in the car are trying to get the driver to speed or perform illegal manoeuvres	☐	☐	☐	☐
10.It's dark outside	☐	☐	☐	☐
11.The driver is talking on a hand-held mobile phone	☐	☐	☐	☐
12.The driver and passengers are not wearing seat belts	☐	☐	☐	☐
13.The traffic is very heavy	☐	☐	☐	☐
14.The driver is tired	☐	☐	☐	☐
15.The driver is talking on a hands-free mobile phone	☐	☐	☐	☐
16.The driver is in a hurry	☐	☐	☐	☐
17.The car can go really fast and the driver is testing it out or showing it off	☐	☐	☐	☐
18.The driver is paying attention to the passengers because they are being "rowdy"	☐	☐	☐	☐
19.The driver is racing other cars	☐	☐	☐	☐
20.The driver has been taking drugs or smoking dope	☐	☐	☐	☐

PLEASE PROCEED TO THE NEXT PART OF THE SURVEY

TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T2

3. SPEED

Now we would like to know about your attitude to speeding. Speeding is defined as "Driving too fast for the prevailing conditions". Please try to be as honest as possible. There is no need to worry about projecting a good image because the answers you give in this survey are confidential.

24. What do you think it would be like to be a passenger in a car when the driver is speeding?(Choose ONE option on each ROW)

For example, in row A, choose box 1 or 2 if you think it would be Pleasant in some way: Choose box 4 or 5 if you think it would be Unpleasant in some way: Choose box 3 if you are Undecided. Do the same for rows B, C & D.

	1 Very	2 Somewhat	3 Neither	4 Somewhat	5 Very
(A) 1 OR 2 = Pleasant:: 4 OR 5 = Unpleasant	☐	☐	☐	☐	☐
(B) 1 OR 2 = A bad thing:: 4 OR 5 = A good thing	☐	☐	☐	☐	☐
(C) 1 OR 2 = Safe:: 4 OR 5 = Risky	☐	☐	☐	☐	☐
(D) 1 OR 2 = Harmful:: 4 OR 5 = Beneficial	☐	☐	☐	☐	☐

25. What percentage of people who are just like you would think it is OK to take a lift from a driver who is known for speeding?

(Write a number between 0% and 100% in this box)

26. Please take a moment to think about the type of motorist who speeds. Now look at the characteristics listed below, and choose the option opposite each one, that best describes that person, in your opinion.

(Choose ONE option on EACH row)

	1. Not at all	2. Somewhat	3. Neutral	4. Quite	5. Very
1.Cool	☐	☐	☐	☐	☐
2.Impatient	☐	☐	☐	☐	☐
3.Immature	☐	☐	☐	☐	☐
4.Popular	☐	☐	☐	☐	☐
5.Responsible	☐	☐	☐	☐	☐
6.Risky	☐	☐	☐	☐	☐
7.Smart	☐	☐	☐	☐	☐
8.Skillful	☐	☐	☐	☐	☐
9.Selfish	☐	☐	☐	☐	☐
10.Unrealistic	☐	☐	☐	☐	☐

27. In the next 3 months do you expect to be a passenger in a car that is being driven by someone who is speeding? (Choose ONE of these options)

☐ 1. Definitely Will
 ☐ 2. Probably Will
 ☐ 3. Unsure
 ☐ 4. Probably Won't
 ☐ 5. Definitely Won't

TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T2

28. "People who are important to me think that it would be OK for me to take a lift with a driver who is known for speeding" To what extent do you agree or disagree with this statement? (Choose ONE of these options)

- ☐ 1. Strongly Disagree ☐ 2. Disagree ☐ 3. Mildly Disagree ☐ 4. Neither ☐ 5. Mildly Agree ☐ 6. Agree ☐ 7. Strongly Agree

29. "For me, to refuse to take a lift with a driver who is known for speeding would be....." (Choose ONE of these options)

- ☐ 1. Very Easy ☐ 2. Easy ☐ 3. Slightly Easy ☐ 4. Neither ☐ 5. Slightly Difficult ☐ 6. Difficult ☐ 7. Very Difficult

30. "It is mainly up to me to decide whether or not I take a lift with a driver who is known for speeding". To what extent do you agree or disagree with this statement? (Choose ONE of these options)

- ☐ 1. Strongly Agree ☐ 2. Agree ☐ 3. Mildly Agree ☐ 4. Neither ☐ 5. Mildly Disagree ☐ 6. Disagree ☐ 7. Strongly Disagree

31. When it comes to travelling with a driver known for speeding, how much do YOU want to comply with what your PARENTS/TEACHERS think you should do? (Choose ONE of these options)

- ☐ 1. Totally ☐ 2. Very Much ☐ 3. Moderately ☐ 4. Somewhat ☐ 5. Slightly ☐ 6. Very Little ☐ 7. Not at all

32. When it comes to travelling with a driver known for speeding, how much do YOU want to comply with what "PEOPLE WHO ARE JUST LIKE YOU" think you should do? (Choose ONE of these options)

- ☐ 1. Totally ☐ 2. Very Much ☐ 3. Moderately ☐ 4. Somewhat ☐ 5. Slightly ☐ 6. Very Little ☐ 7. Not at all

PLEASE PROCEED TO THE NEXT PART OF THE SURVEY

4. SCENARIO

33. We would like you to consider the situation described below and then answer the question as fully and honestly as you possibly can. There is no need to worry about projecting a good image because the answers you give in this survey are totally confidential.

James is 17 years old and has been learning to drive for the past 6 months. After the disco last Friday night, James brought his mates back to his house because his parents were away. When they got there they realized that their friend David had been left behind. James decided that they should take his dad's car and go back to the disco to collect David. Since they were in a hurry he decided to drive as fast as the car could go.

What are the possible consequences of these actions?

Please write as many things as you can think of, numbering them as you go along, starting with the number 1.

PLEASE PROCEED TO THE NEXT PART OF THE SURVEY

TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T2

5. DRIVER EDUCATION PROGRAMME

We would like you to give us some feedback on the Driver Education Programme that you may have taken since September 2009.

34. Have you taken a pre-driver / road safety education course since September 2009? (Choose ONE option)

- ☐ 1. Yes ☐ 2. No

IF YOU ANSWERED "NO" TO THIS QUESTION, PLEASE PROCEED TO THE NEXT SECTION OF THE QUESTIONNAIRE.

IF YOU ANSWERED "YES" TO THIS QUESTION, PLEASE CONTINUE BY ANSWERING THE REST OF THE QUESTIONS IN THIS SECTION.

35. Please rate your own level of participation during this course (Choose ONE option)

- ☐ (1) 76% - 100% ☐ (2) 51% - 75% ☐ (3) 26% - 50% ☐ (4) 0% - 25%

36. Place a tick in the box that best describes how much you are SATISFIED or DISSATISFIED with these components of the driver education course that you completed recently. (Choose ONE option on EACH row)

	1 Not Provided	2 Completely Satisfied	3 Somewhat Satisfied	4 Undecided	5 Somewhat Dissatisfied	6 Completely Dissatisfied
1. Textbook	☐	☐	☐	☐	☐	☐
2. Course handouts	☐	☐	☐	☐	☐	☐
3. Classroom Lectures	☐	☐	☐	☐	☐	☐
4. Group work	☐	☐	☐	☐	☐	☐
5. Presentations by guest speakers	☐	☐	☐	☐	☐	☐
6. Video Presentations	☐	☐	☐	☐	☐	☐
7. CD Interactive Exercises	☐	☐	☐	☐	☐	☐
8. Workload, assignments etc.	☐	☐	☐	☐	☐	☐
9. In-car instruction	☐	☐	☐	☐	☐	☐
10. In-car log	☐	☐	☐	☐	☐	☐
11. In-car supervision	☐	☐	☐	☐	☐	☐

37. Who was the MAIN instructor on this course? (Choose ONE option ONLY).

- ☐ 1. Teacher from your own school ☐ 2. Visiting specialist course teacher ☐ 3. Emergency service personnel ☐ 4. Professional driving instructor

TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T2

38. To what extent to you agree or disagree with the following statements about the instructor on your driver education course? Choose ONE option for EACH statement. Lower scores indicate stronger disagreement, and higher scores indicate stronger agreement.

	1	2	3	4	5	6	7	8	9	10
	Strongly disagree									Strongly agree
1.The instructor knew the subject matter very well .	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
2.The instructor seemed to be concerned as to whether or not the students learned the material.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
3.The instructor recognized individual differences in the students' abilities.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4.The instructor answered the students' questions satisfactorily.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
5.The instructor provided a good combination of lecture and discussion.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
6.The classroom instructor was a better-than-average teacher.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

39. To what extent do you disagree or agree with each of these statements about the pre-driver education course that you completed recently. (Choose ONE option for EACH statement)

	1	2	3	4	5
	Completely Disagree	Somewhat Disagree	Undecided	Somewhat Agree	Completely Agree
1.The programme I took is valuable for educating future drivers.	☐	☐	☐	☐	☐
2.I think that people who take this course are more skilled than those who do not take the course.	☐	☐	☐	☐	☐
3.If I hadn't taken this course, I think I would have more accidents once I get my license.	☐	☐	☐	☐	☐
4.If I knew a secondary school student who was planning to get a driver's license soon, I would recommend that he or she should take this course.	☐	☐	☐	☐	☐
5.I think that people who take this course have more knowledge about road safety than those who do not take the course.	☐	☐	☐	☐	☐
6.This course has increased my confidence as a road user.	☐	☐	☐	☐	☐
7.I think that taking this course has been a good preparation for taking my driver's license THEORY test.	☐	☐	☐	☐	☐
8.I think this course will help me to be a more cautious driver.	☐	☐	☐	☐	☐
9.I think that people who take this course have attitudes that reflect a better understanding of factors that influence risk taking on the roads than those who do not take the course.	☐	☐	☐	☐	☐
10.I think that taking this course has been a good preparation for taking my driver's license PRACTICAL test.	☐	☐	☐	☐	☐

40. If you were to grade the traffic safety education programme you just completed on the same basis that your work is graded in school, which of these grades do you think the programme would deserve?

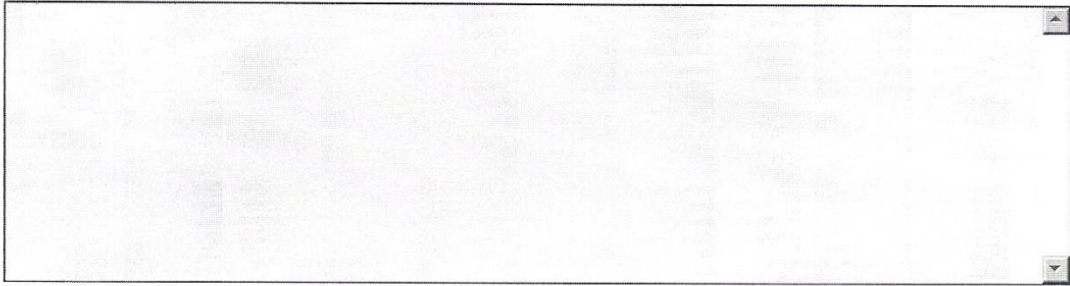
(Choose ONE option)

☐ "A"
 ☐ "B"
 ☐ "C"
 ☐ "D"
 ☐ "E"
 ☐ "F"

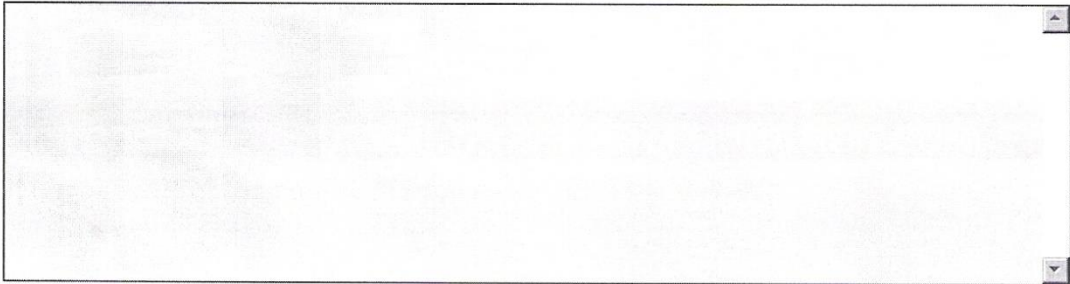
TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T2

41. What part of the course did you most ENJOY and WHY?

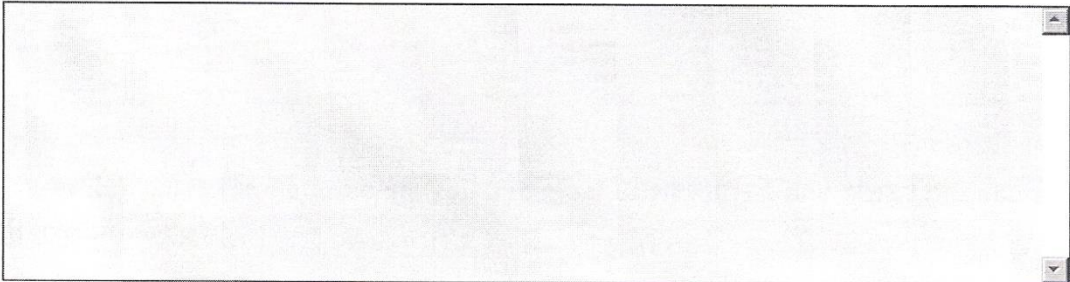
(Please write in the space below)



42. Which part of the course did you find most BENEFICIAL and WHY? (Please write in the space below)

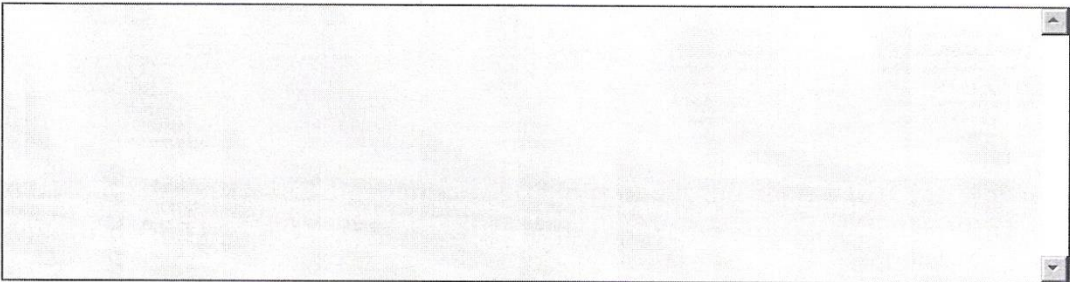


43. What are the THREE most important things about the course that you would like to see CHANGED and WHY? (Please write in the space below)



44. Do you have any suggestions on how to make these changes?

(Please write in the space below)



PLEASE PROCEED TO THE NEXT PART OF THE SURVEY

TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T2

6. PERSONALITY

45. Here are some questions about your personality. Describe yourself as you generally are now, not as you wish to be in the future. Describe yourself as you honestly see yourself, in relation to other people you know of the same sex as you are, and roughly your same age. So that you can describe yourself in an honest manner, recall that your responses will be kept in absolute confidence. Indicate for EACH statement whether it is 1. Very Inaccurate, 2. Moderately Inaccurate, 3. Neither Accurate Nor Inaccurate, 4. Moderately Accurate, or 5. Very Accurate as a description of you.

	1. Very Inaccurate	2. Moderately Inaccurate	3. Neither Accurate Nor Inaccurate	4. Moderately Accurate	5. Very Accurate
1) Am the life of the party.	☐	☐	☐	☐	☐
2) Feel little concern for others.	☐	☐	☐	☐	☐
3) Am always prepared.	☐	☐	☐	☐	☐
4) I get stressed out easily	☐	☐	☐	☐	☐
5) Have a rich vocabulary.	☐	☐	☐	☐	☐
6) Don't talk a lot.	☐	☐	☐	☐	☐
7) Am interested in people.	☐	☐	☐	☐	☐
8) Leave my belongings around.	☐	☐	☐	☐	☐
9) Am relaxed most of the time.	☐	☐	☐	☐	☐
10) Have difficulty understanding abstract ideas.	☐	☐	☐	☐	☐
11) Feel comfortable around people.	☐	☐	☐	☐	☐
12) Insult people.	☐	☐	☐	☐	☐
13) Pay attention to details.	☐	☐	☐	☐	☐
14) Worry about things.	☐	☐	☐	☐	☐
15) Have a vivid imagination.	☐	☐	☐	☐	☐
16) Keep in the background.	☐	☐	☐	☐	☐
17) Sympathize with others' feelings.	☐	☐	☐	☐	☐
18) Make a mess of things.	☐	☐	☐	☐	☐
19) Seldom feel blue.	☐	☐	☐	☐	☐
20) Am not interested in abstract ideas.	☐	☐	☐	☐	☐
21) Start conversations.	☐	☐	☐	☐	☐
22) Am not interested in other people's problems.	☐	☐	☐	☐	☐
23) Get chores done right away.	☐	☐	☐	☐	☐

TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T2

7. PERSONALITY (2)

46. Here are some more questions about your personality. Again describe yourself as you generally are now. Indicate for EACH statement whether it is 1. Very Inaccurate, 2. Moderately Inaccurate, 3. Neither Accurate Nor Inaccurate, 4. Moderately Accurate, or 5. Very Accurate as a description of you.

	1. Very Inaccurate	2. Moderately Inaccurate	3. Neither Accurate Nor Inaccurate	4. Moderately Accurate	5. Very Accurate
24) Am easily disturbed.	☐	☐	☐	☐	☐
25) Have excellent ideas.	☐	☐	☐	☐	☐
26) Have little to say.	☐	☐	☐	☐	☐
27) Have a soft heart.	☐	☐	☐	☐	☐
28) Often forget to put things back in their proper place.	☐	☐	☐	☐	☐
29) Get upset easily.	☐	☐	☐	☐	☐
30) Do not have a good imagination.	☐	☐	☐	☐	☐
31) Talk to a lot of different people at parties.	☐	☐	☐	☐	☐
32) Am not really interested in others.	☐	☐	☐	☐	☐
33) Like order.	☐	☐	☐	☐	☐
34) Change my mood a lot.	☐	☐	☐	☐	☐
35) Am quick to understand things.	☐	☐	☐	☐	☐
36) Don't like to draw attention to myself.	☐	☐	☐	☐	☐
37) Take time out for others.	☐	☐	☐	☐	☐
38) Shirk my duties.	☐	☐	☐	☐	☐
39) Have frequent mood swings.	☐	☐	☐	☐	☐
40) Use difficult words.	☐	☐	☐	☐	☐
41) Don't mind being the center of attention.	☐	☐	☐	☐	☐
42) Feel others' emotions.	☐	☐	☐	☐	☐
43) Follow a schedule.	☐	☐	☐	☐	☐
44) Get irritated easily.	☐	☐	☐	☐	☐
45) Spend time reflecting on things.	☐	☐	☐	☐	☐
46) Am quiet around strangers.	☐	☐	☐	☐	☐
47) Make people feel at ease.	☐	☐	☐	☐	☐
48) Am exacting in my work.	☐	☐	☐	☐	☐
49) Often feel blue.	☐	☐	☐	☐	☐
50) Am full of ideas.	☐	☐	☐	☐	☐

8. FINISH

You have now completed the survey and stage two of this project. Thank you for participating and we look forward to meeting you again sometime in 2011!

This questionnaire was designed to measure certain aspects of your personality, and some of your knowledge and attitudes towards risk taking. You also told us about your past experience, your present behaviour and your intention to engage in risky behaviour in the future. By comparing the responses that you gave here with those that we hope you will give in the future, the study aims to:

- Measure the effects of the pre-driver education programmes that some students attend during Transition Year, on their subsequent knowledge, skills, attitudes and behaviour.
- See whether factors such as age, gender, personality, learning style and past driving-related experiences, influence students' willingness and ability pay attention to programme content and then adopt safe road user practices.
- Provide information for organizations concerned with road safety to help them to develop more effective methods of providing education and training for young people.

Further information and interim results can be obtained by contacting the principal researcher

Margaret Ryan,
School of Psychology, TCD., Dublin 2.
e-mail: ryanf1@tcd.ie.

This study is being supervised by
Dr. Michael Gormley,
School of Psychology, TCD., Dublin 2.
E-mail: michael.gormley@tcd.ie.
Tel: (01)8963909.

&

Dr. Kevin Thomas,
School of Psychology, TCD., Dublin 2.
E-mail: kthomas@tcd.ie.
Tel: (01) 896237.

Should you have been affected by any of the issues touched upon in this study, the following services are available to you:

Road Safety Authority.
<http://www.rsa.ie>. Tel: Lo-Call 1890 506080.

Aware.
<http://www.aware.ie>. Tel: Lo-Call 1890 303302.

Samaritans.
jo@samaritans.org. Tel: Lo-Call 1850 309090.

10.7 Appendix F. Time 3 (T3) – Post-intervention follow-up questionnaire

TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T3

1. PARTICIPANT DETAILS & INFORMATION (P1)

During Transition Year you agreed to participate in a study that aims to measure the impact of pre-driver / road safety education programmes, on students' knowledge, skills, attitudes and behaviour, over time. This questionnaire is the final one in the series and you should complete it in around 45 minutes.

Any information that you provide will remain CONFIDENTIAL. All questionnaires will be securely stored in the School of Psychology TCD. Only the researchers listed below will have access to these records. You will be at liberty to withdraw from the study at any time without prejudice. Your rights under the Freedom of Information Act 1977(amended 2003) will be respected at all times. This project is being conducted by Margaret Ryan and is supervised by Dr. Michael Gormley from the School of Psychology, TCD, Dublin 2. Full contact details for these researchers are provided at the end of the survey.

Please answer the questions in this survey by placing a TICK in the box of your choice (unless you are directed to do otherwise). If you make a mistake or change your mind, cross out your original mark and put a tick in the correct place.

1. Firstly, we need to get some of your personal details so that we can match your responses across each stage of the project. Remember, these details remain confidential.

Your First Name (e.g. Mary)

Your Family Name (e.g. Ryan)

Your Date of Birth (e.g. 14/6/1995)

Your Mother's Initials (e.g. D R)

Your Mother's Date of Birth

Participant Number (see list)

2. Gender (Choose ONE option)

- ☐ 1. Male ☐ 2. Female

3. Age (Choose ONE option)

- ☐ 16 ☐ 17 ☐ 18 ☐ 19 ☐ 20

4. Have you "driven" any of these vehicles in the past 12 months (Choose ONE option for each vehicle)

	1.Never	2.A few times	3.Once a month	4.Once a week	5.Several times weekly	6.Every day
1.Bicycle	☐	☐	☐	☐	☐	☐
2.Motorcycle/Scooter	☐	☐	☐	☐	☐	☐
3.Farm/Industrial Machinery	☐	☐	☐	☐	☐	☐

5. Have you been involved in any of these types of Road Traffic Crashes since September 2009? (Choose ONE option for EACH item)

	1. Never	2. Once	3. Twice	4. Three times or more
1. Minor Property Damage Crash	☐	☐	☐	☐
2. Minor Injury / Moderate Property Damage Crash	☐	☐	☐	☐
3. Severe Serious Injury / Loss of Life Crash	☐	☐	☐	☐

TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T3

6. Apart from crashes that you were also involved in, has anyone close to you been involved in any of these types of Road Traffic Crashes since September 2009? (Choose ONE option for EACH item)

	1. Never	2. Once	3. Twice	4. Three times or more
1. Minor Property Damage Crash	☐	☐	☐	☐
2. Minor Injury / Moderate Property Damage Crash	☐	☐	☐	☐
3. Severe Serious Injury / Loss of Life Crash	☐	☐	☐	☐

7. When do you intend to apply for a Learner Permit to drive? (Choose ONE option)

☐ 1. When I am 17
 ☐ 3. When I am 19
 ☐ 5. I have a Permit already
☐ 2. When I am 18
 ☐ 4. No plans at present

8. If you already hold a Learner Permit, which of these vehicles does it cover and how long have you had it? (Choose ALL options that apply)

	1. Less than 1 month	2. Between 1-3 months	3. Between 4-6 months	4. Between 7-9 months	5. Between 10-12 months	6. Over 12 months
1. Car	☐	☐	☐	☐	☐	☐
2. Motorcycle	☐	☐	☐	☐	☐	☐
3. Tractor	☐	☐	☐	☐	☐	☐

9. Have you driven a car since April 2010? (Choose ONE option)

☐ 1. Yes
 ☐ 2. No

10. If you drive, how often do you take the car out? (Choose ONE option)

☐ 1. Every day
 ☐ 3. Once a week
 ☐ 5. Once a month
☐ 2. Several times a week
 ☐ 4. Several times a month
 ☐ 6. Less than once a month

11. Who accompanies you when you drive? (Choose ONE option for EACH item)

	1. Always	2. Sometimes	3. Never
1. Professional Driving Instructor	☐	☐	☐
2. Parent with full driving license	☐	☐	☐
3. Other Adult with full license	☐	☐	☐
4. Friends with full license	☐	☐	☐
5. Friends with Learner Permit	☐	☐	☐
6. Friends without license	☐	☐	☐
7. I was alone	☐	☐	☐

12. Have you received professional driving instruction and if so for how long? (Choose ONE option)

☐ 1. No
 ☐ 3. Yes, 3-6 hours
 ☐ 5. Yes, 10-12 hours
☐ 2. Yes, under 3 hours
 ☐ 4. Yes, 7-9 hours
 ☐ 6. Yes, over 12 hours

TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T3

13. Have you taken a Driver Theory Test yet? (Choose ONE option)

- ☐ 1. No
 ☐ 2. Yes and Passed
 ☐ 3. Yes and Failed

14. Have you taken an on-road Driving Test yet? (Choose ONE option)

- ☐ 1. No
 ☐ 2. Yes and Passed
 ☐ 3. Yes and Failed

15. If you have taken an on-road Driving Test, how many MONTHS ago did you do it? (Write the number in this box)

16. Have you been involved in any of these types of Road Traffic Crashes while YOU WERE DRIVING? (Choose ONE option for EACH item)

	1. Never	2. Once	3. Twice	4. Three times or more
1. Minor Property Damage Crash	☐	☐	☐	☐
2. Minor Injury / Moderate Property Damage Crash	☐	☐	☐	☐
3. Severe Serious Injury / Loss of Life Crash	☐	☐	☐	☐

17. If you have been in a crash while YOU WERE DRIVING, whose fault was it, in your opinion? (Choose ONE option)

- ☐ 1. Mine
 ☐ 3. About 50/50
 ☐ 5. All someone else's
☐ 2. Mostly Mine
 ☐ 4. Mostly someone else's
 ☐ 6. Don't know / fault not determined

18. Have you been stopped by the Gardai, or received penalty points for any of the following? (Choose EVERY option that applies)

- ☐ 1. Speeding
 ☐ 4. Not wearing a seat belt
 ☐ 7. Impaired driving (drink, drugs, fatigue)
☐ 2. Ignoring a stop sign
 ☐ 5. Ran red light
 ☐ 8. Failed to yield
☐ 3. Using a mobile phone
 ☐ 6. Unsafe passing

Other (please specify)

PLEASE PROCEED TO THE NEXT PART OF THE SURVEY.

TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T3

2. ATTITUDES & KNOWLEDGE

The questions in this part of the survey focus mainly on your knowledge about, and attitudes towards, road safety issues.

19. What are your views on each of these driving-related issues?

(Choose ONE option for EACH statement)

1 = Strongly Agree: 2 = Agree: 3 = Neither: 4 = Disagree: 5 = Strongly Disagree

	1	2	3	4	5
1. Learning to drive will be easy for me	☐	☐	☐	☐	☐
2. Avoiding accidents over a long period is basically down to luck	☐	☐	☐	☐	☐
3. I will find it very difficult to follow the rules of the road all of the time	☐	☐	☐	☐	☐
4. Even with all the thousands of cars on the roads, there's a lot I can do by myself to avoid an accident	☐	☐	☐	☐	☐
5. If we just do what our teachers, parents and the authorities tell us we will go through life like robots, never fully enjoying things	☐	☐	☐	☐	☐
6. Lots of drivers are careless. I can't do anything about it if they crash into me	☐	☐	☐	☐	☐
7. The government/authorities are mainly responsible for improving road safety	☐	☐	☐	☐	☐

20. How many people do you think were killed on roads in the Republic of Ireland in 2010? We are merely interested in your best estimate as opposed to the right answer, so please enter YOUR ESTIMATE in this box.

21. Here are some common driving manoeuvres. Which ones are known to be particularly problematic for young learner drivers? (Choose as many as you wish)

☐ 1. Taking right hand turns	☐ 3. Negotiating bends	☐ 5. Rear-end shunt of car in front
☐ 2. Changing lanes	☐ 4. Overtaking	☐ 6. Negotiating roundabouts

22. What are the chances that a TYPICAL (AVERAGE) ROAD USER will be involved in these types of traffic crashes in the next 5 years? (Choose ONE option for EACH item)

	1. Very Unlikely	2. Unlikely	3. 50/50 Chance	4. Likely	5. Very Likely
1. Minor Property damage	☐	☐	☐	☐	☐
2. Moderate Property damage / Minor Injury	☐	☐	☐	☐	☐
3. Severe Serious Injury / Loss of Life	☐	☐	☐	☐	☐

TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T3

23. How much of a difference do you think each of the factors listed below makes in whether or not TEEN DRIVERS are safe in cars?

(Choose ONE option for EACH item)

	1. No Difference	2. Some Difference	3. A Lot of Difference	4. Not Sure / Don't Know
1. The driver is feeling strong emotions like being angry or stressed	☐	☐	☐	☐
2. The driver has been drinking alcohol	☐	☐	☐	☐
3. The roads are in bad condition	☐	☐	☐	☐
4. There are other teenagers in the car	☐	☐	☐	☐
5. The driver is inexperienced with driving	☐	☐	☐	☐
6. The driver is text messaging, playing a video game or using some other hand held electronic device	☐	☐	☐	☐
7. It is cold or wet and the roads are slippery	☐	☐	☐	☐
8. Other drivers on the road are driving unsafely	☐	☐	☐	☐
9. The passengers in the car are trying to get the driver to speed or perform illegal manoeuvres	☐	☐	☐	☐
10. It's dark outside	☐	☐	☐	☐
11. The driver is talking on a hand-held mobile phone	☐	☐	☐	☐
12. The driver and passengers are not wearing seat belts	☐	☐	☐	☐
13. The traffic is very heavy	☐	☐	☐	☐
14. The driver is tired	☐	☐	☐	☐
15. The driver is talking on a hands-free mobile phone	☐	☐	☐	☐
16. The driver is in a hurry	☐	☐	☐	☐
17. The car can go really fast and the driver is testing it out or showing it off	☐	☐	☐	☐
18. The driver is paying attention to the passengers because they are being "rowdy"	☐	☐	☐	☐
19. The driver is racing other cars	☐	☐	☐	☐
20. The driver has been taking drugs or smoking dope	☐	☐	☐	☐

24. Imagine that you are driving on a rural road and the vehicle in front of you is going very slow and is causing an obstruction. What should you do? (Choose ONE of these options)

☐ 1. Overtake the vehicle as quickly as possible	☐ 3. Drive close behind the vehicle and flash your headlights
☐ 2. Sound the horn to encourage the driver to pull in	☐ 4. Wait until an opportunity to overtake presents itself

TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T3

25. What is the fastest speed a driver could safely go, under good conditions, on each of these road types? Speeds are listed in kilometers per hour. (Choose ONE option for each item)

	30	40	50	60	70	80	90	100	110	120	130
1. Motorway	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
2. Town / City Road	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
3. National Road	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4. Local Road	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

26. What are the chances that a YOU AS A ROAD USER will be involved in these types of traffic crashes in the next 5 years? (Choose ONE option for EACH item)

	1. Very Unlikely	2. Unlikely	3. 50/50 Chance	4. Likely	5. Very Likely
1. Minor Property damage	☐	☐	☐	☐	☐
2. Moderate Property damage / Minor Injury	☐	☐	☐	☐	☐
3. Severe Serious Injury / Loss of Life	☐	☐	☐	☐	☐

27. How much driving experience do you think you will need to have, before your chances of having a crash are the same as those of the average mature driver? (Choose ONE of these options)

☐ 1. Less than 1 year	☐ 3. Between 3 & 5 Years	☐ 5. Between 7 & 9 Years
☐ 2. Between 1 & 3 Years	☐ 4. Between 5 & 7 Years	☐ 6. More than 9 years

28. At what age are road users most at risk of becoming involved in a traffic crash? (Choose ONE of these options)

☐ 1. Under 15 year olds	☐ 5. 45-54 year olds
☐ 2. 15-24 year olds	☐ 6. 55-64 year olds
☐ 3. 25-34 year olds	☐ 7. Over 65 year olds
☐ 4. 35-44 year olds	

29. Purely from a safety perspective, is it ever OK to drink and drive (Choose ONE of these options)

☐ 1. It's OK provided you keep below the legal blood/alcohol limit	☐ 3. It's OK to drive after a few drinks provided you have also had a meal
☐ 2. It's never OK to drink alcohol when you intend to drive	☐ 4. It's OK to sometimes drive over the limit provided you drive carefully

TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T3

30. How willing would you be to do EACH of the following things? (Choose ONE option for EACH item)

	1. Very Unwilling	2. Unwilling	3. Neither	4. Willing	5. Very Willing
1. Cross a busy road from between parked cars	☐	☐	☐	☐	☐
2. Cycle without a helmet	☐	☐	☐	☐	☐
3. Ride a motor cycle without a helmet	☐	☐	☐	☐	☐
4. Take a lift with someone who speeds regularly*	☐	☐	☐	☐	☐
5. Refrain from wearing a seatbelt when travelling in a car	☐	☐	☐	☐	☐
6. Take a lift with a driver who has been drinking	☐	☐	☐	☐	☐
7. Refrain from wearing a seatbelt when using the school bus	☐	☐	☐	☐	☐
8. Drive your parent's car without their permission	☐	☐	☐	☐	☐

31. What are the chances that YOU, AS A DRIVER, will be involved in these types of traffic crashes before you you have held a full license for 1 YEAR? (Choose ONE option for EACH item)

	1. Very Unlikely	2. Unlikely	3. 50/50 Chance	4. Likely	5. Very Likely
1. Minor Property Damage	☐	☐	☐	☐	☐
2. Moderate Property Damage / Minor Injury	☐	☐	☐	☐	☐
3. Severe Serious Injury / Loss of Life	☐	☐	☐	☐	☐

32. In your opinion, could a driver, through personal skill alone, AVOID crashing or becoming injured while engaging in the following activities? (Choose ONE option for EACH item).

	1. Always	2. Often	3. Rarely	4. Never
1. Exceeding the speed limit by 10 km/h in a 50 km/h zone	☐	☐	☐	☐
2. Driving after drinking 4 units of alcohol	☐	☐	☐	☐
3. Driving after using prescription drugs	☐	☐	☐	☐
4. Travelling in a car where people are not wearing seatbelts	☐	☐	☐	☐
5. Exceeding the speed limit by 10 km/h in a 100 km/h zone	☐	☐	☐	☐
6. Driving after using illegal drugs	☐	☐	☐	☐
7. Driving while texting / playing computer games	☐	☐	☐	☐
8. Driving while talking on a mobile phone	☐	☐	☐	☐

TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T3

33. While you are gaining driving experience, how likely is it that you would do the following things? Tick AN OPTION BETWEEN 1-4 to indicate the likelihood that you would do each thing.

THEN ALSO Tick the box marked "I" if you have done this thing already

	1. Very Unlikely	2. Somewhat Likely	3. Very Likely	4. Not Sure / Don't Know	"I" Have done this already
1. The driver is feeling strong emotions like being angry or stressed	☐	☐	☐	☐	☐
2. The driver has been drinking alcohol	☐	☐	☐	☐	☐
3. The roads are in bad condition	☐	☐	☐	☐	☐
4. There are other teenagers in the car	☐	☐	☐	☐	☐
5. The driver is inexperienced with driving	☐	☐	☐	☐	☐
6. The driver is text messaging, playing a video game or using some other hand held electronic device	☐	☐	☐	☐	☐
7. It is cold or wet and the roads are slippery	☐	☐	☐	☐	☐
8. Other drivers on the road are driving unsafely	☐	☐	☐	☐	☐
9. The passengers in the car are trying to get the driver to speed or perform illegal manoeuvres	☐	☐	☐	☐	☐
10. It's dark outside	☐	☐	☐	☐	☐
11. The driver is talking on a hand-held mobile phone	☐	☐	☐	☐	☐
12. The driver and passengers are not wearing seat belts	☐	☐	☐	☐	☐
13. The traffic is very heavy	☐	☐	☐	☐	☐
14. The driver is tired	☐	☐	☐	☐	☐
15. The driver is talking on a hands-free mobile phone	☐	☐	☐	☐	☐
16. The driver is in a hurry	☐	☐	☐	☐	☐
17. The car can go really fast and the driver is testing it out or showing it off	☐	☐	☐	☐	☐
18. The driver is paying attention to the passengers because they are being "rowdy"	☐	☐	☐	☐	☐
19. The driver is racing other cars	☐	☐	☐	☐	☐
20. The driver has been taking drugs or smoking dope	☐	☐	☐	☐	☐

34. What should you do if you become drowsy while driving? (Choose ONE of these options)

☐ 1. Increase your speed to shorten the journey time	☐ 3. Play some loud music
☐ 2. Stop and take a break	☐ 4. Open a window or turn on the air conditioning

TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T3

3. SPEED

Now we would like to know about your attitude to speeding. Speeding is defined as "Driving too fast for the prevailing conditions". Please try to be as honest as possible. There is no need to worry about projecting a good image because the answers you give in this survey are confidential.

35. What do you think it would be like to be driving a car and speeding? Please choose one option for each row. For example, in row A, choose box 1 or 2 if you think it would be Pleasant in some way: Choose box 4 or 5 if you think it would be Unpleasant in some way: Choose box 3 if you are Undecided. (Choose ONE option for EACH row)

	1 Very	2 Somewhat	3 Neither	4 Somewhat	5 Very
(A) 1 OR 2 = Pleasant:: 4 OR 5 = Unpleasant	☐	☐	☐	☐	☐
(B) 1 OR 2 = A bad thing:: 4 OR 5 = A good thing	☐	☐	☐	☐	☐
(C) 1 OR 2 = Safe:: 4 OR 5 = Risky	☐	☐	☐	☐	☐
(D) 1 OR 2 = Harmful:: 4 OR 5 = Beneficial	☐	☐	☐	☐	☐

36. What percentage of people who are just like you would think it is OK to drive fast? (Write a number between 0% and 100% in this box)

37. Please take a moment to imagine that YOU were to drive a car at speed. Now look at the characteristics listed below, and choose the option opposite each one, that best shows how you would describe yourself in this situation. (Choose ONE option for EACH item)

	1. Not at all	2. Somewhat	3. Neutral	4. Quite	5. Very
1. Cool	☐	☐	☐	☐	☐
2. Impatient	☐	☐	☐	☐	☐
3. Immature	☐	☐	☐	☐	☐
4. Popular	☐	☐	☐	☐	☐
5. Responsible	☐	☐	☐	☐	☐
6. Risky	☐	☐	☐	☐	☐
7. Smart	☐	☐	☐	☐	☐
8. Skillful	☐	☐	☐	☐	☐
9. Selfish	☐	☐	☐	☐	☐
10. Unrealistic	☐	☐	☐	☐	☐

38. In the next 3 months do you expect to be a passenger in a car that is being driven by someone who is speeding? (Choose ONE of these options)

☐ 1. Definitely will
 ☐ 2. Probably will
 ☐ 3. Unsure
 ☐ 4. Probably Won't
 ☐ 5. Definitely Won't

TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T3

39. "People who are important to me think that it would be OK for me to take a lift with a driver who is known for speeding" To what extent do you agree or disagree with this statement? (Choose ONE of these options)

- ☐ 1. Strongly Disagree ☐ 2. Disagree ☐ 3. Mildly Disagree ☐ 4. Neither ☐ 5. Mildly Agree ☐ 6. Agree ☐ 7. Strongly Agree

40. "For me, to refuse to take a lift with a driver who is known for speeding would be....." (Choose ONE of these options)

- ☐ 1. Very Easy ☐ 2. Easy ☐ 3. Slightly Easy ☐ 4. Neither ☐ 5. Slightly Difficult ☐ 6. Difficult ☐ 7. Very Difficult

41. "It is mainly up to me to decide whether or not I take a lift with a driver who is known for speeding". To what extent do you agree or disagree with this statement? (Choose ONE of these options)

- ☐ 1. Strongly Agree ☐ 2. Agree ☐ 3. Mildly Agree ☐ 4. Neither ☐ 5. Mildly Disagree ☐ 6. Disagree ☐ 7. Strongly Disagree

42. When it comes to travelling with a driver known for speeding, how much do YOU want to comply with what your PARENTS/TEACHERS think? (Choose ONE of these options)

- ☐ 1. Totally ☐ 2. Very Much ☐ 3. Moderately ☐ 4. Somewhat ☐ 5. Slightly ☐ 6. Very Little ☐ 7. Not at all

43. When it comes to travelling with a driver known for speeding, how much do YOU want to comply with what "PEOPLE WHO ARE JUST LIKE YOU" think? (Choose ONE of these options)

- ☐ 1. Totally ☐ 2. Very Much ☐ 3. Moderately ☐ 4. Somewhat ☐ 5. Slightly ☐ 6. Very Little ☐ 7. Not at all

PLEASE PROCEED TO THE NEXT PART OF THE SURVEY.

TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T3

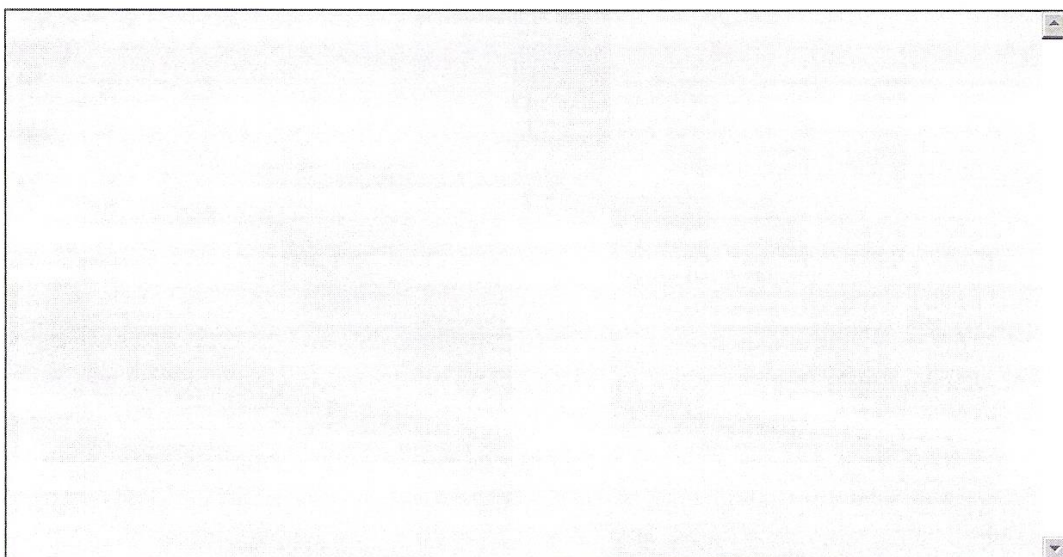
4. Scenario

We would like you to consider the situation described below and then answer the question as fully and honestly as you possibly can. There is no need to worry about projecting a good image because the answers you give in this survey are totally confidential.

44. David is 17 years old and has been learning to drive for the past 6 months. One Friday night while his parents were away he decided to use his dad's car to take some of the lads to football training and afterwards they went to a disco. The disco finished at 2am and on their way home David drove as fast as the car could go because it was so late.

What are the possible consequences of this?

Please write as many things as you can think of, numbering them as you go along, starting with the number 1.



PLEASE PROCEED TO THE NEXT PART OF THE SURVEY.

TRINITY COLLEGE DUBLIN TY DRIVER EDUCATION SURVEY T3

You have now completed the survey and stage three of this project. Thank you for participating in this study.

This questionnaire was designed to measure certain aspects of your personality, and some of your knowledge and attitudes towards risk taking. You also told us about your past experience, your present behaviour and your intention to engage in risky behaviour in the future. By comparing the responses that you gave here with those that you provided in the past, the study aims to:

- Measure the effects of the pre-driver education programmes that some students attend during Transition Year, on their subsequent knowledge, skills, attitudes and behaviour.
- See whether factors such as age, gender, personality, learning style and past driving-related experiences, influence students' willingness and ability pay attention to programme content and then adopt safe road user practices.
- Provide information for organizations concerned with road safety to help them to develop more effective methods of providing education and training for young people.

Further information and interim results can be obtained by contacting the principal researcher
Margaret Ryan,
School of Psychology, TCD., Dublin 2.
e-mail: ryanf1@tcd.ie.

This study is being supervised by
Dr. Michael Gormley,
School of Psychology, TCD., Dublin 2.
E-mail: michael.gormley@tcd.ie.
Tel: (01)8963909.

Should you have been affected by any of the issues touched upon in this study, the following services are available to you:

Road Safety Authority.
<http://www.rsa.ie>. Tel: Lo-Call 1890 506080.
Aware.
<http://www.aware.ie>. Tel: Lo-Call 1890 303302.
Samaritans.
jo@samaritans.org. Tel: Lo-Call 1850 309090.

10.8 Appendix G. Time 2 (T2) - Supplementary knowledge quiz

These questions were designed to test your knowledge of the rules of the road. Please put a circle around the letter opposite the correct answer(s).

1. What do flashing amber lights at a Pelican Crossing mean for drivers? (Circle ONE option)**³⁴

- (a) Danger ahead - you must stop and wait until they stop flashing.
- (b) Prepare to slow down.
- (c)*³⁵ Stop and give way to pedestrians, but proceed if the way is clear.
- (d) Extra vigilance needed – children may be nearby.

2. What are the MOST IMPORTANT things that a driver should be conscious of in this situation? (Circle TWO options)

- (a)* People crossing the street at the rear of the bus.
- (b) Caution and proper road conduct on the part of all road users.
- (c) The bus driver will always signal before moving off.
- (d)* People crossing the street from the left to catch the bus



3. In which of these circumstances must you NOT overtake other vehicles? (Circle ONE option)**

- (a) When you are driving in a residential area.
- (b) When the vehicle in front is travelling 10km/h under the speed limit.
- (c) When the surrounding traffic is flowing freely.
- (d)* When you are in the left-hand lane of a dual carriageway when the traffic is moving at normal speed.

4. What should a driver do when approaching this road sign? (Circle ONE option)**

- (a)* Yield to traffic on the major road.
- (b) Yield to traffic coming from the right.
- (c) Yield to trucks and buses only.
- (d) All vehicles, except bicycles, must yield.



5. Which of these rules apply to PEDESTRIANS using zebra crossings? (Circle ALL correct options)

- (a)* Pedestrians should avoid causing a driver to brake suddenly or to swerve.
- (b) Pedestrians have the right of way over other traffic while standing at the crossing.
- (c)* Pedestrians are responsible for their own safety while using zebra crossings.
- (d)* Pedestrians must not cross within or within 15 meters of the crossing.

³⁴ Note: Items marked ** were used in both of the supplementary tests.

³⁵ Note: Items marked * denote correct responses.

6. When should drivers use their vehicle's rear view mirrors? (Circle ONE option)

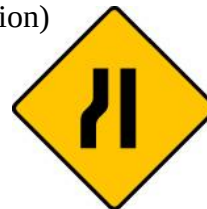
- (a) Increasing their speed.
- (b)* Moving off or changing lanes.
- (c) Changing lanes only.
- (d) Moving off only.

7. Drivers should be patient with which of these types of road users? (Circle ALL CORRECT options)**

- (a)* Elderly drivers.
- (b)* Pedestrians.
- (c)* People who drive cars with “Baby on Board” stickers.
- (d)* Cyclists.
- (e)* Bus / taxi drivers.

8. What do this yellow and black road sign mean? (Circle ONE option)

- (a) You must overtake on the right only.
- (b) Left-hand lane has an uneven surface.
- (c)* Road narrows on one side.
- (d) Merging traffic from the left.

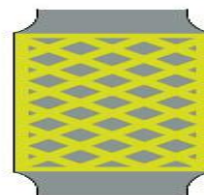


9. What is the minimum tyre tread depth permitted for vehicles on Irish roads? (Circle ONE option)**

- (a) 1mm
- (b) 1.2 mm
- (c)* 1.6 mm
- (d) 1.9 mm

10. What does this (yellow) road marking mean? (Circle ONE option)

- (a) You may enter only if the traffic lights are green.
- (b) Traffic from the right and left have the right-of-way.
- (c) You have right-of-way over traffic from both right and left
- (d)* You must not enter unless your exit is clear or you are turning right.



11. If you arrive at the scene of an accident what should you do? (Circle ONE option)**

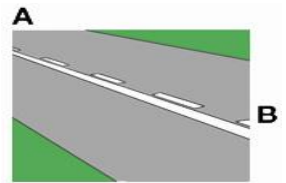
- (a) Keep injured people comfortable by giving them something to drink.
- (b)* Move injured people, to prevent them from sustaining further injury.
- (c)* Switch off the engine of the car and apply the handbrake.
- (d)* Use your mobile phone to call relatives of people involved.

12. In WET conditions, what is the approximate stopping distance for the average car travelling at 100km/h? (Circle ONE option)

- (a) 97 metres or 24 car lengths
- (b)* 123 metres or 31 car lengths
- (c) 148 metres or 37 car lengths
- (d) 172 metres or 43 car lengths

13. If driving from A to B, what do these road markings mean? (Circle ONE option)

- (a) You may cross the continuous white line only when performing a 'U'-turn.
- (b)* You may overtake by crossing the continuous white line.
- (c) You may not overtake by crossing the continuous white line.
- (d) You may not overtake, only motorcyclists may cross the continuous white line.



14. Which of these statements is NOT TRUE about the conditions under which learner drivers are allowed to drive a car in a public place? (Circle ONE option)

- (a) Driver must be over 17 years of age.
- (b) Driver must have passed the driver theory test.
- (c) Driver must be in possession of his/her learner permit while driving.
- (d)* Driver must be accompanied by an adult.
- (e) The vehicle is taxed and insured.

15. What do this (blue) road sign mean? (Circle ONE option)

- (a) Crossing onto the opposite carriageway is not allowed.
- (b) No overtaking.
- (c)* End of motorway.
- (d) Stopping under bridge is not allowed.



16. Which of the following actions can cause a vehicle to skid? (Circle THREE options)**

- (a)* Harsh acceleration.
- (b) Not enough pressure in the tyres.
- (c)* Heavy braking.
- (d) Too much pressure in the tyres.
- (e) The steering wheel being too free or pliable.
- (f)* Excessive speed.

17. If stopped by the Gardai, with which of these requests would you, as a driver, be required to comply? (Circle ONE option)**

- (a)* Write out your signature.
- (b) Allow them to take your driving licence back to the Garda station.
- (c)* Show them a valid motor insurance certificate.
- (d)* Demonstrate that you are sober.

18. What does this hand signal mean? (Circle ONE option)

- (a) The driver intends to turn left.
- (b)* The driver intends to slow down or stop.
- (c) The driver intends to turn right.
- (d) The driver intends to begin a 'U'-turn.



19. Which of these rules are TRUE in relation to motorcyclists? (Circle ONE option)**

- (a)* They must have a white or yellow headlamp, red rear lamp and rear reflector on their bike.
- (b) They are permitted to ride between traffic lanes.
- (c) They don't need to get a separate license to ride their motorbike if they have already have a full driving license.
- (d) They should wear a helmet with a dark visor to avoid being blinded by strong sunlight.

20. Why do so many of Ireland's fatal crashes happen at night? (Circle ONE option)**

- (a) Drivers take more risks because roads have less traffic
- (b) It is more difficult to see hazards so drivers have less time to react.
- (c) Driver impairment (fatigue, intoxication)
- (d)* All of the above

21. Imagine that you are buying a used car. As a responsible driver, in addition to the engine, brakes and tyres what is the most important thing that you should establish when buying a used car? (Circle ONE option)**

- (a)* That it is in good running order.
- (b) That it hasn't been in an accident previously
- (c) That it can accelerate quickly
- (d) That it will hold its re-sale value
- (e) That the manufacturers are unlikely to go out of business.

22. Your driving should allow for which danger over the brow of this hill? (Circle ONE option)

- (a) An oncoming vehicle may be straddling part of your lane.
- (b) There may be no road markings.
- (c)* Speed cameras may be in operation.
- (d) A high-sided vehicle may be oncoming.



23. When is it permissible to carry more passengers in your car than there are seats available?

(Choose ONE option)**

- (a) When the passengers do not interfere with your visibility.
- (b)* Never.
- (c) When you have appropriate insurance cover.
- (d) When you are carrying children.

24. The slogan "Only a fool breaks the two second rule" refers to... (Circle ONE option)

- (a) The amount of time it should take to accelerate after traffic lights turn green.
- (b) The maximum amount of time that a driver could safely take his/her eyes off the road ahead.
- (c)* Maintaining a safe following distance from the vehicle in front at any speed.
- (d) The amount of time drivers may to stop on double yellow line.

25. Imagine that you are driving this car approaching the roundabout. Which conduct is correct? (Circle TWO options)



- (a)* I must wait.
- (b) The vehicle to the right must wait.
- (c)* The vehicle on the roundabout has right of way.
- (d) Treat the roundabout as a junction with roads of equal importance.

26. Which of the following rules must CYCLISTS obey? (Circle ALL CORRECT options)**

- (a)* Give proper signals before moving off, changing lanes and making a turn.
- (b)* Don't use mobile phone or personal entertainment system.
- (c)* Wear reflective clothing at all times.
- (d)* A cyclist must use a cycle track if it is provided

10.9 Appendix H. Time 3 (T3) - Supplementary knowledge quiz

These questions were designed to test your knowledge of the rules of the road.
Please put a circle around the letter opposite each correct answer(s).

1. What do flashing amber lights at a Pelican Crossing mean for drivers?
(Circle ONE option)**

- (a) Danger ahead - you must stop and wait until they stop flashing.
- (b) Prepare to slow down.
- (c)* Stop and give way to pedestrians, but proceed if the way is clear.
- (d) Extra vigilance needed – children may be nearby.

2. Why must you pay special attention to pedestrians in this situation?
(Circle TWO options)

- (a) On side streets, pedestrians have the right of way.
- (b)* Parked vehicles restrict the view of the motorists and pedestrians.
- (c)* Pedestrians frequently step onto the road way without paying attention.
- (d) Pedestrians are only allowed to cross the road at pedestrian crossings.



3. In which of these circumstances must you NOT overtake other vehicles?
(Circle ONE option)**

- (a) When you are driving in a residential area.
- (b) When the vehicle in front is travelling at 10km/h under the speed limit.
- (c) When the surrounding traffic is flowing freely.
- (d)* When you are in the left-hand lane of a dual carriageway when the traffic is moving at normal speed.

4. What should a driver do when approaching this road sign? (Circle ONE option)**

- (a)* Yield to traffic coming from the right.
- (b) Yield to traffic on the major road.
- (c) Yield to trucks and buses only.
- (d) All vehicles, except bicycles, must yield.



5. Drivers should always make way for.....
(Circle ALL CORRECT options)

- (a)* Emergency vehicles using sirens and flashing lights.
- (b)* Pedestrians on or at a zebra crossing.
- (c) Cyclists leaving a cycle lane.
- (d)* Pedestrians at a junction, if they have started crossing the road.

6. When are 'lighting up hour'? (Circle ONE option)

- (a)* From half an hour after sunset to half an hour before sunrise.
- (b) When visibility is less than 300 metres.
- (c) From mid-night until 6 a.m.
- (d) When visibility is less than 200 metres.

7. Drivers should be patient with which of these types of road users?

(Circle ALL CORRECT options)**

- (a)* Middle aged drivers.
- (b)* Pedestrians.
- (c)* People who drive cars with “Baby on Board” stickers.
- (d)* Cyclists.
- (e)* Bus / taxi drivers.

8. What does this yellow and black road sign mean? (Circle ONE option)

- (a) Series of bends ahead.
- (b) Crosswinds ahead.
- (c) Steep hill ahead.
- (d)* Slippery stretch of road ahead.



9. What is the minimum tyre tread depth permitted for vehicles on Irish roads?

(Circle ONE option)**

- (a) 1mm.
- (b) 1.2 mm.
- (c)* 1.6 mm.
- (d) 1.9 mm.

10. What does this yellow and black chevron road sign mean? (Circle ONE option)

- (a) Series of speed ramps ahead.
- (b) Road closed – you must turn back.
- (c)* Sharp change of direction ahead.
- (d) Traffic from the left has priority.



11. If you arrive at the scene of an accident what should you do?

(Circle ALL CORRECT options)**

- (a) Keep injured people comfortable by giving them something to drink.
- (b)* Move injured people, if they are in danger of sustaining further injury.
- (c)* Switch off the engines of the cars involved and apply the handbrakes.
- (d)* Use your mobile phone to call the emergency services.

12. In WET conditions, what is the approximate stopping distance for the average car travelling at 60km/h? (Circle ONE option)

- (a) 35.2 metres or 9 car lengths.
- (b)* 48.5 metres or 12 car lengths.
- (c) 81.4 metres or 20 car lengths.
- (d) 97.1 metres or 24 car lengths.

13. What does this road markings mean? (Circle ONE option)

- (a) Road surface is uneven.
- (b) You may park for a maximum of one hour only.
- (c)* Pedestrian crossing is nearby.
- (d) You may overtake if the road is clear ahead.



14. Which of these statements is TRUE about the conditions under which learner drivers are allowed to drive a car in a public place? (Circle the ONE correct option)

- (a) Driver must be over 16 years of age.
- (b) Driver must have applied for the on-road driving test.
- (c)* Driver must be in possession of his/her learner permit while driving.
- (d) Driver must be accompanied by an adult.
- (e) The vehicle must be under 10 years old.

15. What does this (blue) road sign mean? (Circle ONE option)

- (a) Steep climb up ahead for 3 kilometres.
- (b) Crossing traffic ahead.
- (c) Three lanes ahead.
- (d)* Three hundred metres to the next exit.



16. Which of the following actions can cause a vehicle to skid? (Circle THREE options)**

- (a)* Harsh acceleration.
- (b) Not enough pressure in the tyres.
- (c)* Heavy braking.
- (d) The steering wheel being too free or pliable.
- (e)* Excessive speed.

17. If stopped by the Gardai, with which of these requests would you, as a driver, be required to comply? (Circle ALL CORRECT options)**

- (a)* Write out your signature.
- (b) Allow them to take your driving license back to the Garda station.
- (c)* Provide evidence that your car is taxed and insured.
- (d)* Demonstrate that you are sober.

18. What does this hand signal mean? (Circle ONE option)

- (a)* The driver intends to turn left.
- (b) The driver intends to slow down or stop.
- (c) The driver intends to turn right.
- (d) The driver intends to begin a 'U'-turn.



19. Which of these rules are TRUE in relation to motorcyclists? (Circle ONE option)**

- (a)* They must have a white or yellow headlamp, red rear lamp and rear reflector on their bike.
- (b) They are permitted to ride between traffic lanes.
- (c) They don't need to get a separate license to ride their motorbike if they already have a full driving license.
- (d) They should wear a helmet with a dark visor to avoid being blinded by strong sunlight.

20. Why do so many of Ireland's fatal crashes happen at night? (Circle ONE option)**

- (a) Drivers take more risks because roads have less traffic
- (b) It is more difficult to see hazards so drivers have less time to react.
- (c) Driver impairment (fatigue, intoxication).
- (d)* All of the above.

21. Imagine that you are buying a used car. As a responsible driver, in addition to the engine, brakes and tyres, what is the most important thing that you should establish? (Circle ONE option)**

- (a)* That it is in good running order.
- (b) That it can accelerate quickly.
- (c) That it will hold its re-sale value.
- (d) That the manufacturers are unlikely to go out of business.

22. Should you overtake the cyclists? (Circle ONE option)

- (a) Yes, the cyclists will hear your vehicle and get out of the way.
- (b)* No, you cannot see clearly ahead.
- (c) Yes, provided the broken line does not become continuous.
- (d) Yes, any oncoming traffic can observe the situation and make any necessary adjustments.



23. When is it permissible to carry more passengers in your car than there are seats available? (Circle ONE option)**

- (a) When the passengers do not interfere with your visibility.
- (b)* Never.
- (c) When you have appropriate insurance cover.
- (d) When you are carrying children.

24. Driving at night, you should dip your headlights when..... (Circle ONE option)

- (a)* Meeting or driving behind other traffic, or in a lit-up area.
- (b) Driving at less than 50 km/h.
- (c) Entering a motorway.
- (d) Driving on rural roads.

25. A strong side wind is blowing from the left. You want to overtake the truck. You are most exposed to danger..... (Circle TWO options)

- (a)* On leaving the slipstream of the truck.
- (b) If you apply the brakes while in the slipstream of the truck.
- (c) Prior to entering the slipstream of the truck.
- (d)* When you enter the slipstream of the truck.



26. Which of the following rules must CYCLISTS obey? (Circle ALL CORRECT options)**

- (a)* Give proper signals before moving off, changing lanes and making a turn.
- (b)* Don't use mobile phone or personal entertainment system.
- (c)* Wear reflective clothing at all times.
- (d)* A cyclist must use a cycle track if it is provided.

10.10 Appendix I. Research variables and measurement schedule

Appendix/ Question*	Variable description	Number of items	Measurement schedule		
			T1	T2	T3
<u>Demographics</u>					
D/1	Participant information/consent	1	√	√	√
D/2	Personal details	3-6	√	√	√
D/3	Location of residence	1	√		√
D/4	Gender	1	√	√	√
D/5	Age	1	√	√	√
D/6	Parents' educational status	1 X 2	√		
D/7	Type of pre-driver course planned	1	√		
D/8	Intention to apply for a learner permit	1	√	√	√
<u>Experience with traffic and crashes</u>					
D/9	Recent experience with vehicles	4	√	√	√
D/10	Previous experience driving a car	1	√		√
D/11	If driving who supervised driving practice	6	√	√	√
D/12	Personal crash involvement	3	√	√	√
D/13	Significant other(s) crash involvement	3	√	√	√
F/10	Frequency of driving	1			√
F/12	Amount of professional driver training	1			√
F/13	Has taken the driver theory test	1			√
F/14	Has taken the practical driving test	1			√
F/15	Number of months since taking the practical test	1			√
F/16	Crash involvement while driving	3			√
F/17	If crashed while driving, who was at fault	1			√
F/18	Cautioned/penalized for aberrant driving	1			√
<u>Exposure to aberrant driving practices</u>					
D/15-19	Parents driving behaviour	5 X 2	√		
D/20	Frequency of exposure to aberrant driving practices as measured by the Driver Behaviour Questionnaire	6	√		

(cont.)

* The actual questions can be accessed using these appendices and question references. For convenience, only the T1 reference details are provided for measures that were repeated in subsequent tests.

Appendix/ Question	Variable description	No. of items	<u>Measurement schedule</u>		
			T1	T2	T3
	<u>Knowledge</u>				
	<u>Short knowledge quiz</u>				
D/22	Number of people killed on Irish roads	1	✓	✓	✓
D/25	Driving speed limits	4	✓	✓	✓
D/26	Estimating the amount of driving experience required to mitigate risk	1	✓	✓	✓
D/28	Correct procedure if driving while fatigued	1	✓	✓	✓
D/29	Correct procedure if driving while being obstructed	1	✓	✓	✓
D/31	Drinking driving	1	✓	✓	✓
D/35	Age of road user most likely to be involved in a crash	1	✓	✓	✓
G & H	<u>Supplementary knowledge quiz</u>	26		✓	✓
	<u>Beliefs & Attitudes</u>				
	<u>Risk perception</u>				
D/21	Beliefs about Self-efficacy and locus of control	7	✓	✓	✓
D/23	Identifying high-risk driving manoeuvres	6	✓	✓	✓
D/24	Estimating crash risk for a typical road user	3	✓	✓	✓
D/30	Estimating crash risk for 'self' as road user	3	✓	✓	✓
D/33	Estimating crash risk for 'self' as novice driver	3	✓	✓	✓
D/27	Judging the role of skill in mitigating risk	8	✓	✓	✓
D/32	Willingness to take risks in traffic	7	✓	✓	✓
D/36	Judging factors that increase risk for teens in cars	20	✓	✓	✓
F/34	Estimating the likelihood that they will engage in risk increasing behaviour as a novice driver	20			✓
F/34	Has already engaged in risk-increasing behaviours as a driver	20			✓
D/52	Estimating the consequences of a high-risk scenario	Free response	✓	✓	✓
	<u>Attitude to speeding</u>				
D/37	Behavioural beliefs	4	✓	✓	✓
D/48	Subjective norms – peer norms	1	✓	✓	✓
D/39	Beliefs about characteristics of prototypical speeders	10	✓	✓	✓
D/40	Expectations/ intentions for being in a speeding car	1	✓	✓	✓
D/41	Subjective norms – parental norms	1	✓	✓	✓
D/42	Perceived behaviour control - self-efficacy	1	✓	✓	✓
D/43	Perceived behavioural control - controllability	1	✓	✓	✓
D/44	Motivation to comply - with views of parents/teachers	1	✓	✓	✓
D/45	Motivation to comply - with views of peers	1	✓	✓	✓
D/46	Recent experience with speeding	1	✓		
D/43	Relationship with driver of speeding car	6	✓		
		(cont.)			

Appendix/ Question	Variable description	No. of items	<u>Measurement schedule</u>		
			T1	T2	T3
	<u>Personality</u>				
D/14	Arnett Inventory of Sensation Seeking	20	√		
D/34	Barrett Impulsiveness Scale	15	√		
E/45-46	IPIP-50	50		√	
	<u>Evaluation of pre-driver education course</u>				
	<u>Student survey</u>				
E/34	Has taken a PLDE course	1		√	
E/35	Level of participation in the course	1		√	
E/36	Level of satisfaction with course components	11		√	
E/37	Identity of course teacher	1		√	
E/38	Evaluating the course teacher	6		√	
E/39	Evaluating the driver education course	10		√	
E/40	Grade awarded for course	1		√	
E/41	What part of the course was most enjoyable	Free response		√	
E/42	What part of the course was most beneficial	Free response		√	
E/43	What things might be changed	Free response		√	
E/44	Suggestions for how to implement changes	Free response		√	
N/A	<u>TY coordinator survey</u>			√	
N/A	Curriculum standards	8		√	
N/A	Teaching standards	3		√	
N/A	Course materials standards	3		√	
N/A	Administrative and evaluation standards	6		√	

10.11 Appendix J. TY coordinator survey

TY COORDINATOR QUESTIONNAIRE

School:

Please answer these questions in relation to the pre-learner driver education course that was delivered to your TY students during the school year 2009-2010.

Item	CURRICULUM STANDARDS	YES	NO
1	Does the school have a curriculum guide for the course?		
2	Do course teachers have a copy of the curriculum and follow it?		
3	Is traffic safety education considered an integral part of the school curriculum?		
4	Does the course stipulate appropriate performance objectives for all lessons?		
5	Does the course include activities that enable the student to accomplish these objectives?		
6	Does the curriculum include tests which measure student achievements with respect to all of the course objectives?		
7	Do teachers of other subjects integrate traffic safety concepts into their classes?		
8	Are written criteria for successful completion of the course given to all students?		
	TEACHING STANDARDS	YES	NO
9	Are course teachers selected on the basis of their academic achievements and/or their experience with teaching traffic safety education?		
10	Have teachers/instructors received any certification before teaching the course?		
11	Is the course-related performance of the teacher/instructor assessed regularly?		

	COURSE MATERIAL STANDARDS	YES	NO
12	Does the course contain sufficient amounts of quality instructional materials to help students achieve the course objectives?		
13	Are supplementary teaching materials, lectures, demonstrations etc. related to driver and traffic safety education used? (i.e. elements that are not part of the main road safety course)		
14	If so, are these critically reviewed before use by school authorities?		
	ADMINISTRATION AND EVALUATION STANDARDS	YES	NO
15	Do students receive academic credit for the successful completion of the course?		
16	Are academic standards maintained on a par with those of other courses?		
17	Are parents involved in the educational process?		
18	Is written information concerning all aspects of the programme provided for all parents?		
19	Is the program evaluated annually at school-level i.e. by administrators, TY coordinators, and/or instructional staff?		
20	Are student performance recorded and maintained as a guide for program evaluations and to indicate students achievement?		

10.12 Appendix K. Information/consent (Parents)



LETTER OF CONSENT (Parents)



Re: Trinity College, Dublin's Evaluation of Transition Year Pre-driver Education Programmes.

The school that your son/daughter attends has agreed to participate in this research project that aims to evaluate the various forms of pre-driver education currently in use by transition year students in Irish secondary schools. This research is being undertaken by Margaret Ryan, who is a research student at the School of Psychology, Trinity College, Dublin.

The study will examine the impact of the driver education that your son/daughter will receive during Transition Year on their knowledge, skills, attitudes and behaviour over time. It will also examine factors that influence the ways in which they engage with programme content. The research will be conducted using questionnaires, which take approximately 50 minutes to complete. They will be asked to do this on 3 separate occasions: Once in the Autumn of 2009, then again in April/May 2010 and finally in January/February 2011.

If you agree to allow your son/daughter to participate in this study their identity will be coded for anonymity purposes and the information they provide will be securely stored in the School of Psychology TCD. Only myself and my supervisors will have access to these records. Students will be at liberty to withdraw from the study at any time without

prejudice. Your/their rights under the Freedom of Information Act 1977 (amended 2003) will be respected at all times.

Further details can be obtained by contacting the researcher

Margaret Ryan,

c/o School of Psychology, TCD, Dublin 2.

ryanf1@tcd.ie

This study is being supervised by

Dr. Michael Gormley,

&

Dr. Kevin Thomas,

michael.gormley@tcd.ie

kthomas@tcd.ie,

Tel: 01-8963093

01-8963237

Please place an X in the box to indicate that you have read and understood the above and that you agree to participate in this study.

☐

Enter Your Name here	
Son/Daughter's Name	
Enter School Name here	
Date	

10.13 Appendix L. Results for Chapter 4, Personal characteristics

10.13.1 Confirmatory factor analysis for personality measures

Separate confirmatory factor analyses (CFAs) were conducted to examine the structure of the data from the AISS (Arnett, 1994), the BIS-15 (Spinella, 2007) and the IPIP (Goldberg, 2011), using AMOS software (Arbuckle, 2009).

10.13.1.1 AISS

CAF was used to fit a succession of models based on scores from the AISS (Arnett, 1994). First, a univariate model was tested where all observed variables loaded onto a single latent variable. The results revealed non-significant loadings for two items: Item 3 “If I have to wait a long time, I am usually patient about it” and item 15 “I often like to have the TV on while I am doing something else, such as reading or cleaning up”. Despite the removal of these items the univariate model remained a poor fit for the data ($\chi^2(1880) = 1007.72 [P=.00]$; $RMSEA = .06 [.06-.06]$; $GFI = .93$; $CFI = .51$; $ECVI = .57 [.52-.63]$). A two-factor model was constructed where twenty observed variables loaded onto two correlated latent variables, labelled “Novelty” and “Intensity”. Results for this model showed that four observed variables on the Novelty factor (items 3,5,13 and 15) and one observed variable in the Intensity factor (item 4) “Intensity” did not load significantly on to these factors. These items were subsequently deleted and the model was re-evaluated using the remaining 15 items. Although the model fit improved ($\chi^2(1880) = 605.65 [P=.00]$; $RMSEA = .06 [.05-.06]$; $GFI = .95$; $CFI = .67$; $ECVI = .36 [.32-.40]$), both the $RMSEA$ and the CFI remained below acceptable thresholds. Inspection of the modification indices highlighted correlations between several of the error terms associated with each of the factors. However, when these correlations were added the model fit remained poor, prompting the rejection of this model.

10.13.1.2 BIS

A range of CFA models were fitted for the data from the BIS 15 (Spinella, 2007). A unidimensional model was tested, but provided a poor fit for the observed data. Although the *RMSEA* was below .10, and the *GFI* exceeded .90, the *CFI* value was low: (χ^2 (1880) = 672.56 [P = .00]; *RMSEA* = .059 [.055-.063]; *GFI* = .99; *CFI* = .51; *ECVI* = .39 [.35-.44]). Since the developers of the full test (BIS-11) (Patton et al., 1995) and the shorter 15 item version (BIS 15) (Spinella, 2007) provided evidence that impulsiveness, as measured by these tests, consisted of 3 dimensions which are independent of each other, a multi-dimensional model was constructed, using three uncorrelated unobserved variables. This model also failed to fit the sample data: (χ^2 (1880) = 867.32 [P = .00]; *RMSEA* = .068 [.06-.07]; *GFI* = .91; *CFI* = .34; *ECVI* = .49 [.45-.55]). Another model, which introduced correlations between the unobserved variables, also represented a poor fit for the data: (χ^2 (1880) = 551.75 [P = .00]; *RMSEA* = .053 [.049-.058]; *GFI* = .94; *CFI* = .61; *ECVI* = .33 [.29-.37]). Subsequent reference to the modification indices did not suggest alterations to the model that would improve it to an acceptable level, thus this model was rejected.

10.13.1.3 IPIP

The 5-factor model of personality was also tested by conducting a CFA on the scores from the IPIP 50-item scale Goldberg (Goldberg, 2011), by stipulating five independent unobserved variables. This model represented a poor fit for the data (χ^2 (1880) = 10196.26 [P = .00]; *RMSEA* = .06 [.06-.06]; *GFI* = .79; *CFI* = .60; *ECVI* = 5.54 [5.37-5.72]). Furthermore, consultation with the modification indices did not suggest changes that might result in a substantial improvement to the model fit, thus this model was rejected.

These results show that attempts to fit suitable models to the data from all three personality tests were unsuccessful.

10.13.2 Exploratory factor analysis for personality measures

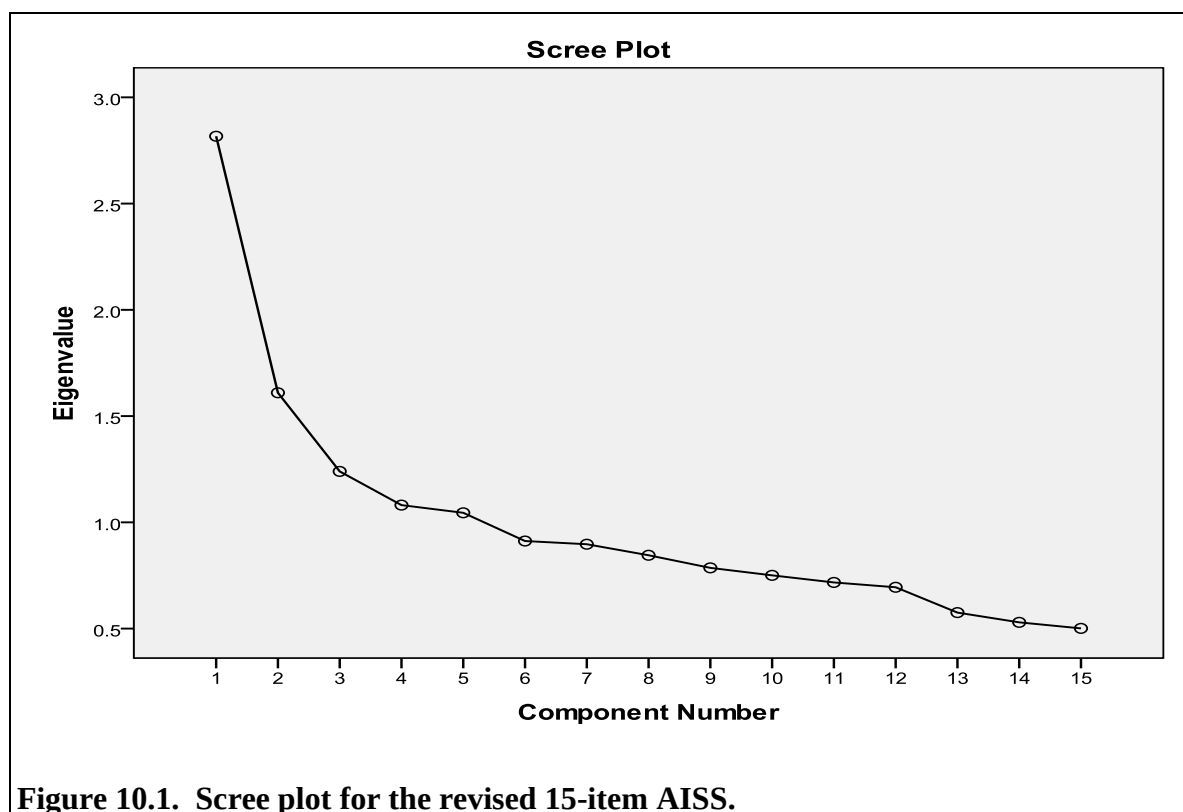


Table 10.1 Factor pattern matrix for the 15-item AISS

Item	Intensity	Novelty
20. I can see how it must be exciting to be in a battle during a war	0.69	
12. I like a movie where there are a lot of explosions and car chases	0.66	
16. It would be interesting to see a car accident happen	0.60	
10. I would never like to gamble with money, even if I could afford it	0.49	
6. I stay away from movies that are said to be frightening or highly suspenseful	0.48	
18. I like the feeling of standing next to the edge on a high place and looking down	0.44	
8. If I were to go to an amusement park, I would prefer to ride the roller coaster or other fast rides	0.29	
9. I would like to travel to places that are strange and far away		0.70
11. I would have enjoyed being one of the first explorers of an unknown land		0.61
1. I can see how it would be interesting to marry someone from a foreign country		0.60
19. If it were possible to visit another planet or the moon for free, I would be among the first to sign up		0.54
7. I think it's fun and exciting to perform or speak before a group		0.51

(cont.)

Item	Intensity	Novelty
17. I think it is best to order something familiar when eating in a restaurant		0.34
2. When the water is very cold, I prefer not to swim even if it is a hot day		0.29
14. In general, I work better when I am under pressure		0.20
Extraction Method: Principal Component Analysis.		
Rotation Method: Promax with Kaiser Normalization.		

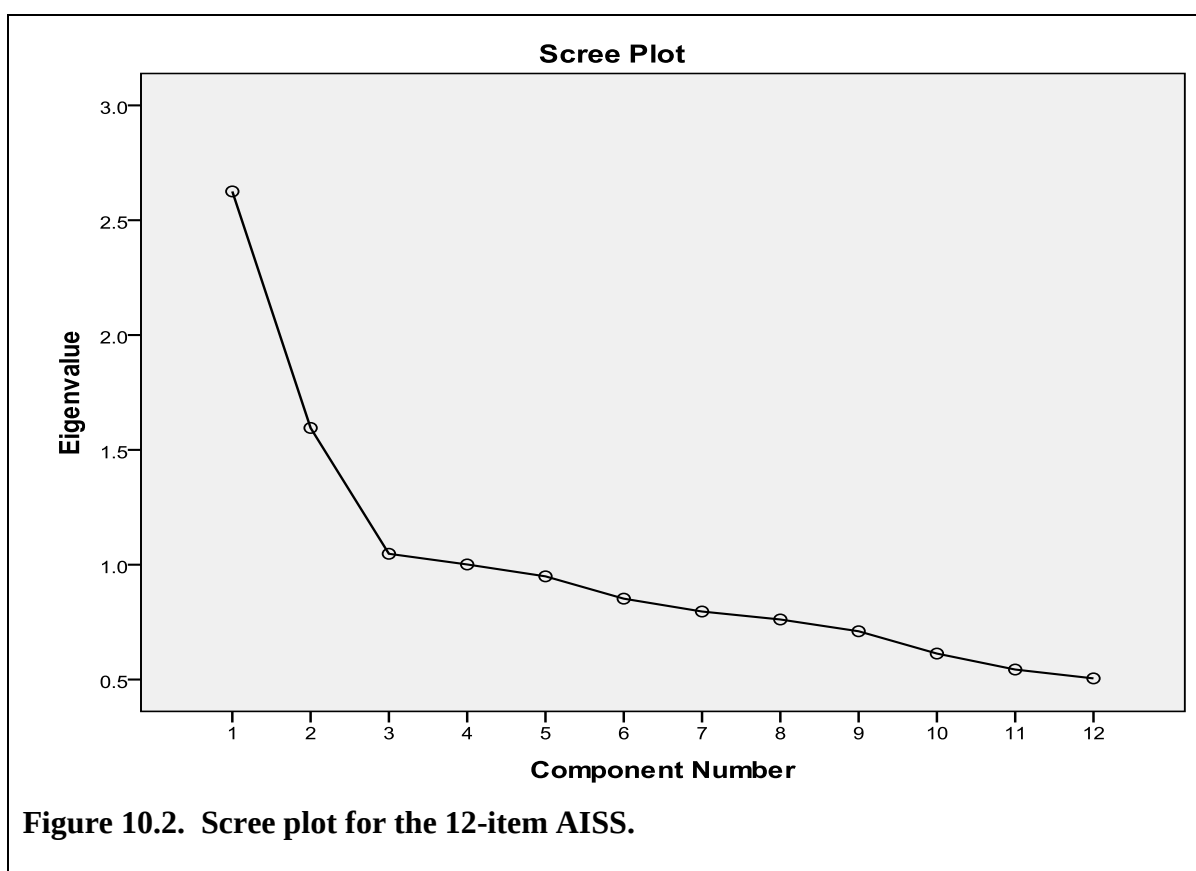


Table 10.2 Factor pattern matrix for the 12-item AISS

Item	Intensity	Novelty
20. I AISS I can see how it must be exciting to be in a battle during a war	.71	
12. I like a movie where there are a lot of explosions and car chases	.67	
16. It would be interesting to see a car accident happen	.61	
10. I would never like to gamble with money, even if I could afford it	.50	
6. I stay away from movies that are said to be frightening or highly suspenseful	.46	
18. I like the feeling of standing next to the edge on a high place and looking down	.45	
9. I would like to travel to places that are strange and far away		.69
1. I can see how it would be interesting to marry someone from a foreign country		.65
11. I would have enjoyed being one of the first explorers of an unknown land		.63
19. If it were possible to visit another planet or the moon for free, I would be among the first to sign up		.54
7. I think it's fun and exciting to perform or speak before a group		.50
17. I think it is best to order something familiar when eating in a restaurant		.33

Extraction Method: Principal Component Analysis.

Rotation Method: Promax with Kaiser Normalization.

Table 10.3 Factor pattern matrix for the 15-item BIS

Item	Behavioural Impulsiveness	Poor cognitive planning	Distractibility
13. I act on the spur of the moment	.77		
7. I buy things on impulse	.74		
1. I act on impulse	.72		
5. I do things without thinking	.44		.34
11. I say things without thinking	.44		
12. I plan for the future		.75	
8. I plan for job security		.66	
15. I plan tasks carefully		.65	
4. I save regularly		.56	-.39
2. I am a careful thinker		.55	
9. I concentrate easily		.48	.39
10. I am restless during classes or lectures			.73
			(cont.)

Item	Behavioural Impulsiveness	Poor cognitive planning	Distractibility
3. I am easily bored solving thought problems			.71
14. I squirm during classes or lectures			.58
6. I don't pay attention			.51

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.

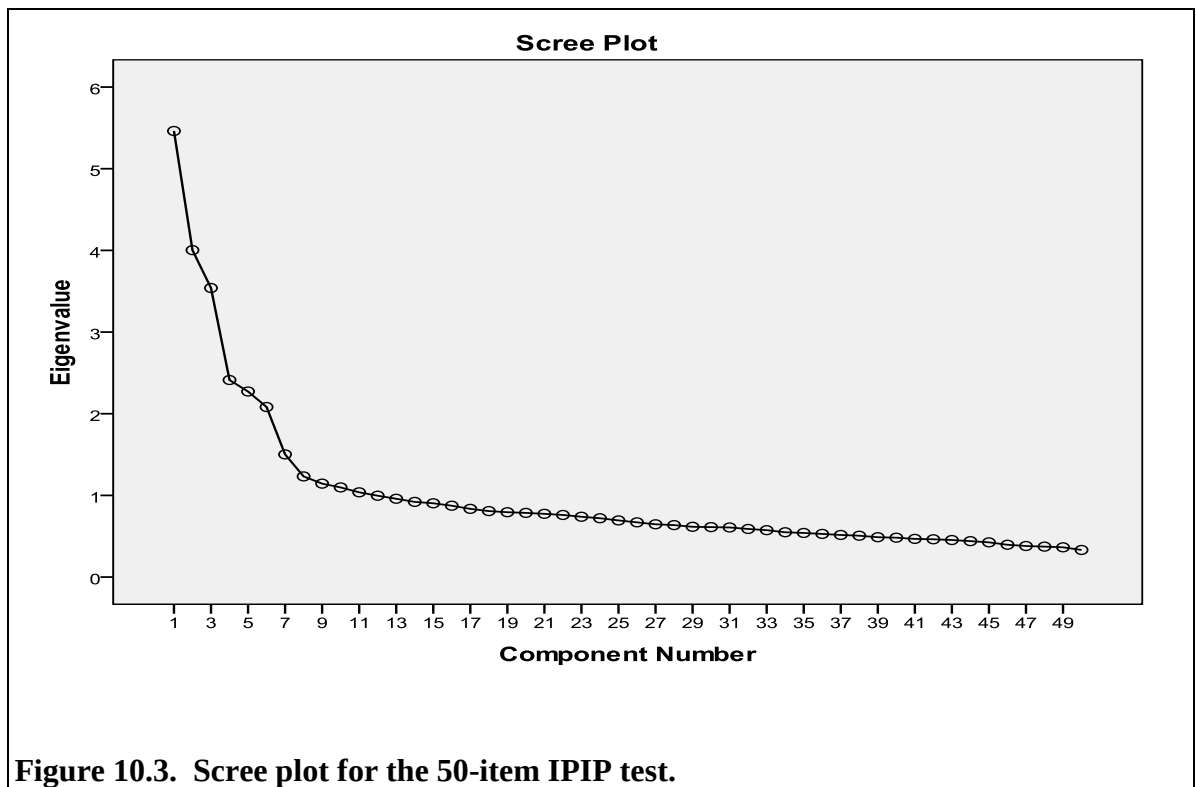


Table 10.4 Factor pattern matrix for the 50-item IPIP

Item	Extraversion	Emotional stability	Agreeableness	Intellect/Imagination	Conscientiousness
16	0.67				
1	0.67				
31	0.65				
6	0.62				
41	0.59				
36	0.59				
11	0.49				
46	0.47				
26	0.43				
21	0.39				
39		0.67			
44		0.66			
34		0.65			
4		0.62			
29		0.60			
49		0.51			
14		0.50	-0.33		
24		0.39			
9		0.38			
19		-			
17			0.68		
22			0.65		
37			0.62		
27			0.59		
42			0.56		
32			0.50		
7			0.47		
12		0.30	0.45		
47			0.35		
2			-		
5				0.67	
40				0.67	
50				0.61	
30				0.59	
15				0.58	
25				0.49	
10				0.47	
35				0.46	
20				0.39	

(cont.)

Item	Extraversion	Emotional stability	Agreeableness	Intellect/Imagination	Conscientiousness
45				0.38	
3					0.64
33					0.61
43					0.60
18					0.58
28					0.52
48					0.51
8					0.50
23					0.48
13					0.40
38					0.31

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

10.14 Appendix M. Results for Chapter 5 Knowledge tests

Table 10.5 IP models for short knowledge test proficiency

Parameter	Model 1	Model 2	Model 3	Model 4	Model 5
Fixed effects coefficients					
Intercepts	103.03** * (0.52)	100.31** * (0.58)	100.28*** (0.69)	100.63*** (0.69)	100.53*** (0.58)
<u>Level-2 (between-student)</u>					
Mean SES					0.96* (0.37) -3.29** (0.99)
Mean exposure to aberrant driving					
Mean experience with vehicles					2.46** (0.77)
Mean impulsiveness					-2.37* (1.04)
<u>Level 3 (between-groups)</u>					
Non-PLDE (Reference: Did PLDE)			0.33 (0.97)		
Programme groups (Reference: controls)					
Group A				-.041 (1.30)	
Group B				-1.23 (1.56)	
Group C				-0.17 (0.94)	
Group D				-1.03 (2.33)	
Group E				2.29 (2.42)	
Slopes					
<u>Level-1 (intra-student)</u>					
New time		5.50*** (0.53)	5.96* (0.65)	3.01*** (0.67)	5.27*** (0.60)
Age		0.01 (0.01)			
<u>Level-2 (between-student)</u>					
Mean SES					-0.84 (0.49) (cont.)

Parameter	Model 1	Model 2	Model 3	Model 4	Model 5
Mean exposure to aberrant driving					2.64* (1.08)
Mean experience with vehicles					-1.32 (0.85)
Mean impulsiveness					-0.85 (1.28)
Level 3 (between-groups)					
Non-PLDE (Reference: did PLDE)			-2.91* (1.41)		
Programme groups (Reference: controls)					
Group A				2.82* (0.82)	
Group B				3.72** (1.20)	
Group C				4.25*** (1.10)	
Group D				2.81 (1.16)	
Group E				0.86 (2.73)	
Variance components		Random effects coefficients			
Residual (σ^2)	173.71 (7.03)	158.51 (6.49)	158.31 (6.48)	157.31 (6.44)	152.66 (6.49)
Individual (τ_π)	34.64*** (6.11)	42.05*** (5.95)	42.06*** (5.94)	42.49*** (5.93)	34.71*** (5.76)
Intercept (τ_0)	5.31*** (2.21)	5.50*** (2.73)	5.41*** (2.71)	5.50* (2.73)	5.61*** (2.78)
Slope (τ_0)		0.57 (2.10)	0.02 (1.93)	0.04 (1.92)	2.61 (2.67)
Model Summary					
Deviance statistic (-2*log likelihood)	20161.61	20049.32	20044.33	20035.75	19952.09
Number of estimated parameters	4	11	9	17	67
Effect size (<i>pseudo-R</i> ²)		.03	.01	.01	.08

Note 1: Standard errors are in parentheses.

Note 2: All models were estimated using fixed intercepts and random slopes.

* $p < .05$. ** $p < .01$, *** $p < 0.001$.

Table 10.6 IVF for short knowledge test proficiency

Parameter	Model 1	Model 2	Model 3	Model 4	Model 5
Fixed effects coefficients					
Intercepts	102.78*** (0.55)	100.45*** (0.60)	100.42*** (0.67)	100.72*** (1.45)	100.69*** (0.63)
<u>Level-2 (between-student)</u>					
SES					0.92* (0.37)
Exposure to aberrant driving					-3.17** (1.05)
Experience with vehicles					1.87** (0.75)
Impulsiveness					-2.57* (1.09)
<u>Level 3 (between-groups)</u>					
Non-PLDE (Reference: Did PLDE)			0.31 (1.62)		
Programme groups (Reference: controls)					
Group A				0.22 (2.13)	
Group B				-1.49 (1.88)	
Group C				-0.40 (2.04)	
Group D				-1.26 (2.14)	
Group E				2.69 (2.30)	
Slopes					
<u>Level-1 (intra-students)</u>					
New time		5.04*** (0.60)	5.46*** (0.66)	2.79 (1.47)	5.13** (0.59)
Age		0.02 (.03)			
<u>Level-2 (between-student)</u>					
SES					-0.68 (0.53)
Exposure to aberrant driving					3.53* (1.31)
Experience with vehicles					0.03 (0.92)
Impulsiveness					2.58 (1.50)

(cont.)

Parameter	Model 1	Model 2	Model 3	Model 4	Model 5
Level 3 (between groups)					
Non-PLDE (Reference: Did PLDE)			-2.64 (1.61)		
Programme groups (Reference: controls)					
Group A				1.53 (2.11)	
Group B				4.17* (1.87)	
Group C				1.96 (2.07)	
Group D				1.86 (2.17)	
Group E				2.80 (2.46)	
Variance components		Random effects coefficients			
Residual (σ^2)	202.72 (8.90)	190.37 (8.47)	189.72 (8.44)	189.33 (8.42)	181.17 (8.37)
Individual (τ_π)	13.99*** (6.89)	19.89*** (6.73)	20.39*** (6.72)	20.13*** (6.70)	13.91** (6.51)
Intercept (τ_δ)	6.07*** (2.48)	5.55*** (2.92)	5.86** (3.01)	5.44** (2.89)	6.56 (3.19)
Slope(τ_δ)		0.19 (2.70)	0.10 (2.66)	0.11 (2.66)	1.94 (3.21)
Model Summary					
Deviance statistic (-2*log likelihood)	17725.68	17657.68	17654.83	17647.18	17565.53
Number of estimated parameters	4	11	9	17	67
Effect size (<i>pseudo-R</i> ²)		.03	.01	.01	.02

Note 1: Standard errors are in parentheses.

Note 2: All models were estimated using fixed intercepts and random slopes.

* $p < .05$. ** $p < .01$, *** $p < 0.001$.

Table 10.7 Post-intervention models for supplementary knowledge test proficiency

Parameters	Model 1	Model 2	Model 3	Model 4	Model 5
Fixed effects coefficients					
Intercepts	105.54** * (0.49)	105.53** * (0.75)	105.97*** (0.82)	103.54*** (1.62)	105.55*** (0.74)
<u>Level-1 (intra-student)</u>					
<u>Level-2 (between-student)</u>					
Exposure to aberrant driving					-1.40* (0.68)
Impulsiveness					-2.31*(0.76)
<u>Level 3 (between-groups)</u>					
Non-PLE (Reference: did PLE)			-2.51* (1.96)		
Programme groups (Reference: controls)					
Group A				2.79 (2.36)	
Group B				0.47 (2.14)	
Group C				4.23 (2.26)	
Group D				1.34 (2.37)	
Group E				1.43 (2.47)	
Slopes					
<u>Level-1 (intra-student)</u>					
New time		-0.07 (0.77)	-0.46 (0.79)	1.76 (1.53)	-0.05 (0.72)
Age		.01 (.01)			
<u>Level-2 (between-student)</u>					- (cont.)

Parameters	Model 1	Model 2	Model 3	Model 4	Model 5
Level 3 (between-groups)					
Non-PLE (Reference: did PLE)			2.26 (1.94)		
Programme groups (Reference: controls)					
Group A				-2.17 (2.18)	
Group B				0.07 (1.99)	
Group C				-0.88 (2.11)	
Group D				-1.53 (2.21)	
Group E				-2.13 (2.35)	
Slope interactions					
Mean exposure + non-PLE					
Mean exposure + PLE					
Variance components					
	Random effects coefficients				
Residual (σ^2)	110.57 (4.77)	105.53 (4.62)	105.53 (4.62)	105.79 (4.63)	105.47 (4.61)
Individual (τ_π)	42.62** (4.90)	44.99*** (4.86)	44.97*** (4.86)	44.73*** (4.86)	41.52*** (4.80)
Intercept (τ_6)	4.72*** (1.98)	13.60*** (4.71)	12.94*** (4.55)	9.31*** (3.62)	12.96*** (4.53)
Exposure to aberrant driving					3.06 (3.20)
Impulsiveness					2.96 (4.25)
Slope(τ_6)		11.01*** (4.49)	10.23*** (4.28)	5.49*** (3.02)	10.26*** (4.27)
Model Summary					
Deviance statistic (-2*log likelihood)	17162.89	17137.2	17135.54	17125.54	172.58
Number of estimated parameters	4	11	9	17	16
Effect size (<i>pseudo-R</i> ²)		.01	.01	.01	.02

Note 1: Standard errors are in parentheses.

Note 2: All models were estimated using fixed intercepts and random slopes. * $p < .05$. ** $p < .01$, *** $p < 0.001$.

10.15 Appendix N. Results for Chapter 6, Risk perception tests

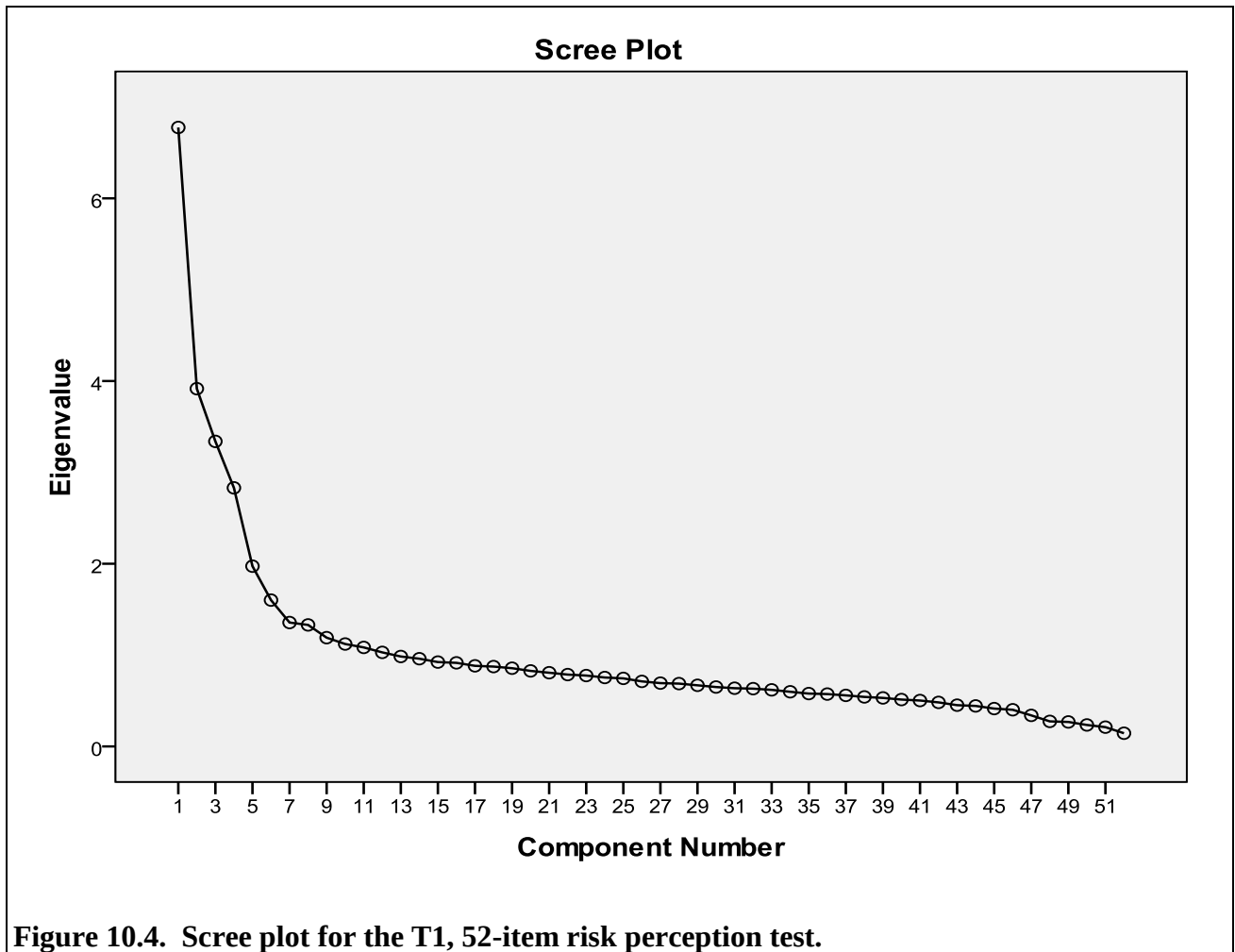


Table 10.8 Rotated PCA component matrix for the T1, 52-item risk perception test

Item description	Question	<u>Component</u>						
		1	2	3	4	5	6	7
Driver is racing other cars	D/36	0.72						
Driver has been taking drugs or smoking dope	D/36	0.71						
Driver has been drinking alcohol	D/36	0.69						
Car can go really fast and the driver is testing it out or showing it off	D/36	0.68						
Driver is texting, playing video games or using hand held electronic device	D/36	0.61						
Passengers are trying to get driver to speed or perform illegal manoeuvres	D/36	0.58						
Driver is inexperienced	D/36	0.54						
Driver is paying attention to the passengers because they are being "rowdy"	D/36	0.53						
Driver is feeling strong emotions like being angry or stressed	D/36	0.52						
Driver is tired	D/36	0.52						
Driver is in a hurry	D/36	0.44						
Other drivers are driving unsafely	D/36	0.40						
Driver and passengers are not wearing seatbelts	D/36	0.40						
Roads in bad condition	D/36	0.38						
Driver is talking on a hand-held mobile phone	D/36							
Avoid crashing after taking drugs	D/27		0.78					
Avoid crashing after drinking 4 units alcohol	D/27		0.78					
Avoid crashing while texting or playing computer games	D/27		0.77					

(cont)

Item description	Question	<u>Component</u>						
		1	2	3	4	5	6	7
Avoid crashing while talking on a mobile phone	D/27		0.72					
Avoid Crashing travelling in car with people who are not using a seatbelt	D/27		0.68					
Avoid crashing after taking prescription drugs	D/27		0.55					
Avoid crashing while exceeding speed limit by 10 km/h in a 100 zone	D/27		0.55					
Avoid crashing while exceeding speed limit by 10 km/h in a 50 zone	D/27		0.34					
Chances that YOU as a driver will be involved in a Moderate Property Damage Crash	D/33			0.83				
Chances that YOU as a road user will be involved in a Moderate Property Damage crash	D/30			0.76				
Chances that YOU as a driver will be involved in a Minor Property Damage crash	D/33			0.76				
Chances that YOU as a road user will be involved in a Minor Property Damage crash	D/30			0.69				
Chances that YOU as a driver will be involved in a Serious Injury / Loss of Life crash	D/33			0.67				
Chances that YOU as a road user will be involved in a Serious Injury / Loss of Life crash	D/30			0.62				
Willingness to refrain from wearing seatbelt in car	D/32				0.64			
Willingness to ride motorcycle without a helmet	D/32				0.62			
Willingness to take a lift with a driver who has been drinking	D/32				0.60			
Willingness to drive parents car without permission	D/32				0.57			
Willingness to refrain from wearing a seatbelt in the school bus	D/32				0.57			
Willingness to cycle without a helmet	D/32				0.54			
Willingness to cross a busy road from between parked cars	D/32				0.48			
Traffic is heavy	D/36							(cont.)

Item description	Question	<u>Component</u>						
		1	2	3	4	5	6	7
Driver is talking on a hands-free mobile phone	D/36					0.58		
Its dark outside	D/36					0.55		

It is cold or wet and the roads are slippery	D/36	0.44		
There are other teenagers in the car	D/36	0.32		
Chances that a typical road user will be involved in a Serious Injury/Loss of Life crash	D/24		0.83	
Chances that a typical road user will be in a Minor Property Damage crash	D/24		0.79	
Chances that a typical road user will be involved in a Serious Injury/Loss of Life crash	D/24		0.38	
Lots of drivers are careless. I can't do anything about it if they crash into me	D/21	0.42		0.52
If we just do what our teachers, parents and the authorities tell us, we will go through life like robots, never fully enjoying things	D/21	0.31	0.34	0.41
Learning to drive will be easy for me	D/21			0.37
Avoiding accidents over a long period is basically down to luck is down to luck	D/21	0.31		0.35
I will find it very difficult to follow the rules of the road all of the time	D/21	0.30		0.32
Even with all the thousands of cars on the roads, there's a lot I can do by myself to avoid an accident	D/21			
The government/authorities are mainly responsible for improving road safety	D/21			

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

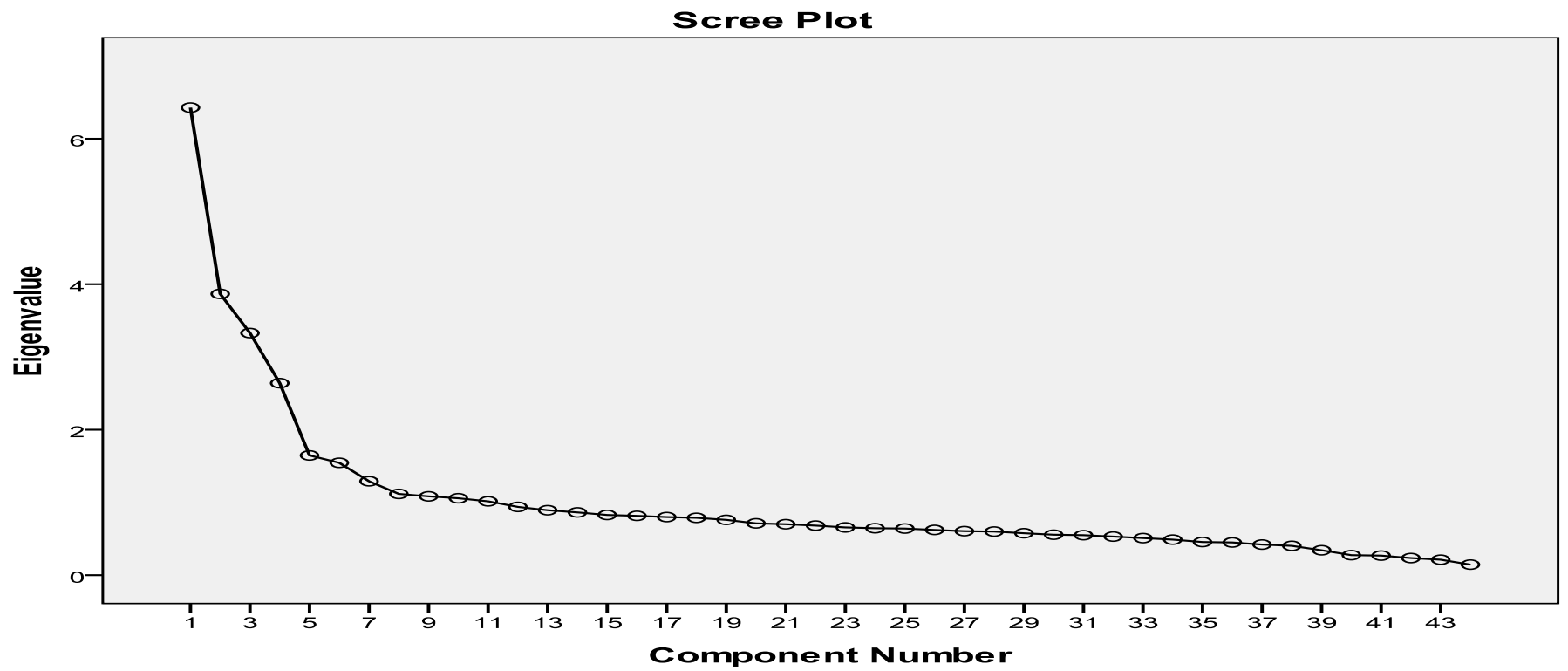


Figure 10.5. Scree plot for the T1, 42-item risk perception test.

Table 10.9 Rotated PCA component matrix for the T1, 42-item risk perception test

Item description	Question	Component			
		1	2	3	4
Driver is racing other cars	D/36	0.69			
Driver has been taking drugs or smoking dope	D/36	0.67			
Driver has been drinking alcohol	D/36	0.66			
Car can go really fast and the driver is testing it out or showing it off	D/36	0.65			
Driver is texting, playing video games or using hand held electronic device	D/36	0.60			
Passengers are trying to get driver to speed or perform illegal manoeuvres	D/36	0.58			
Driver is tired	D/36	0.57			
Driver is paying attention to the passengers because they are being "rowdy"	D/36	0.56			
Driver is inexperienced	D/36	0.55			
Driver is feeling strong emotions like being angry or stressed	D/36	0.53			
Driver is talking on a hands-free mobile phone	D/36	0.49			
Driver is in a hurry	D/36	0.51			
It is cold or wet and the roads are slippery	D/36	0.48			
Other drivers are driving unsafely	D/36	0.47			
Roads in bad condition	D/36	0.47			
Driver and passengers are not wearing seatbelts	D/36	0.44			
Its dark outside	D/36	0.39			
There are other teenagers in the car	D/36	0.34			
Chances that YOU as a road user will be involved in a Moderate Property Damage crash	D/30		0.81		
Chances that YOU as a driver will be involved in a Moderate Property Damage Crash	D/33		0.78		
Chances that YOU as a road user will be involved in a Serious Injury / Loss of Life crash	D/30		0.74		(cont.)

Item description	Question	Component			
		1	2	3	4
Chances that YOU as a driver will be involved in a Serious Injury / Loss of Life crash	D33		0.73		
Chances that YOU as a road user will be involved in a Minor Property Damage crash	D/30		0.59		
Chances that a typical road user will be in a Minor Property Damage crash	D/24		0.58		
Chances that YOU as a driver will be involved in a Minor Property Damage crash	D/33		0.58		
Chances that a typical road user will be involved in a Serious Injury/Loss of Life crash	D/24		0.52		
Chances that a typical road user will be involved in a Serious Injury/Loss of Life crash	D/24		0.41		
Avoid crashing after taking drugs	D/27			0.80	
Avoid crashing while texting or playing computer games	D/27			0.78	
Avoid crashing after drinking 4 units alcohol	D/27			0.78	
Avoid crashing while talking on a mobile phone	D/27			0.72	
Avoid Crashing travelling in car with people who are not using a seatbelt	D/27			0.66	
Avoid crashing after taking prescription drugs	D/27			0.54	
Avoid crashing while exceeding speed limit by 10 km/h in a 100 zone	D/27			0.53	
Avoid crashing while exceeding speed limit by 10 km/h in a 50 zone	D/27			0.32	
Willingness to refrain from wearing a seatbelt in the school bus	D/32				0.67
Willingness to cycle without a helmet	D/32				0.64
Willingness to refrain from wearing seatbelt in car	D/32				0.57
Willingness to cross a busy road from between parked cars	D/32				0.56
Willingness to ride motorcycle without a helmet	D/32				0.47
Willingness to drive parents car without permission	D/32				0.47
Willingness to take a lift with a driver who has been drinking	D/32				0.45

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

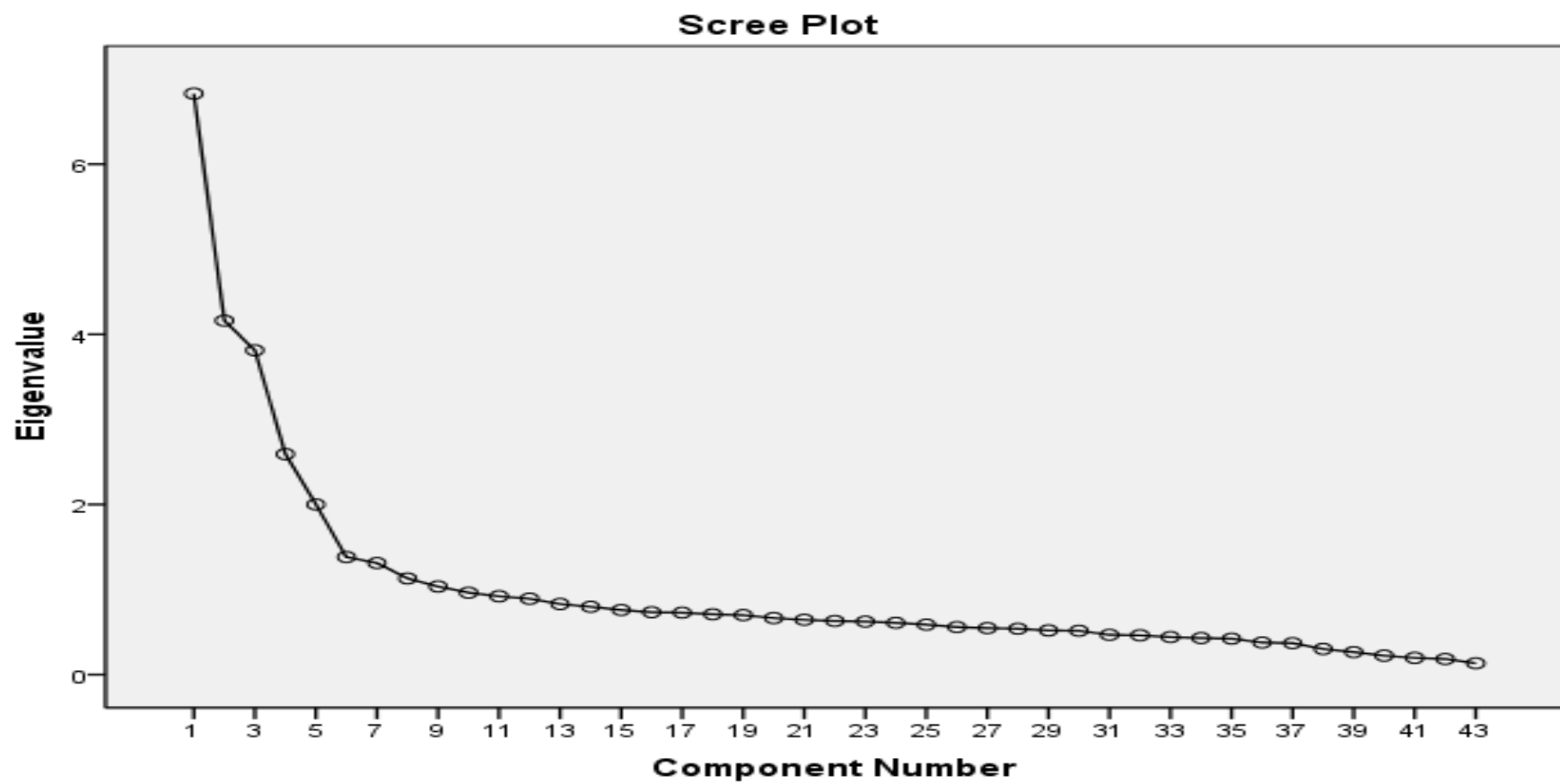


Figure 10.6. Scree plot for the T2, 42-item risk perception test.

Table 10.10 Rotated PCA component matrix for the T2, 42-item risk perception test

Item description	Question	<u>Component</u>			
		1	2	3	4
Driver is racing other cars	D/36	0.69			
Driver has been drinking alcohol	D/36	0.67			
Car can go really fast and the driver is testing it out or showing it off	D/36	0.67			
Driver has been taking drugs or smoking dope	D/36	0.66			
Driver is texting, playing video games or using hand held electronic device	D/36	0.65			
Driver is paying attention to the passengers because they are being "rowdy"	D/36	0.62			
Passengers are trying to get driver to speed or perform illegal manoeuvres	D/36	0.59			
Driver is feeling strong emotions like being angry or stressed	D/36	0.59			
Driver is tired	D/36	0.57			
Driver is inexperienced	D/36	0.54			
Driver is in a hurry	D/36	0.54			
Driver is talking on a hand-held mobile phone	D/36	0.52			
There are other teenagers in the car	D/36	0.48			
It is cold or wet and the roads are slippery	D/36	0.47			
Driver and passengers are not wearing seatbelts	D/36	0.47			
Other drivers are driving unsafely	D/36	0.46			
Roads in bad condition	D/36	0.43			
Its dark outside	D/36	0.34			
Avoid crashing after drinking 4 units alcohol	D/27		0.84		
Avoid crashing while texting or playing computer games	D/27		0.81		
Avoid crashing after taking drugs	D/27		0.81		
Avoid crashing while talking on a mobile phone	D/27		0.75		(cont.)

Item description	Question	<u>Component</u>			
		1	2	3	4
Avoid crashing after taking prescription drugs	D/27		0.69		
Avoid crashing travelling in car with people who are not using a seatbelt	D/27		0.68		
Avoid crashing while exceeding speed limit by 10 km/h in a 100 zone	D/27		0.63		
Avoid crashing while exceeding speed limit by 10 km/h in a 50 zone	D/27		0.47		
Chances that YOU as a road user will be involved in a Moderate Property Damage crash	D30			0.82	
Chances that YOU as a driver will be involved in a Moderate Property Damage Crash	D/33			0.81	
Chances that YOU as a road user will be involved in a Serious Injury / Loss of Life crash	D30			0.77	
Chances that YOU as a driver will be involved in a Serious Injury / Loss of Life crash	D/33			0.77	
Chances that YOU as a driver will be involved in a Minor Property Damage crash	D/33			0.60	
Chances that a typical road user will be involved in a Moderate Property Damage crash	D/24			0.59	
Chances that YOU as a road user will be involved in a Minor Property Damage crash	D30			0.58	
Chances that a typical road user will be involved in a Serious Injury/Loss of Life crash	D/24			0.57	
Chances that a typical road user will be in a Minor Property Damage crash	D/24			0.36	
Willingness to refrain from wearing a seatbelt in the school bus	D/32				0.68
Willingness to cycle without a helmet	D/32				0.59
Willingness to refrain from wearing seatbelt in car	D/32				0.57
Willingness to cross a busy road from between parked cars	D/32				0.54
Willingness to drive parents car without permission	D/32				0.52
Willingness to take a lift with a driver who has been drinking	D/32	0.30			0.44
Willingness to ride motorcycle without a helmet	D/32				0.44

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

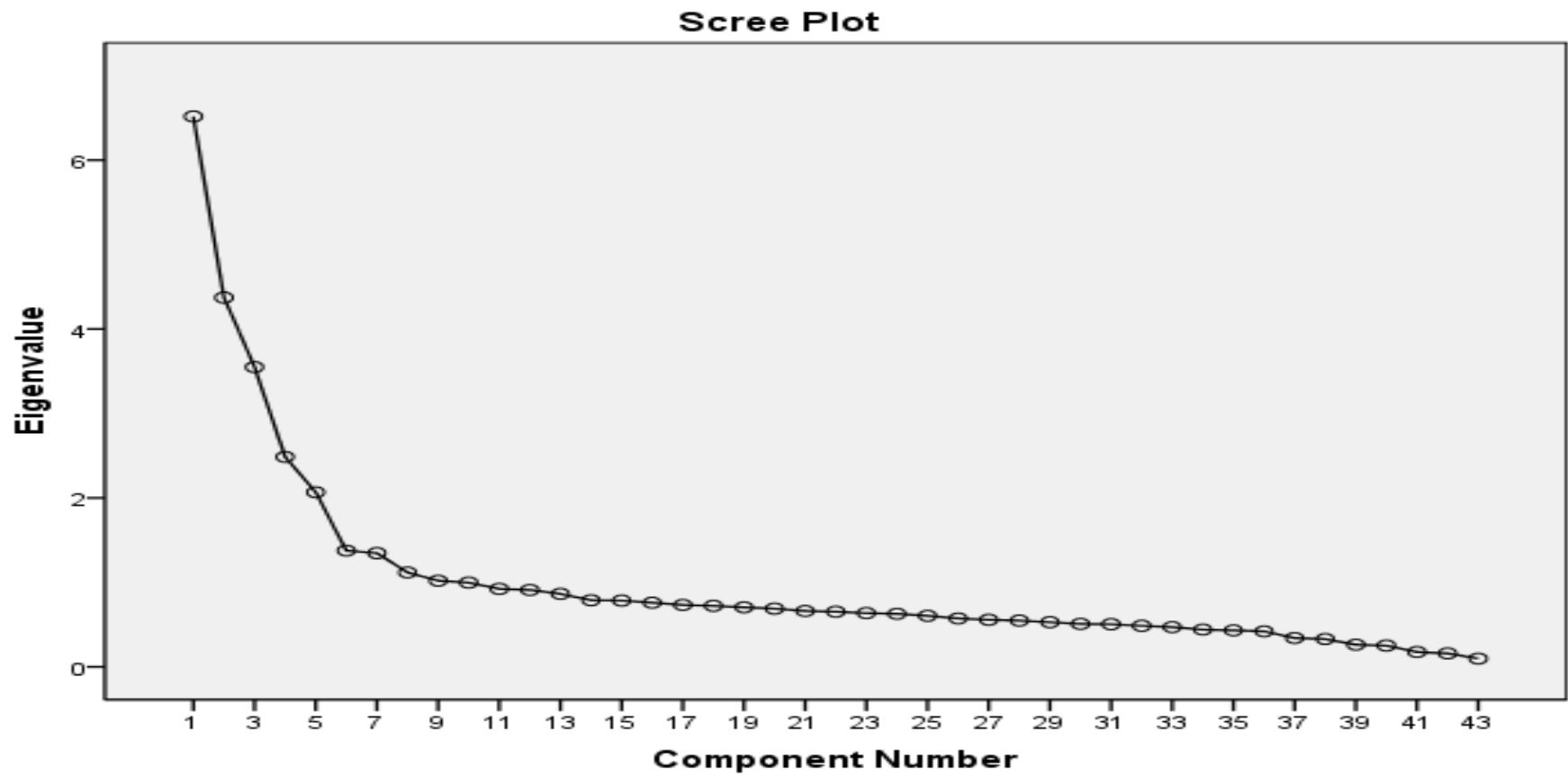


Figure 10.7. Scree plot for the T3, 42-item risk perception test.

Table 10.11 Rotated PCA component matrix for the T3, 42-item risk perception test

Item description	Question	Component			
		1	2	3	4
Driver is racing other cars	D/36	0.67			
Driver is texting, playing video games or using hand held electronic device	D/36	0.65			
Car can go really fast and the driver is testing it out or showing it off	D/36	0.65			
Driver has been drinking alcohol	D/36	0.62			
Driver is paying attention to the passengers because they are being "rowdy"	D/36	0.58			
Passengers are trying to get driver to speed or perform illegal manoeuvres	D/36	0.56			
Driver is talking on a hand-held mobile phone	D/36	0.55			
Driver is tired	D/36	0.55			
Driver is feeling strong emotions like being angry or stressed	D/36	0.55			
Driver has been taking drugs or smoking dope	D/36	0.54			
Driver is inexperienced	D/36	0.54			
Other drivers are driving unsafely	D/36	0.50			
Driver is in a hurry	D/36	0.49			
It is cold or wet and the roads are slippery	D/36	0.47			
Driver and passengers are not wearing seatbelts	D/36	0.46			
There are other teenagers in the car	D/36	0.46			
Roads in bad condition	D/36	0.44			
Its dark outside	D/36	0.33			
Chances that YOU as a road user will be involved in a Moderate Property Damage crash	D/30		0.85		
Chances that YOU as a driver will be involved in a Moderate Property Damage Crash	D/33		0.83		
Chances that YOU as a road user will be involved in a Serious Injury / Loss of Life crash	D/30		0.77		
Chances that YOU as a driver will be involved in a Serious Injury / Loss of Life crash	D/33		0.77		
Chances that YOU as a road user will be involved in a Minor Property Damage crash	D/30		0.65		(cont.)

Item description	Question	<u>Component</u>			
		1	2	3	4
Chances that a typical road user will be involved in a Moderate Property Damage crash	D/24		0.64		
Chances that YOU as a driver will be involved in a Minor Property Damage crash	D/33		0.63		
Chances that a typical road user will be involved in a Serious Injury/Loss of Life crash	D/24		0.61		
Chances that a typical road user will be in a Minor Property Damage crash	D/24		0.42		
Avoid crashing while texting or playing computer games	D/27			0.78	
Avoid crashing after drinking 4 units alcohol	D/27			0.76	
Avoid crashing while talking on a mobile phone	D/27			0.74	
Avoid crashing after taking drugs	D/27			0.74	
Avoid Crashing travelling in car with people who are not using a seatbelt	D/27			0.62	
Avoid crashing after taking prescription drugs	D/27			0.60	
Avoid crashing while exceeding speed limit by 10 km/h in a 100 zone	D/27			0.60	
Avoid crashing while exceeding speed limit by 10 km/h in a 50 zone	D/27			0.48	
Willingness to refrain from wearing a seatbelt in the school bus	D/32				0.73
Willingness to cycle without a helmet	D/32				0.70
Willingness to take a lift with a driver who has been drinking	D/32				0.65
Willingness to cross a busy road from between parked cars	D/32				0.56
Willingness to refrain from wearing seatbelt in car	D/32				0.51
Willingness to drive parents car without permission	D/32				0.47
Willingness to ride motorcycle without a helmet	D/32				0.40

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

Table 10.12 IP models for the PRAD scale

Parameters	Model 1	Model 2	Model 5
Fixed effects coefficients			
Intercepts			
Level-2 (between-student)			
Gender Female (Reference: Male)			-0.04* (0.04)
Exposure to aberrant driving			0.12*** (0.01)
Impulsiveness			0.10*** (0.02)
Slopes			
Level-1 (intra-student)			
New time		-0.01 (0.01)	0.01 (0.01)
Mean age		0.01 (0.01)	
Random effects coefficients			
Variance components			
Residual (σ^2)	0.05 (0.01)	0.05 (0.01)	0.05 (0.01)
Individual (τ_π)	0.02*** (0.01)	0.02*** (0.01)	0.02*** (0.01)
Intercept (τ_0)	0.01*** (0.01)	0.01 (0.01)	<0.01 (<0.01)
Slope(τ_0)		<0.01 (<0.01)	<0.01 (<0.01)
Model Summary			
Deviance statistic (-2*log likelihood)	420.74	410.95	261.65
Number of estimated parameters	4	11	11
Effect size (<i>pseudo-R</i> ²)		<.01	.05

Note 1: Standard errors are in parentheses.

Note 2: Models were estimated using random intercepts and fixed slopes for level-2 (τ_π) predictors. However, where a model contained between-student predictors, the level-3 (τ_0) intercept and slope estimates were fixed in order to make the residual variance in the model easier to interpret.

* $p < .05$. ** $p < .01$, *** $p < 0.001$.

Table 10.13 IVF model for the PRAD scale

Parameters	Model 1	Model 2	Model 3	Model 4	Model 5
Fixed effects coefficients					
Intercepts	1.48*** (0.01)	1.50*** (0.01)	1.50*** (0.01)	1.45*** (0.02)	1.49*** (0.02)
<u>Level-2 (between-student)</u>					
Gender Female (Reference: Male)					-0.06* (0.03)
Exposure to aberrant driving					0.09*** (0.03)
Impulsiveness					0.08* (0.04)
Non-PLE (Reference: Did PLE)			-0.05 (0.01)		
Programme groups (Reference: controls)					
Group A				0.01 (0.04)	
Group B				0.06 (0.04)	
Group C				0.06 (0.04)	
Group D				0.05 (0.04)	
Group E				0.06 (0.05)	
Slopes					
<u>Level-1 (intra-student)</u>					
New time		-0.05*** (0.01)	-0.05*** (0.01)	-0.03 (0.03)	-0.05*** (0.01)
Mean age		-0.01 (0.01)			
<u>Level 3 (between-groups)</u>					
Non-PLE (Reference: Did PLE)			0.02 (0.03)		
Programme groups (Reference: controls)					
Group A				-0.04 (0.03)	
Group B				-0.01 (0.04)	
Group C				-0.04 (0.04)	
Group D				-0.01 (0.04)	
Group E				-0.01 (0.04)	(0.04)
Random effects coefficients					
Variance components					
Residual (σ^2)	0.05 (0.01)	0.05 (0.01)	0.05 (0.01)	0.01 (0.01)	0.05 (0.01)
Individual (τ_{π})	0.02*** (0.01)	0.02*** (0.01)	0.02*** (0.01)	0.01*** (0.01)	0.02*** (0.01)
Intercept (τ_{δ})	0.01*** (0.01)	0.01*** (0.01)	0.01*** (0.01)	0.01*** (0.01)	<0.01* (<0.01)
Gender Female (Reference: Male)					
Exposure to aberrant driving					
Impulsiveness					
Slope(τ_{δ})		<0.01* (0.01)	<0.01* (0.01)	<0.01* (0.01)	<0.01 (<0.01)
Gender Female (Reference: Male)					
Model Summary					
Deviance statistic (-2*log likelihood)	386.15	366.31	363.95	356.08	356.08
Number of estimated parameters	4	11	9	17	17
Effect size (<i>pseudo-R</i> ²)		.02	.01	.01	.01
				463	

Note 1: Standard errors are in parentheses.

Note 2: Models were estimated using random intercepts and fixed slopes for level-2 ($\tau\pi$) predictors. However, where a model contained between-student predictors, the level-3 ($\tau\epsilon$) intercept and slope estimates were fixed in order to make the residual variance in the model easier to interpret.

* $p < .05$. ** $p < .01$, *** $p < 0.001$.

Table 10.14 T3 models for the likelihood of encountering risk-increasing factors while gaining experience with driving

Parameters	Model 1	Model 2	Model 3
Fixed effects coefficients			
Intercepts	1.76*** (0.02)	1.76*** (0.02)	1.80*** (0.05)
Slopes			
<u>Level-2 (between-student)</u>			
<u>Level-3 (between-groups)</u>			
Non-PLE (Reference: Did PLE)		0.04 (0.05)	
Programme groups (Reference: controls)			
Group A			-0.08 (0.07)
Group B			-0.03 (0.06)
Group C			-0.01 (0.07)
Group D			-0.01 (0.07)
Group E			-0.10 (0.08)
Model Summary			
Deviance statistic (-2*log likelihood)	1957.91	1959.57	1971.66
Number of estimated parameters	2	4	15
Effect size (<i>pseudo-R</i> ²)		<.01	<.01

Note 1: Standard errors are in parentheses.

Note 2: Models were estimated using random intercepts and fixed slopes for level-2 ($\tau\pi$) predictors. However, where a model contained between-student predictors, the level-3 ($\tau\epsilon$) intercept and slope estimates were fixed, to make the residual variance in the model easier to interpret.

* $p < .05$. ** $p < .01$, *** $p < 0.001$.

Table 10.15 IP models for the CRLE scale

Parameters	Model 1	Model 2	Model 3
Fixed effects coefficients			
Intercepts			
<u>Level-2 (between-student)</u>			
Gender Female (Reference: Male)	3.44*** (0.02)	3.46*** (0.02)	3.45*** (0.02)
<u>Level 3 (between groups)</u>			
Non-PLE (Reference: Did PLE)			0.10 (0.03)
Programme groups (Reference: controls)			
Group A			
Group B			
Group C			
Group D			
Group E			
Slopes			
<u>Level-1 (intra-student)</u>			
New time		-0.06** (0.02)	-0.05* (0.02)
Mean age		0.03 (0.03)	
<u>Level-2 (between-student)</u>			
Gender Female (Reference: Male)			
<u>Level 3 (between-groups)</u>			
Non-PLE (Reference: Did PLE)			-0.07 (0.03)
Programme groups (Reference: controls)			
Group A			
Group B			
Group C			
Group D			
Group E			
Random effects components			
Variance components			
Residual (σ^2)	0.23 (0.01)	0.23 (0.01)	0.23 (0.01)
Individual (τ_π)	0.11*** (0.01)	0.11*** (0.01)	0.11*** (0.01)
Intercept (τ_0)	0.01*** (0.01)	0.01** (0.01)	0.01** (0.01)
Slope(τ_0)		0.001 (0.001)	0.001 (0.001)
Model Summary			
Deviance statistic (-2*log likelihood)	3942.57	3932.66	3932.66
Number of estimated parameters	4	11	11
Effect size (<i>pseudo-R</i> ²)		.01	.01

Note 1: Standard errors are in parentheses.

Note 2: Models were estimated using random intercepts and fixed slopes for level-2 (τ_π) predictors. However, where a model included level-3 predictors, the level-3 (τ_0) intercept and slope estimates were fixed in order to make the residual variance in the model equal to 1.

* $p < .05$. ** $p < .01$, *** $p < 0.001$.

Table 10.16 IVF models for the CRLE scale

Parameters	Model 1	Model 2	Model 3	Model 4
Fixed effects coefficients				
Intercepts	3.46*** (0.02)	3.47*** (0.02)	3.45*** (0.02)	3.58*** (0.05)
<u>Level-2 (between-student)</u>				
Gender Female (Reference: Male)				
Non-PLE (Reference: Did PLE)			0.11 (0.06)	
Programme groups (Reference: controls)				
Group A				0.15 (0.07)
Group B				0.13 (0.06)
Group C				0.13 (0.07)
Group D				0.08 (0.07)
Group E				0.09 (0.08)
Slopes				
<u>Level-1 (intra-student)</u>				
New time		-0.02 (0.03)	-0.02 (0.03)	-0.05 (0.05)
Mean age		0.01 (0.02)		
<u>Level-2 (between-students)</u>				
Gender Female (Reference: Male)				
Location Rural (Reference: Urban)				
<u>Level 3 (between-groups)</u>				
Non-PLE (Reference: Did PLE)			0.02 (0.07)	
Programme groups (Reference: controls)				
Group A				-0.09 (0.08)
Group B				-0.06 (0.07)
Group C				-0.07 (0.08)
Group D				-0.07 (0.08)
Group E				-0.04 (0.09)
Random effects coefficients				
Variance components				
Residual (σ^2)	0.26 (0.01)	0.25 (0.01)	0.25 (0.01)	0.25 (0.01)
Individual (τ_π)	0.10*** (0.01)	0.10*** (0.01)	0.10*** (0.01)	0.10*** (0.01)
Intercept (τ_δ)	0.01*** (0.01)	0.01** (0.01)	<0.01 (0.01)	<0.01 (0.01)
Gender Female (Reference: Male)				
Slope(τ_δ)		0.01 (0.01)	<0.01 (0.01)	<0.01 (0.01)
Gender Female (Reference: Male)				
Model Summary				
Deviance statistic (-2*log likelihood)	3820.76	3815.95	3811.9	3803.58
Number of estimated parameters	4	11	9	17
Effect size (<i>pseudo-R</i> ²)		.01	.01	.01

Note 1: Standard errors are in parentheses.

Note 2: Models were estimated using random intercepts and fixed slopes for level-2 (τ_π) predictors. However, where a m

predictors, the level-3 (τ^2) intercept and slope estimates were fixed in order to make the residual variance in the model equal to 1.0. * $p < .05$. ** $p < .01$, *** $p < 0.001$.

Table 10.17 IP models for the PCR scale

Parameters	Model 1	Model 2	Model 3	Model 4	Model 5
Fixed effects coefficients					
Intercepts	2.18*** (0.02)	2.22*** (0.02)	2.22*** (0.02)	2.20*** (0.05)	2.22*** (0.02)
<u>Level-2 (between-student)</u>					
Exposure to aberrant driving					0.11** (0.03)
Experience with vehicles					0.08*** (0.02)
Impulsiveness					0.24*** (0.03)
<u>Level 3 (between-groups)</u>					
Non-PLE (Reference: Did PLE)			-0.02 (0.06)		
Programme groups (Reference: controls)					
Group A				0.10 (0.07)	
Group B				-0.04 (0.06)	
Group C				-0.02 (0.07)	
Group D				0.11 (0.07)	
Group E				0.01 (0.08)	
Slopes					
<u>Level-1 (intra-student)</u>					
New time		-0.06* (0.03)	-0.07* (0.03)	-0.04 (0.07)	-0.06* (0.03)
Mean age		0.03 (0.03)			
<u>Level-2 (between-student)</u>					
Impulsiveness					-0.14** (0.05) (cont.)

Parameters	Model 1	Model 2	Model 3	Model 4	Model 5
Level 3 (between-groups)					
Non-PLE (Reference: Did PLE)			0.02 (0.07)		
Programme groups (Reference: controls)					
Group A				-0.02 (0.09)	
Group B				-0.02 (0.08)	
Group C				-0.10 (0.09)	
Group D				-0.01 (0.09)	
Group E				-0.04 (0.11)	
Variance components		Random effects coefficients			
Residual (σ^2)	0.40 (0.02)	0.39 (0.02)	0.39 (0.02)	0.39 (0.02)	0.39 (0.02)
Individual (τ_π)	0.07*** (0.01)	0.07*** (0.01)	0.07*** (0.01)	0.07*** (0.01)	0.06*** (0.01)
	<0.01**	<0.01	<0.01	<0.01	<0.01
Intercept (τ_δ)	(<0.01)	(<0.01)	(<0.01)	(<0.01)	(<0.01)
		<0.01	<0.01	<0.01	<0.01
Slope(τ_δ)		(<0.01)	(<0.01)	(<0.01)	(<0.01)
Model Summary					
Deviance statistic (-2*log likelihood)	5179.03	5169.95	5169.75	5154.15	5096.89
Number of estimated parameters	4	11	9	17	11
Effect size (<i>pseudo-R</i> ²)		.01	<.01	.01	.03

Note 1: Standard errors are in parentheses.

Note 2: Models were estimated using random intercepts and fixed slopes for level-2 (τ_π) predictors.

However, where a model contained between-student predictors, the level-3 (τ_δ) intercept and slope estimates were fixed in order to make the residual variance in the model easier to interpret.

* $p < .05$. ** $p < .01$, *** $p < 0.001$.

Table 10.18 IVF models for the PCR scale

Parameters	Model 1	Model 2	Model 3	Model 4	Model 5
Fixed effects coefficients					
Intercepts	2.18*** (0.02)	2.22*** (0.02)	2.22*** (0.02)	2.21*** (0.05)	2.22*** (0.02)
<u>Level-2 (between-student)</u>					
Exposure to aberrant driving					0.12*** (0.03)
Experience with vehicles					0.09*** (0.02)
Impulsiveness					0.24*** (0.04)
<u>Level 3 (between-groups)</u>					
Non-PLE (Reference: Did PLE)			-0.01 (0.06)		
Programme groups (Reference: controls)					
Group A				0.09 (0.07)	
Group B				-0.07 (0.06)	
Group C				-0.03 (0.07)	
Group D				0.11 (0.08)	
Group E				0.01 (0.08)	
Slopes					
<u>Level-1 (intra-student)</u>					
New time		-0.06 (0.03)	-0.07 (0.03)	-0.01 (0.08)	-0.06 (0.03)
Mean age		-0.01 (0.03)			
<u>Level-2 (between-students)</u>					
Impulsiveness					-0.15** (0.03)
Sensation seeking					(cont.)

Parameters	Model 1	Model 2	Model 3	Model 4	Model 5
<u>Level 3 (between-groups)</u>					
Non-PLE (Reference: Did PLE)			0.07 (0.09)		
Programme groups (Reference: controls)					
Group A				-0.02 (0.11)	
Group B				-0.01 (0.09)	
Group C				-0.04 (0.11)	
Group D				-0.09 (0.11)	
Group E				-0.05 (0.12)	
Variance components					
Random effects coefficients					

Residual (σ^2)	0.37 (0.02)	0.36 (0.02)	0.36 (0.02)	0.36 (0.02)	0.36 (0.02)
Individual (τ_π)	0.04*** (0.01)	0.04*** (0.01)	0.04*** (0.01)	0.04*** (0.01)	0.04*** (0.01)
Intercept (τ_0)	<0.01***	<0.01***	<0.01***	<0.01***	<0.01***
Slope(τ_6)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Model Summary					
Deviance statistic (-2*log likelihood)	4443.27	4431.88	4431.19	4416.99	4419.11
Number of estimated parameters	4	11	9	17	16
Effect size (pseudo-R ²)		.03	.02	<.01	<.01

Note 1: Standard errors are in parentheses.

Note 2: Models were estimated using random intercepts and fixed slopes for level-2 (τ_π) predictors.

However, where a model contained between-student

predictors, the level-3 (τ_6) intercept and slope estimates were fixed in order to make the residual variance in the model easier to interpret.

* $p < .05$. ** $p < .01$, *** $p < 0.001$.

Table 10.19 IP models for the WTRT scale

Parameters	Model 1	Model 2	Model 3	Model
Fixed effects coefficients				
Intercepts	2.38*** (0.03)	2.35*** (0.03)	2.33*** (0.03)	2.45***
<u>Level-2 (between-student)</u>				
Gender Female (Reference: Male)				
Exposure to aberrant driving				
Impulsiveness				
Sensation seeking				
<u>Level 3 (between-groups)</u>				
Non-PLE (Reference: Did PLE)			0.13 (0.08)	
Programme groups (Reference: controls)				
Group A				-0.08
Group B				-0.17*
Group C				-0.19*
Group D				0.08
Group E				-0.20*
Slopes				
<u>Level-1 (intra-student)</u>				
New time		0.06** (0.02)	0.04* (0.02)	1.55*
Mean age		0.01 (0.01)		
<u>Level-2 (between-student)</u>				
Impulsiveness				
Sensation seeking				
<u>Level 3 (between-groups)</u>				
Non-PLE (Reference: Did PLE)			0.07 (0.06)	
Programme groups (Reference: controls)				
Group A				-1.43
Group B				-1.56
Parameters	Model 1	Model 2	Model 3	Model
Group C				-1.49
Group D				-1.48
Group D				-1.48
Group E				-1.47
Random effects coefficients				
Variance components				
Residual (σ^2)	0.29 (0.01)	0.29 (0.01)	0.29 (0.01)	0.29
Individual (τ_π)	0.16*** (0.01)	0.16*** (0.01)	0.16*** (0.01)	0.16***
Intercept (τ_0)	0.03*** (0.01)	0.03*** (0.01)	0.02*** (0.01)	0.01*** (0.01)
Slope(τ_0)		< 0.01 (< 0.01)	< 0.01 (< 0.01)	< 0.01 (< 0.01)
Model Summary				
Deviance statistic (-2*log likelihood)	4989.64	4981.32	4976.31	4976.31
Number of estimated parameters	4	11	9	9
Effect size (<i>pseudo-R</i> ²)		.01	.01	

Note 1: Standard errors are in parentheses.

Note 2: Models were estimated using random intercepts and fixed slopes for level-2 ($\tau\pi$) predictors. However, where a n student predictors, the level-3 ($\tau\delta$) intercept and slope estimates were fixed in order to make the residual variance in the n
 $*p < .05$. ** $p < .01$, *** $p < 0.001$.

Table 10.20 IVF score models for WTRT scale

Parameters	Model 1	Model 2	Model 3	Model 4	Model 5
Fixed effects coefficients					
Intercepts	2.38*** (0.03)	2.35*** (0.03)	2.34*** (0.04)	2.38*** (0.07)	2.43*** (0.03)
<u>Level-2 (between-student)</u>					
Gender Female (Reference: Male)					-0.16*** (0.05)
Exposure to aberrant driving					0.14*** (0.03)
Impulsiveness					0.54*** (0.04)
Sensation seeking					0.25*** (0.04)
<u>Level-3 (between-groups)</u>					
Non-PLE (Reference: Did PLE)			0.04 (0.09)		
Programme groups (Reference: controls)					
Group A				-0.01 (0.10)	
Group B				0.08 (0.09)	
Group C				-0.09 (0.09)	
Group D				0.15 (0.10)	
Group E				-0.13 (0.11)	
Slopes					
<u>Level-1 (intra-student)</u>					
New time		0.06* (0.03) -0.04 (0.04)	0.05 (0.03)	0.14* (0.07)	0.06* (0.03)
Mean age					
<u>Level-2 (between-student)</u>					
Impulsiveness					-0.29*** (0.05)
Sensation seeking					-0.16** (0.05)
Non-PLE (Reference: Did PLE)			0.10 (0.08)		
Programme groups (Reference: controls)					
Group A				-0.18 (.010)	
Group B				-0.04 (.0.9)	
Group C				-0.05 (0.10)	(cont.)
Parameters	Model 1	Model 2	Model 3	Model 4	Model 5
Group D					
Group E					
Variance components					
Random effects coefficients					
Residual (σ^2)	0.34 (0.01) 0.13*** (0.01)	0.33 (0.01) 0.13*** (0.01)	0.33 (0.01) 0.13*** (0.01)	0.33 (0.01) 0.13*** (0.01)	0.32 (0.01) 0.08*** (0.01)
Individual (τ_π)	0.02*** (0.01)	0.02*** (0.01)	0.02*** (0.01)	0.01** (0.01)	
Intercept (τ_δ)					0.01* (0.01)
Slope(τ_δ)		0.001*	0.01* (0.01)	0.01* (0.01)	0.002

		(0.01)		(0.001)		
Model Summary						
Deviance statistic (-2*log likelihood)		4698.52	4689.48	4687.09	4677.37	4395.29
Number of estimated parameters		4	11	9	17	13
Effect size (<i>pseudo-R</i> ²)			.02	.01	.04	.16

Note 1: Standard errors are in parentheses.

Note 2: Models were estimated using random intercepts and fixed slopes for level-2 ($\tau\pi$) predictors.

However, where a model contained between-student predictors, the level-3 ($\tau\delta$) intercept and slope estimates were fixed in order to make the residual variance in the model easier to interpret.

* $p < .05$. ** $p < .01$, *** $p < 0.001$.

Table 10.21 IP models for mean number of scenario consequences

Parameters	Mode 1 1	Mode 1 2	Mode 1 3	Model 4	Mode 1 5
Regression coefficients			Fixed effects		
Intercepts	3.06*** (0.07)	3.34*** (0.8)	3.35*** (0.08)	3.36*** (0.17)	3.34*** (0.08)
<u>Level 2 (between-student)</u>					
Mean impulsiveness					-0.34* (0.07)
<u>Level-3 (between-groups)</u>					
PLDE (Reference: non-PLDE)			0.01 (0.28)		
Programme groups (Reference: controls)					
Programme A				0.04 (0.26)	
Programme B				-0.21 (0.22)	
Programme C				0.45 (0.24)	
Group D				-0.90 (0.26)	
Group E				-0.28 (0.27)	
Slopes					
New time		-0.60*** (0.07)	-0.60** (0.06)	-0.46** (0.16)	-0.60*** (0.07)
Mean age		0.01 (0.01)			
<u>Level 2 (between-student)</u>					
Mean impulsiveness					
<u>Level-3 (between-groups)</u>					
PLDE (Reference: non-PLDE)			0.08 (0.02)		
Programme groups (Reference: controls)					
Programme A				-0.13 (0.23)	
Programme B				-0.17 (0.21)	
Programme C				-0.32 (0.22)	
Group D				0.12 (0.23)	
Group E				0.05 (0.25)	(cont.)
Parameters	Mode 1 1	Mode 1 2	Mode 1 3	Model 4	Mode 1 5
Variance components			Random effects		
Residual (σ^2)	1.74 (0.07) 0.36*** (0.08)	1.50 (0.06)	1.50 (0.05) 0.48*** (0.06)	1.50 (0.06) 0.49*** (0.06)	1.50 (0.06) 0.44*** (0.06)
Individual (τ_π)	0.07*** (0.06)	0.49 (0.06) 0.18*** (0.06)	0.12*** (0.03)	0.11 *** (0.01)	0.18*** (0.03)
Intercept (τ_θ)			0.06*** (0.01)	0.05*** (0.01)	0.05*** (0.01)
<u>Slope(τ_θ)</u>		0.06** (0.01)			
Model Summary					
Deviance statistic (-2*log likelihood)	4566.39	8345.05	8340.9	8332.3	8323.72
Number of estimated parameters	4	11	16	17	8

Effect size (*pseudo-R*²) .03 .03 .04 .03

Note 1: Standard errors are in parentheses.

Note 2: Models were estimated using random intercepts and fixed slopes for level-2 ($\tau\pi$) predictors. However, where a model contained between-student predictors, the level-3 ($\tau\delta$) intercept and slope estimates were fixed in order to make the residual variance in the model easier to interpret.

* $p < .05$. ** $p < .01$, *** $p < 0.001$.

Table 10.22 IVF models for mean number of scenario consequences

Parameters	Model 1	Model 2	Model 3	Model 4	Model 5
Regression coefficients			Fixed effects		
Intercepts	3.11***(0.05)	3.38*** (0.09)	3.48*** (0.20)	3.45*** (0.18)	3.28*** (0.10)
<u>Level 2 (between-student)</u>					-0.29** (0.11)
Mean impulsiveness					
<u>Level-3 (between-groups)</u>					
Programme groups (Reference: controls)					
PLDE (Reference: non-PLE)			0.01 (0.03)		
Programme A				0.11 (0.29)	
Programme B				-0.31 (0.25)	
Programme C				0.38 (0.27)	
Group D				-0.21 (0.28)	
Group E				-0.37 (0.29)	
Slopes					
<u>Level-1 (intra-student)</u>					
New time		-0.31** (0.05)	-0.33** (0.11)	-0.32** (0.11)	-0.32*** (0.50)
Mean age		0.03 (0.02)			
<u>Level 2 (between-student)</u>					
<u>Level-3 (between-groups)</u>					
PLDE (Reference: non-PLE)			0.02 (0.12)		
Programme groups (Reference: controls)					
Programme A				-0.04 (0.15)	
Programme B				0.11 (0.14)	

Programme C				-0.21 (0.15)	
Group D				-0.01 (0.15)	
Group E				0.23 (0.16)	(cont.)
Parameters	Mo	Mo	Mo		Mo
	del 1	del 2	del 3	Model 4	del 5
Variance components	Random effects				
Residual (σ^2)	1.8 (0.09)	1.47 (0.07)	1.47 (0.07)	1.47 (0.07)	1.47 (0.07)
	0.18***	0.35***	0.35***	0.35***	0.31***
Individual (τ_π)	(0.07)	(0.06)	(0.06)	(0.06)	(0.05)
	0.05***	0.21***	0.18***	0.14***	0.21**
Intercept (τ_0)	(0.02)	(0.07)	(0.09)	(0.05)	(0.08)
Slope(τ_0)		0.1 (0.03)	0.1 (0.03)	0.1 (0.03)	0.1 (0.03)
Model Summary					
Deviance statistic					
(-2*log likelihood)	6187.29	6037.6	6014.06	6024.98	6007.83
Number of estimated parameters	4	11	10	17	9
Effect size (<i>pseudo-R</i> ²)		.18	.01	.06	.04

Note 1: Standard errors are in parentheses.

Note 2: Models were estimated using random intercepts and fixed slopes for level-2 (τ_π) predictors.

However, where a model contained between-student predictors, the level-3 (τ_0) intercept and slope estimates were fixed in order to make the residual variance in the model easier to interpret.

* $p < .05$. ** $p < .01$, *** $p < 0.001$.

Table 10.23 IP models for accessibility of ‘crashing’ as a scenario consequence

Models	β (SE)	<i>t</i>	df	<i>exp(b)</i>	95% CI
Unconditional model					
Coefficient	0.25*** (0.01)	18.58	36	1.29	(1.25, 1.33)
Model 2 - Time					
Intercept (T1)	0.28*** (0.02)	15.1	36	1.32	(1.28, 1.38)
Slope (T2)	-0.06* (0.02)	-2.31	36	0.94	(0.90, 0.99)
Model 3 - PLDE					
Intercept (non-PLDE)	0.26*** (0.04)	5.59	36	1.30	(1.18, 1.43)
PLDE	0.02 (0.05)	0.42	36	1.02	(0.92, 1.14)
Slope (non-PLDE)	0.05 (0.05)	0.92	36	1.05	(0.94, 1.17)
PLDE	-0.13* (0.06)	-2.20	36	0.88	(0.78, 0.99)
Model 4 – PLDE groups					
Intercept (Controls)	0.26** (0.05)	5.79	31	1.30	(1.19, 1.43)
Group A	0.09 (0.06)	1.48	31	1.10	0.97, 1.25)
Group B	-0.03 (0.06)	-0.43	31	0.98	(0.87, 1.10)
Group C	0.07 (0.06)	1.11	31	1.07	(0.94, 1.22)
Group D	-0.06 (0.07)	-0.92	31	0.94	(0.82, 1.08)
Group E	0.07 (0.08)	0.94	31	1.07	(0.92, 1.26)
Slope (Controls)	0.06 (0.06)	0.99	31	1.06	(0.94, 1.19)
Group A	-0.11 (0.08)	-1.29	31	0.89	(0.76, 1.06)
Group B	-0.18* (0.08)	-2.28	31	0.84	(0.72, 0.98)
Group C	-0.18* (0.08)	-2.23	31	0.83	(0.71, 0.98)
Group D	-0.08 (0.09)	-0.89	31	0.93	(0.70, 1.06)
Group E	-0.15 (0.11)	-1.45	31	0.86	(0.70, 1.06)

* $p < .05$, ** $p < .001$, *** $p < .001$.

Table 10.24 IVF models for accessibility of ‘crashing’ as a scenario consequence

Models	β (SE)	<i>t</i>	df	<i>exp(b)</i>	95% CI
Unconditional model					
Coefficient	0.24*** (0.02)	9.72	36	1.27	(1.21, 1.34)
Model 2 - Time					
Intercept (T1)	0.28*** (0.02)	8.85	36	1.33	(1.25, 1.43)
Slope (T3)	-0.04* (0.02)	-2.04	36	0.95	(0.90, 0.99)
Model 3 - PLDE					
Intercept (non-PLDE)	0.26*** (0.04)	5.59	36	1.30	(1.18, 1.43)
PLDE	0.02 (0.05)	0.42	36	1.02	(0.92, 1.15)
Slope (non-PLDE)	0.05 (0.04)	1.03	36	1.05	(0.95, 1.18)
PLDE	-0.03 (0.07)	-0.36	36	0.98	(0.88, 1.08)
Model 4 – PLDE groups					
Intercept (Controls)	0.26** (0.05)	10.25	31	1.29	(1.23, 1.36)
Group A	0.11 (0.05)	2.01	31	1.12	(1.03, 1.24)
Group B	-0.03 (0.03)	-0.79	31	0.97	(0.91, 1.04)
Group C	0.06 (0.04)	1.43	31	1.07	(0.97, 1.17)
Group D	-0.02 (0.06)	-0.45	31	0.97	(0.85, 1.11)
Group E	0.10 (0.04)	2.34	31	1.11	(1.01, 1.21)
Slope (Controls)	-0.04 (0.03)	-1.57	31	0.96	(0.91, 1.01)
Group A	-0.06 (0.03)	-1.86	31	0.94	(0.88, 1.01)
Group B	-0.05 (0.03)	1.73	31	1.05	(0.99, 1.11)
Group C	-0.03 (0.04)	-0.79	31	0.97	(0.88, 1.06)
Group D	-0.01 (0.05)	0.06	31	1.01	(0.91, 0.11)
Group E	-0.04 (0.04)	-1.10	31	0.96	(0.89, 1.04)

* $p < .05$, ** $p < .001$, *** $p < .001$.

Table 10.25 IP models for accessibility of ‘death’ as a scenario consequence

Models	β (SE)	<i>t</i>	df	<i>exp(b)</i>	95% CI
Unconditional model					
Coefficient	0.88*** (0.02)	47.21	36	2.43	(2.34, 2.53)
Model 2 - Time					
Intercept (T1)	0.89 (0.02)	35.81	36	2.44	(2.32, 2.57)
Slope (T2)	-0.03 (0.03)	-0.59	36	0.98	(0.91, 1.06)
Model 3 - PLDE					
Intercept (non-PLDE)	1.02 *** (0.1)	9.81	36	2.78	(2.25, 3.43)
PLDE	-0.15 (0.11)	-1.40	36	0.86	(0.69, 1.07)
Slope (non-PLDE)	-0.07 (0.16)	-0.46	36	0.93	(0.67, 1.28)
PLDE	-0.03 (0.17)	0.20	36	1.03	(0.73, 1.45)
Model 4 – PLDE groups					
Intercept (Controls)	1.00*** (0.05)	18.82	31	2.71	(2.43, 3.02)
Group A	-0.05 (0.08)	-0.62	31	0.95	(0.81, 1.14)
Group B	-0.14 (0.07)	-1.96	31	0.87	(0.76, 1.06)
Group C	-0.09 (0.07)	-1.27	31	0.91	(0.78, 1.06)
Group D	-0.16 (0.08)	-2.08	31	0.85	(0.73, 1.01)
Group E	-0.16 (0.09)	-1.84	31	0.85	(0.71, 1.01)
Slope (Controls)	0.07 (0.08)	0.84	31	1.07	(0.91, 1.26)
Group A	-0.27* (0.12)	-2.17	31	0.76	(0.59, 0.98)
Group B	-0.08 (0.12)	-0.68	31	0.93	(0.74, 1.17)
Group C	-0.19* (0.12)	-2.04	31	0.81	(0.68, 1.11)
Group D	-0.05 (0.12)	-0.42	31	0.95	(0.74, 1.22)
Group E	-0.02 (0.12)	-0.17	31	0.98	(0.76, 1.27)

* $p < .05$, ** $p < .001$, *** $p < .001$.

Table 10.26 IVF models for accessibility of ‘death’ as a scenario consequence

Models	β (SE)	<i>t</i>	df	<i>exp(b)</i>	95% CI
Unconditional model					
Coefficient	0.94*** (0.02)	44.03	36	2.56	(2.45, 2.68)
Model 2 - Time					
Intercept (T1)	0.97*** (0.03)	31.47	36	2.63	(2.48, 2.81)
Slope (T3)	-0.03 (0.04)	-1.34	36	0.97	(0.93, 1.02)
Model 3 - PLDE					
Intercept (non-PLDE)	0.94*** (0.05)	19.4	36	2.56	(2.32, 2.83)
PLDE	-0.09 (0.06)	-1.01	36	0.91	(0.75, 1.09)
Slope (non-PLDE)	-0.04 (0.04)	-1.27	36	0.96	(0.75, 1.10)
PLDE	0.04 (0.07)	0.56	36	1.04	(0.91, 1.19)
Model 4 – PLDE groups					
Intercept (Controls)	1.06*** (0.07)	15.13	31	2.89	(2.51, 3.35)
Group A	-0.06 (0.10)	-0.55	31	0.96	(0.77, 1.16)
Group B	-0.16 (0.09)	-1.71	31	0.85	(0.71, 1.03)
Group C	-0.12 (0.11)	-1.15	31	0.89	(0.73, 1.09)
Group D	-0.08 (0.11)	-0.79	31	0.92	(0.74, 1.14)
Group E	-0.14 (0.13)	-1.08	31	0.87	(0.67, 1.13)
Slope (Controls)	-0.08 (0.05)	-1.48	31	0.93	(0.73, 1.05)
Group A	0.02 (0.08)	0.24	31	1.02	(0.87, 1.88)
Group B	0.09 (0.07)	1.29	31	1.09	(0.95, 1.25)
Group C	0.04 (0.07)	0.49	31	1.04	(0.89, 1.21)
Group D	0.03 (0.08)	0.35	31	1.03	(0.88, 1.20)
Group E	0.12 (0.09)	1.42	31	1.13	(0.94, 1.36)

* $p < .05$, ** $p < .001$, *** $p < .001$.

Table 10.27 IP models for accessibility of ‘injury’ as a scenario consequence

Models	β (SE)	<i>t</i>	df	<i>exp(b)</i>	95% CI
Unconditional model					
Coefficient	0.94*** (0.02)	40.65	36	2.56	(2.45, 2.69)
Model 2 - Time					
Intercept (T1)	0.97*** (0.02)	49.08	36	2.64	(1.25, 1.43)
Slope (T2)	0.03 (0.04)	0.80	36	1.03	(0.96, 1.11)
Model 3 - PLDE					
Intercept (non-PLDE)	1.02 *** (0.05)	19.39	36	2.76	(2.48, 3.07)
PLDE	-0.06 (0.06)	-1.08	36	0.94	(0.84, 1.06)
Slope (non-PLDE)	-0.10 (0.08)	-1.16	36	0.91	(0.76, 1.08)
PLDE	0.16 (0.09)	1.70	36	1.17	(0.97, 1.41)
Model 4 – PLDE groups					
Intercept (Controls)	1.00** (0.05)	22.26	31	2.73	(2.49, 2.99)
Group A	-0.09 (0.07)	-1.29	31	0.92	(0.81, 1.05)
Group B	-0.12 (0.06)	-1.83	31	0.89	(0.86, 1.02)
Group C	-0.06 (0.04)	-1.04	31	0.94	(0.82, 1.07)
Group D	-0.07 (0.07)	-1.25	31	0.93	(0.81, 1.07)
Group E	-0.10 (0.09)	-1.12	31	0.91	(0.76, 1.08)
Slope (Controls)	-0.13 (0.09)	-1.48	31	0.87	(0.73, 1.05)
Group A	0.25 (0.15)	1.98	31	1.28	(1.01, 1.82)
Group B	0.26 (0.13)	1.99	31	1.29	(0.99, 1.68)
Group C	0.17 (0.13)	1.28	31	1.18	(0.91, 1.55)
Group D	0.19 (0.14)	1.39	31	1.21	(0.91, 1.62)
Group E	0.10 (0.15)	0.67	31	1.21	(0.91, 1.62)

* $p < .05$, ** $p < .001$, *** $p < .001$.

Table 10.28 IVF models for accessibility of ‘injury’ as a scenario consequence

Models	β (SE)	<i>t</i>	df	<i>exp(b)</i>	95% CI
Unconditional model					
Coefficient	0.94*** (0.02)	40.65	36	2.56	(2.44, 2.69)
Model 2 - Time					
Intercept (T1)	0.98*** (0.02)	8.85	36	1.33	(1.25, 1.43)
Slope (T3)	-0.04 (0.02)	-2.06	36	0.95	(0.91, 1.00)
Model 3 - PLDE					
Intercept (non-PLDE)	0.96*** (0.04)	5.59	36	1.30	(1.18, 1.43)
PLDE	0.02 (0.05)	0.42	36	1.02	(0.92, 1.15)
Slope (non-PLDE)	0.05 (0.04)	1.03	36	1.05	(0.95, 1.18)
PLDE	-0.03 (0.07)	-0.36	36	0.98	(0.88, 1.08)
Model 4 – PLDE groups					
Intercept (Controls)	1.01*** (0.06)	15.69	31	2.76	(2.42, 3.15)
Group A	-0.02 (0.10)	-0.20	31	0.98	(0.81, 1.20)
Group B	-0.09 (0.09)	-0.98	31	0.91	(0.76, 1.11)
Group C	0.01 (0.09)	0.02	31	1.01	(0.83, 1.21)
Group D	-0.02 (0.11)	-0.17	31	0.98	(0.85, 1.11)
Group E	-0.10 (0.14)	-0.66	31	0.91	(0.69, 1.21)
Slope (Controls)	-0.06 (0.05)	-1.19	31	0.94	(0.84, 1.05)
Group A	0.01 (0.08)	-0.01	31	1.01	(0.86, 1.17)
Group B	0.03 (0.07)	0.42	31	1.03	(0.89, 1.19)
Group C	0.02 (0.07)	-0.26	31	0.98	(0.84, 1.14)
Group D	0.07 (0.09)	0.81	31	1.07	(0.90, 1.28)
Group E	0.05 (0.09)	0.54	31	1.05	(0.86, 1.29)

* $p < .05$, ** $p < .001$, *** $p < .001$.

Table 10.29 IP models for listings of crashing in the absence of death or injury

Models	$\beta(SE)$	<i>t</i>	df	Odds ratio	95% CI
Unconditional model					
Coefficient	-0.50*** (0.05)	-9.76	37	0.61	(0.55, 0.67)
Model 2 - Time					
Intercept (T1)	-0.76*** (0.08)	-9.95	37	0.47	(0.40, 0.55)
Slope (T2)	0.52*** (0.10)	5.15	37	1.68	(1.37, 2.06)
Model 3 - PLDE					
Intercept (PLDE)	-0.76*** (0.08)	-9.68	36	0.47	(0.40, 0.55)
Non-PLDE	-0.08 (0.20)	-0.43	36	0.92	(0.61, 1.38)
Slope (PLDE)	0.49*** (0.11)	4.55	36	1.63	(1.31, 2.02)
Non-PLDE	0.22 (0.27)	0.82	36	1.25	(0.72, 2.15)
Model 4 - PLDE groups					
Intercept (Controls)	-0.84*** (0.19)	-4.49	32	0.43	(0.30, 0.63)
Group A	-0.08 (0.26)	-0.30	32	0.92	(0.54, 1.58)
Group B	0.05 (0.24)	0.21	32	1.05	(0.65, 1.71)
Group C	-0.14 (0.26)	-0.55	32	0.87	(0.51, 1.47)
Group D	0.32 (0.26)	1.23	32	1.37	(0.81, 2.31)
Group E	0.43 (0.43)	1.45	32	1.54	(0.84, 2.83)
Slope (Controls)	0.71** (0.24)	2.89	32	2.03	(1.23, 3.34)
Group A	-0.01 (0.35)	-0.02	32	0.98	(0.49, 2.04)
Group B	-0.06 (0.32)	-1.84	32	0.94	(0.50, 1.79)
Group C	-0.22 (0.34)	-0.64	32	0.81	(0.40, 1.60)
Group D	-0.55 (0.34)	-1.61	32	0.58	(0.29, 1.16)
Group E	-0.52 (0.39)	-1.05	32	0.66	(0.29, 1.48)
Model 5 - Between-students					
Intercept (Males)	-0.61*** (0.10)	-6.05	37	0.54	(0.44, 0.66)
Females	-0.32* (0.15)	-2.17	37	0.72	(0.54, 0.97)
Slope (Males)	0.49*** (0.15)	3.55	37	1.62	(1.23, 2.14)
Females	0.09 (0.20)	0.46	37	1.10	(0.74, 1.61)

^a 1 = Mentioned crashing, but did not list injury or death, 0 = Listed crashing and also listed injury and/or death.

* $p < .05$, ** $p < .001$, *** $p < .001$.

Table 10.30 IVF models for crashing without death or injury

Models	β (SE)	<i>t</i>	df	Odds ratio	95% CI
Unconditional model					
Coefficient	-0.74*** (0.06)	-13.27	37	0.48	(0.43, 0.53)
Model 2 - Time					
Intercept (T1)	-0.76*** (0.07)	-11.02	37	0.47	(0.40, 0.54)
Slope (T2)	0.04 (0.10)	0.39	37	1.04	(0.84, 1.28)
Model 3 - PLDE					
Intercept (PLDE)	-0.75*** (0.08)	-10.01	36	0.47	(0.40, 0.55)
Non-PLDE	-0.08 (0.20)	-0.46	36	0.92	(0.62, 1.35)
Slope (PLDE)	0.01 (0.11)	0.10	36	1.01	(0.08, 1.27)
Non-PLDE	0.19 (0.28)	0.67	36	1.21	(0.69, 2.11)
Model 4 - PLDE groups					
Intercept (Controls)	-0.84*** (0.15)	-5.71	32	0.43	(0.32, 0.58)
Group A	-0.01 (0.21)	-0.09	32	0.98	(0.63, 1.51)
Group B	0.03 (0.22)	0.16	32	1.04	(0.66, 1.62)
Group C	-0.15 (0.19)	-0.82	32	0.86	(0.59, 1.25)
Group D	0.33 (0.22)	1.50	32	1.39	(0.89, 2.21)
Group E	0.41 (0.16)	2.45	32	1.51	(1.07, 2.13)
Slope (Controls)	0.20 (0.20)	0.98	32	1.22	(0.81, 1.86)
Group A	0.14 (0.25)	0.55	32	1.15	(0.69, 1.91)
Group B	-0.17 (0.31)	-0.53	32	0.85	(0.51, 1.61)
Group C	-0.10 (0.28)	-0.35	32	0.91	(0.51, 1.61)
Group D	-0.61 (0.37)	-1.65	32	0.54	(0.25, 1.15)
Group E	-0.29 (0.75)	-1.11	32	0.75	(0.44, 1.27)
Model 5 - Between-students					
Intercept (Males)	-0.62*** (0.09)	-6.72	37	0.54	(0.44, 0.65)
Females	-0.30* (0.14)	-2.07	37	0.74	(0.56, 0.99)
Slope (Males)	-0.05 (0.15)	-0.29	37	0.95	(0.69, 1.32)
Females	0.19 (0.19)	0.99	37	1.21	(0.83, 1.78)

^a 1 = Mentioned crashing, but did not list injury or death, 0 = Listed crashing and also listed injury and/or death.

* $p < .05$, ** $p < .001$, *** $p < .001$.

10.16 Appendix O. Results for Chapter 7, Attitude towards speeding tests

Table 10.31 PCA rotated component matrix for the T1, Attitude towards speeding items

Item	1	2	3
Selfish Prototype	0.79		
Unrealistic Prototype	0.78		
Immature Prototype	0.63		
Impatient Prototype	0.61		
Risky Prototype	0.48		
For me to REFUSE to take a lift with speeding driver		-0.75	
People who are close to me think it's OK to take a lift with a driver who is known for speeding		0.62	
In the next 3 months do you expect to be a passenger in a car being driven by someone who is speeding		0.61	
Its mainly up to me whether or not I take a lift with a driver who is known for speeding		-0.54	
What percentage would approve of you taking a lift with a speeding driver		0.49	
Willingness to take a lift with a driver who speeds		0.49	
Behavioural beliefs bad-good			0.76
Behavioural beliefs harmful-beneficial			0.75
Behavioural beliefs safe-risky			0.60
Behavioural beliefs pleasant - unpleasant			0.55

Item	1	2	3
Cool Prototype			
Popular Prototype			
Skilful Prototype			
Responsible Prototype			
Smart Prototype			
How much do you want to comply with parents			
How much do you want to comply with people just like you			

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

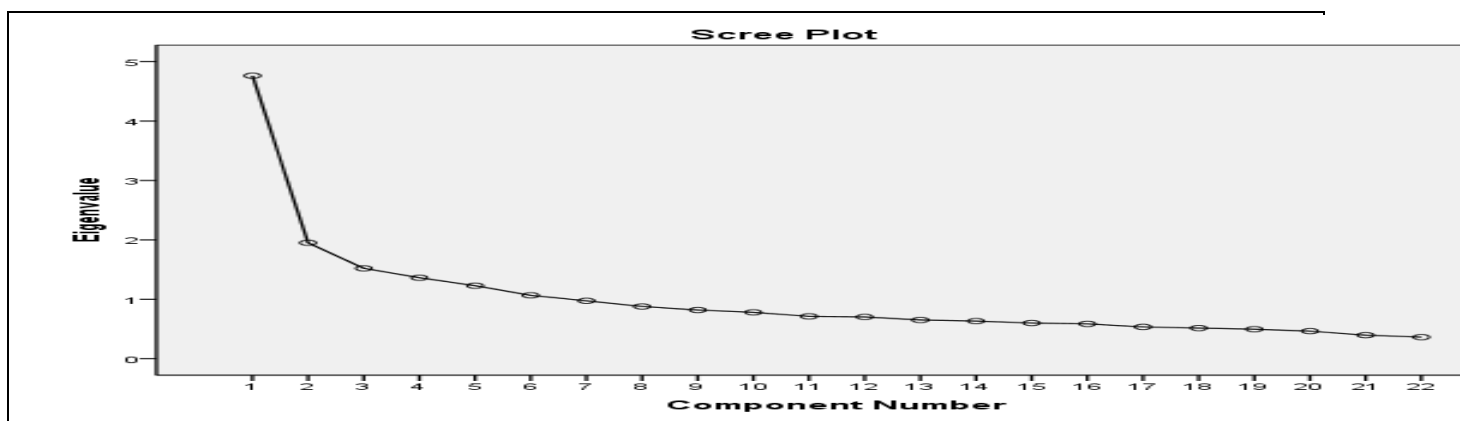


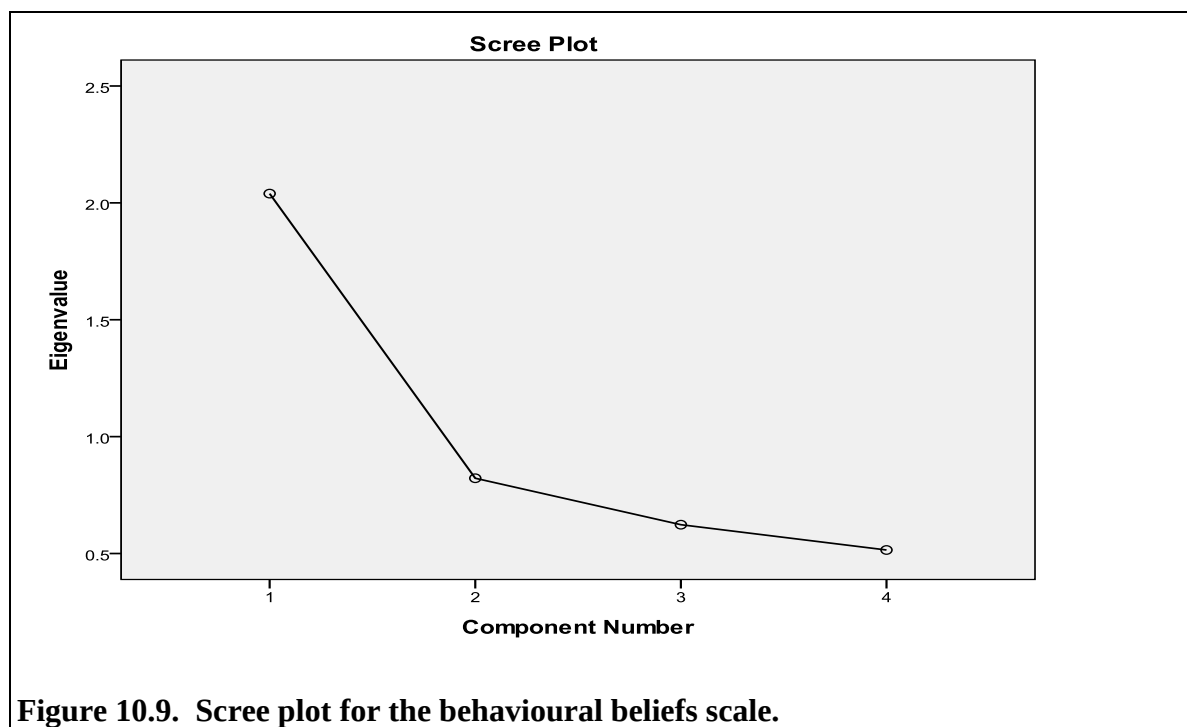
Figure 10.8. Scree plot for the 29-item Attitude to speeding scale.

Table 10.32 Rotated component matrix for T1, Prototypical speeding driver items

Item	Component		
	1	2	3
Unrealistic	0.82		
Selfish	0.82		
Immature	0.60	-0.46	
Impatient	0.58		
Risky	0.49	-0.38	
Responsible		0.81	
Smart		0.77	
Cool			0.78
Popular			0.77
Skilful		0.52	0.57

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.



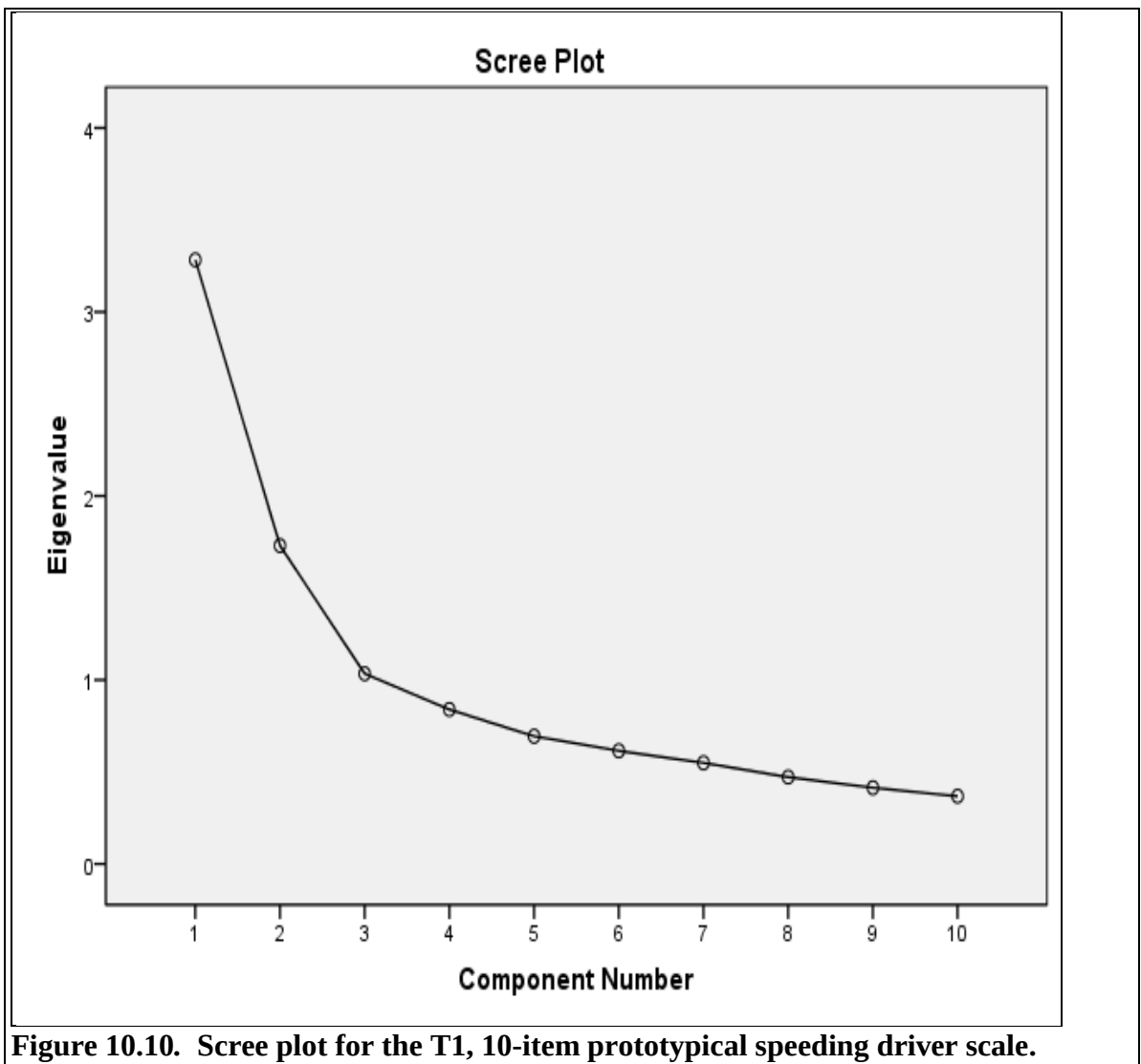


Table 10.33 IP model 1: Unconditional model for attitude towards speeding variables

	<u>Fixed Effects</u>		<u>Random effects</u>							
			<u>L-2 Variance</u>		<u>L-3 Variance</u>		<u>ICC%</u>			
Variable	β (SE)	$t^\dagger$	L-2 ($\tau\pi$)	$(\chi^2)^{\dagger\dagger}$	L-3 ($\tau\delta$)	$(\chi^2)^\dagger$	L-1	L-2	L-3	L-1
<u>Attitude</u>										
IP Models	2.14*** (0.04)	54.09	0.14***	1960.45	0.04***	180.19	71	22	7	(0.81, 3.47)
IVF Models	2.15*** (0.04)	56.73	0.14***	1751.99	0.04***	143.09	73	21	6	(0.81, 3.49)
<u>Subjective norms</u>										
<u>Peer approval (D/38)</u>										
IP Models	3.97*** (0.05)	81.72	0.66***	2002.04	0.03*	58.77	75	24	1	(1.00, 6.58)
IVF Models	3.69*** (0.05)	72.34	0.35***	1451.61	0.04**	67.9	85	14	1	(0.75, 6.63)
<u>Significant others' approval</u>										
IP Models	2.50*** (0.07)	35.74	0.77***	2344.99	0.12***	118.64	64	31	5	(0.01, 5.00)
IVF Models	2.48*** (0.07)	37.39	0.57***	1731.97	0.10***	105.75	75	21	4	(0.01, 5.24)
<u>Motivation to comply with parents</u>										
IP Models	4.07*** (0.07)	56.06	1.59***	4499.32	0.11***	103.83	41	55	4	(1.94, 6.20)
IVF Models	4.23*** (0.06)	68.77	1.20**	1254.28	0.07***	89.63	92	6	2	(0.85, 7.61)
<u>Motivation to comply with peers</u>										
IP Models	4.18*** (0.04)	100.89	1.41***	3593.52	<0.01	32.25	51	49	1	(1.83 , 6.53)
IVF Models	4.09*** (0.04)	136.78	0.01	939.79	<0.01	25.68	99	1	0	(0.44, 7.74)
<u>Perceived behavioural control</u>										
<u>Easy to refuse a speeder</u>										
IP Models	4.52*** (0.06)	74.71	1.06***	2547.91	0.06***	75.11	63	35	2	(1.80, 7.24)
IVF Models	4.58*** (0.08)	58.08	0.80***	1915.11	0.15***	113.05	69	26	5	(1.69, 7.47)
<u>Deciding to travel with speeders</u>										
IP Models	5.52*** (0.08)	72.76	0.32***	16086.2	0.13***	103.28	81	13	6	(2.77, 8.27)
IVF Models	5.56*** (0.06)	99.36	0.24***	1390.16	0.07***	97.78	85	11	4	(3.00, 5.32)
<u>Behavioural expectations</u>										
IP Models	3.19*** (0.05)	59.88	0.59***	3049.98	0.07***	119.06	54	41	5	(1.47, 4.91)
IVF Models (cont.)	3.25*** (0.06)	56.02	0.44***	2120.55	0.08***	138.57	64	30	6	(1.34, 5.16)
	<u>Fixed Effects</u>		<u>Random effects</u>							
			<u>L-2 Variance</u>		<u>L-3 Variance</u>		<u>ICC%</u>			
Variable	β (SE)	$t^\dagger$	L-2 ($\tau\pi$)	$(\chi^2)^{\dagger\dagger}$	L-3 ($\tau\delta$)	$(\chi^2)^\dagger$	L-1	L-2	L-3	L-1
<u>Prototypes</u>										
<u>Negative prototypes</u>										
IP Models	3.58*** (0.03)	114.1	0.21***	2071.75	0.02***	81.22	68	24	8	(2.05, 5.11)
IVF Models	3.44*** (0.03)	118.6	0.15***	1539.82	0.01**	61.96	83	16	1	(1.72, 5.16)
<u>Positive prototypes</u>										
IP Models	2.27*** (0.03)	76.14	0.17***	2219.52	0.02***	99.01	69	28	3	(1.00, 1.54)
IVF Models	2.20*** (0.03)	72.19	0.11***	1491.74	0.02***	87.86	83	15	2	(0.67, 3.73)
<u>Willingness</u>										
IP Models	2.54*** (0.04)	60.83	0.34***	2483.66	0.04***	113.19	63	33	4	(0.97, 4.11)
IVF Models	2.52*** (0.04)	61.47	0.26***	1826.72	0.03***	96.61	72	25	3	(0.81, 4.23)

Note 1: L-1 refers to intra-student variance, L-2 refers to between-student variance; L-3 refers to between groups variance.

Note 2: Standard errors are in parentheses.

† df for all models = 37.

†† df for IP models = 1212; df for IVF models = 1106.

††† Number of parameters in all models = 4.

* $p < .05$. ** $p < .01$, *** $p < 0.001$.

Table 10.34 IP model 2: Time effects for attitude towards speeding variables

Items	<u>Attitude</u>	<u>Subjective norms</u>			<u>PBC</u>			<u>Expectations</u>	<u>Prototypes</u>		<u>Willingness</u>
	D/37	D/38	D/41	D/44	D/45	D/42	D/43	D/40	D/39(N)	D/39(P)	D/32-4
Fixed effects coefficients											
Parameters			2.53	3.89		4.55					
Intercepts		3.91*	***	***	4.30*	***	5.51*	3.14**	3.47**	2.32**	
	2.2***	**	(0.0	(0.09	**	(0.06	**	*	*	*	2.55**
	(0.03)	(0.05)	6)	)	(0.05)	)	(0.08)	(0.05)	(0.03)	(0.03)	*(0.05)
Slopes											
<u>Level-1(intra-student)</u>											
Mean Age			-								
			0.02	-0.01		0.11					
	-0.01	-0.06	(0.0	(0.08	-0.13	(0.08	-0.04	-0.07	-0.03	0.01	0.03
	(0.04)	(0.07)	7)	)	(0.08)	)	(0.07)	(0.07)	(0.04)	(0.03)	(0.01)
New time			-	0.36	-						
			0.07	***	0.31*	0.03	0.36*	0.16**	0.20**		
	-0.01	0.15*	(0.0	(0.06	**	(0.10	*	*	*	-0.18*	0.02
	(0.03)	(0.06)	6)	)	(0.05)	)	(0.11)	(0.04)	(0.03)	(0.02)	(0.04)
Random effects coefficients											
Variance components											
Residual (σ^2)			1.58	1.08		1.84					
	0.45	2.01	(0.0	(0.04	1.39	(0.07	0.20	0.76	0.59	0.42	0.64
	(0.02)	(0.07)	6)	)	(.06)	)	(0.01)	(0.03)	(0.02)	(0.02)	(0.03)
Individual (τ_π) [†]			0.78	1.65		1.10					
		0.66*	***	***	1.43*	***	2.02*	.059**	0.23**	0.17**	0.34**
	0.14***	**	(0.0	(0.09	**	(0.10	**	*	*	*	*
	(002)	(0.08)	7)	)	(0.09)	)	(0.08)	(0.04)	(0.02)	(0.02)	(0.03)
Intercept (τ_0)^{††}			0.20	0.07		0.21					
		0.07*	***	**		***	0.44*	0.05**			0.04**
	0.04***	*	(0.0	(0.04	0.01	(0.07	**	*	0.01*	0.01**	*
	(0.02)	(0.03)	7)	)	(0.02)	)	(0.12)	(0.02)	(0.01)	(0.01)	(0.01)
Slope (τ_0)^{††}			0.12	0.06		0.22					
			***	**		***	0.47*				
	<0.01	0.02	(0.0	(0.03	0.01	(0.08	**	<0.01	0.01	<0.01	0.01
	(0.01)	(0.03)	5)	)	(0.02)	)	(0.11)	(0.01)	(0.01)	(0.01)	(0.01)
Model Summary											
Deviance statistic (-2*log likelihood)	5778.08	9493.63	9178.02	9088	9321.63	9663.66	7063.02	7620.34	6505.71	5705.56	6930.11
Comparison with unconditional model											
Goodness of fit (χ^2) ^{†††}			11.0	90.1	45.24	18.5	455.4	21.86*	40.17*	40.42*	
	2.65	9.06*	9*	2***	***	8***	1***	**	**	**	2.74
Effect size (pseudo- R^2)	<.01	.02	.03	.01	.01	<.01	.03	.01	.01	.01	.02

Note 1: Standard errors are in parentheses. Note 2: Number of parameters in all models = 7. † df = 1212: †† df = 37:

†††df = 3: *p < .05. **p < .01, ***p < 0.001.

Table 10.35 IVF model 2: Time effects for attitude towards speeding variables

Items	<u>Attitude</u>				<u>Subjective norms</u>				<u>PB C</u>		
	D/37	D/38	D/41	D/44	D/45	D/42	D/43	D/40	D/39(N)	D/39(P)	D/32-4
Parameters											
Intercepts	2.21** * (0.05)	3.88** * (0.06)	2.53* ** (0.07)	3.83 *** (0.09)	4.20 (0.07)	4.54* ** (0.08)	5.45* ** (0.09)	3.12** * (0.06)	3.47* ** (0.04)	2.29* ** (0.03)	2.55* ** (0.05)
Slopes											
<u>Level-1</u> (intra-student)											
Mean age	0.02 (0.04)	-0.06 (0.07)	-0.01 (0.07)	-0.08 (0.08)	-0.07 (0.07)		-0.04 (0.07)	-0.05 (0.05)	0.01 (0.01)	-0.03 (0.04)	-0.06 (0.04)
New time	-0.05 (0.06)	0.34** (0.10)	-0.09 (0.11)	0.68 *** (0.08)	0.36 ** (0.11)		0.43* ** (0.11)	0.37** * (0.09)	- 0.13* (0.04)	0.18* * (0.04)	0.07 (0.07)
Variance components											
Residual (σ^2)				2.73			1.7				
	0.47 (0.02)	2.17 (0.09)	1.97 (0.08)		3.31 (0.14)	2.12 (0.09)		0.91 (0.04)	0.76 (0.03)	0.59 (0.03)	0.75 (0.03)
Individual (τ_π) [†]	0.14** * (0.02)	0.39** * (0.08)	0.58* ** (0.08)	0.32 *** (0.09)	<0.0 1 (0.10)	0.83* ** (0.09)	0.31* ** (0.06)	0.46** * (0.04)	0.15* ** (0.03)	0.11* ** (0.03)	0.26* ** (0.03)
Intercept (τ_0)^{††}	0.04** * (0.01)	0.06** (0.03)	0.10* ** (0.04)	0.06 ** (0.04)	0.02 (0.03)		0.34* ** (0.07)	0.06** * (0.03)		0.01 (0.01)	0.01 (0.01)
			0.04* * (0.01)		0.03 (0.05)	0.09* * (0.05)	0.28* ** (0.10)			0.01 (0.01)	0.02 (0.01)
Slope (τ_0)^{††}	0.01 (0.01)	0.01 (0.03)	0.01 (0.01)	0.04 (0.05)	0.05 (0.05)			0.01 (0.01)	0.01 (0.01)		
Model Summary											
Deviance statistic (-2*log likelihood)	5339.1 6	8574.9 2	8623. 3	9059 .32	9225 .36	8933. 05	8126. 13	7118.5 7	6288. 04	5706. 14	6077. 96
Comparison with unconditional model											
Goodness of fit (χ^2) ^{†††}	1.6*	40.94* **	4.14*	89.0 3***	99.32 ***	7.86*	71.73*	58.43 ***	14.05 **	34.26 ***	6.23*
Effect size (pseudo R^2)	0.03	.02	.01	.03	0.03	.04	.22	.03	.01	.02	.03

Note 1: Standard errors are in parentheses. Note 2: Number of parameters in all models = 7. † df = 1212; †† df = 37; ††† df = 3; *p < .0.001.

Table 10.36 IP model 3: PLDE effects for attitude towards speeding variables

Subjective norm Expect- Prototypes

	PBC			ations			
Item	D/38	D/44	D/45	D/43	D/40	D/39(N)	D/39(P)
Parameters	Fixed effects coefficients						
							2.29** (0.03)
Intercepts Level 3 (between-groups)	3.86*** (0.07)	3.91*** (0.07)	4.35*** (0.06)	5.49*** (0.13)	3.07*** (0.06)	3.50*** (0.04)	
Non-PLDE (Reference: Did PLDE)	0.21 (0.17)	-0.14 (0.18)	-0.10 (0.14)	-0.22 (0.29)	0.21 (0.13)	-0.04 (0.09)	0.03 (0.08)
Slopes Level-1 (intra-student)							
	0.13 (0.07)		-0.33 (0.06)	0.01 (0.12)			-0.07*(0.03)
New time Level 3 (between-groups)		0.34*** (0.07)			0.15*** (0.04)	0.20*** (0.04)	
Non-PLDE (Reference: Did PLDE)	0.15 (0.18)	0.15 (0.16)	0.09 (0.14)	0.05 (0.26)	0.06 (0.10)	-0.11 (0.09)	0.16* (0.07)
Variance components	Random effects coefficients						
		1.08 (0.04)		0.20 (0.01)			
Residual (σ^2)	2.00 (0.08)		1.38 (0.09)		0.76 (0.03)	0.59 (0.02)	0.42 (0.02)
Individual (τ_π) [†]	0.66*** (0.07)	1.65*** (0.09)	1.43*** (0.09)	2.02*** (0.08)	.059*** (0.04)	0.22*** (0.02)	0.17*** (0.02)
Intercept (τ_0) ^{††}	0.06** (0.03)	0.07** (0.04)	0.01 (0.02)	0.43*** (0.10)	0.05*** (0.02)	0.01* (0.01)	0.01** (0.01)
Slope (τ_0) ^{††}	0.03 (0.03)	0.06** (0.03)	0.01 (0.02)	0.43*** (0.10)	<0.01 (0.01)	0.01 (0.01)	<0.01 (0.01)
Model Summary							
Deviance statistic (-2*log likelihood)	9486.72	9086.61	9321.08	7059.37	7617.09	6503.4	5699.43
Comparison with unconditional model							
Goodness of fit (χ^2) ^{†††}	4.61	1.37	0.55	3.65	1.52	2.30	6.10
Effect size(<i>pseudo R</i> ²)	.01	<.01	.04	.02	.01	<.01	<.01

Note 1: Standard errors are in parentheses. Note 2: Number of parameters in all models = 7. † df = 1212; †† df = 37; ††† df = 3; *p < .05. **p < .01, ***p < 0.001.

Table 10.37 IVF model 3: PLDE effects for attitude towards speeding variables

Item	<u>Subjective norms</u>		<u>PBC</u>		<u>Expectations</u>	<u>Prototypes</u>	
	D/38	D/44	D/45	D/43	D/40	D/39(N)	D/39(P)
Parameters	Fixed effects coefficients						
Intercepts <u>Level 3 (between-groups)</u> Non-PLDE (Reference: Did PLDE)	3.84*** (0.07)	3.90*** (0.07)	4.49** (0.07)	5.52*** (0.12)	3.08*** (0.06)	3.51*** (0.04)	2.29*** (0.03)
Slopes <u>Level-1 (intra-student)</u>							
	0.29 (0.16)	-0.03 (0.18)	-0.09 (0.16)	-0.25 (0.27)	0.12 (0.14)	-0.05 (0.09)	-0.01 (0.08)

New time	-0.37*** (0.07)	0.68*** (0.08)	0.78** * (0.09)	0.31* (0.11)	0.29*** (0.05)	-0.11* (0.04)	-0.19*** (0.04)
<u>Level 3 (between-groups)</u>							
Non-PLDE (Reference:Did PLDE)	-0.14 (0.17)	-0.10 (0.21)	0.05 (0.23)	0.32 (0.26)	0.08 (0.11)	-0.06 (0.10)	0.06 (0.09)
Variance components	Random effects coefficients						
Residual (σ^2)	2.17 (0.09)	2.73 (0.12)	3.31 (0.14)	1.7 (0.07)	0.91 (0.04)	0.76 (0.03)	0.59 (0.03)
Individual (τ_π) [†]	0.39*** (0.08)	0.32*** (0.09)	<0.01 (0.10)	0.31*** (0.06)	0.46*** (0.04)	0.15*** (0.03)	0.11*** (0.03)
Intercept (τ_0) ^{††}	0.04** (0.02)	0.06** (0.04)	0.02 (0.03)	0.33*** (0.10)	0.06*** (0.03)	0.01 (0.01)	0.01 (0.01)
Slope (τ_0) ^{††}	< 0.01 (0.03)	0.03 (0.04)	0.03 (0.05)	0.26*** (0.09)	0.01 (0.01)	0.01 (0.01)	<0.01 (<0.01)
Model Summary							
Deviance statistic (-2*log likelihood)	8572.24	9058.87	9224.9 3	8124.61	7117.14	6282.88	5705.76
Comparison with unconditional model							
Goodness of fit (χ^2) ^{†††}	2.68	0.45	0.43	1.52	1.43	5.16	0.65
Effect size (<i>pseudo R</i> ²)	.01	<-.01	<-.01	-0.01	<-.01	<-.01	<-.01

Note 1: Standard errors are in parentheses. Note 2: Number of parameters in all models = 9.

† df = 1106; †† df = 36; ††† df = 2; *p < .05.

p < .01, *p < 0.001.

Table 10.38 IP model 4: PLDE course effects for attitude towards speeding variables

	<u>Subjective norms</u>			<u>PBC</u>	<u>Expectation</u> <u>s</u>	<u>Prototypes</u>	
Item	D/38	D/44	D/45	D/43	D/40	D/39(N)	D/39(P)
Parameters	Fixed effects coefficients						
Intercepts	4.08*** (0.14)	3.87*** (0.06)	4.26*** (0.12)	5.26*** (0.25)	3.28*** (0.12)	3.46*** (0.07)	2.32*** (0.07)
<u>Level 3 (between-</u>							
<u>groups)</u>							
Programme groups							
(Reference:							
controls)							
Group A	-0.29 (0.20)	0.40 (0.22)	0.04 (0.18)	0.13 (0.39)	-0.28 (0.18)	0.01 (0.10)	-0.04 (0.10)
Group B	-0.19 (0.18)	0.21 (0.20)	0.28 (0.16)	-0.01 (0.35)	-0.20 (0.16)	0.08 (0.09)	-0.01 (0.09)
Group C	-0.09 (0.20)	-0.03 (0.21)	0.01 (0.17)	0.37 (0.37)	-0.21 (0.17)	0.18 (0.10)	-0.13 (0.10)
Group D	-0.02 (0.20)	0.02 (0.22)	-0.01 (0.17)	0.40 (0.39)	-0.12 (0.18)	-0.11 (0.10)	-0.13 (0.10)
Group E	-0.69** (0.22)	0.01 (0.24)	0.01 (0.20)	0.44 (0.40)	-0.27 (0.19)	-0.01 (0.11)	-0.06 (0.11)
Slopes							
<u>Level-1 (intra-</u>							
<u>students)</u>							
New time	0.26* (0.15)	0.38*** (0.05)	-0.25* (0.12)	0.50* (0.23)	0.21*** (0.09)	0.10 (0.08)	0.09* (0.07)
<u>Level 3 (between-</u>							

groups)

Programme groups
(Reference:
controls)

		0.09	0.04	-0.48		0.14	-0.14*
Group A	-0.10 (0.21)	(0.18)	(0.18)	(0.38)	-0.17 (0.12)	(0.12)	(0.09)
		-0.19	-0.16	-0.37		0.03	-0.17*
Group B	-0.30 (0.19)	(0.17)	(0.16)	(0.33)	-0.16 (0.11)	(0.11)	(0.08)
		-0.25	-0.11	-0.48		0.12	-0.16*
Group C	-0.12 (0.21)	(0.18)	(0.17)	(0.36)	0.04 (0.12)	(0.11)	(0.09)
		-0.22	-0.09	-0.48		0.19	-0.19*
Group D	-0.25 (0.21)	(0.18)	(0.17)	(0.38)	0.07 (0.12)	(0.12)	(0.09)
		0.02	0.04	-0.49		0.10	-0.23*
Group E	0.31 (0.24)	(0.20)	(0.20)	(0.38)	-0.02 (0.14)	(0.13)	(0.11)

Variance components

		Random effects coefficients					
		1.08	1.38	0.20		0.59	0.42
Residual (σ^2)	2.00 (0.08)	(0.04)	(0.09)	(0.01)	0.75 (0.03)	(0.02)	(0.02)
	0.66***	1.65***	1.43***	2.02***	.059***	0.22***	0.17***
Individual (τ_π) [†]	(0.07)	(0.09)	(0.09)	(0.08)	(0.04)	(0.02)	(0.02)

(cont.)

		<u>Subjective</u>			<u>Expectation</u>		<u>Prototypes</u>	
	<u>norms</u>			<u>PBC</u>	<u>s</u>			
Item		D/38	D/44	D/45	D/43	D/40	D/38	D/44
			0.05**	0.01	0.40***	0.05***	0.01	0.01*
Intercept (τ_6)^{††}	0.03* (0.03)		(0.03)	(0.02)	(0.09)	(0.02)	(0.01)	(0.01)
Slope (τ_6)^{††}	0.01 (0.02)		0.03*	0.01	0.43***	<0.01 (0.01)	0.01	<0.01
			(0.02)	(0.02)	(0.10)		(0.01)	(0.01)

Model Summary

Deviance statistic (-2*log likelihood)	9472.51	9073.04	9314.23	7055.03	7607.67	6493.4	5693.8

Comparison with

Model 2

Goodness of fit (χ^2) ^{†††}	21.12*	14.95	7.41	7.99	34.53***	12.31	11.76
Effect size (<i>pseudo</i> R^2)	.02	.02	<.01	.03	.01	.02	<.01

Note 1: Standard errors are in parentheses.

Note 2: Number of parameters in all models = 17.

† df = 1212: †† df = 32: ††† df = 2: *p < .05. **p < .01,

***p < 0.001.

Table 10.39 IVF model 4: PLDE course effects for attitude towards speeding variables

Item	<u>Subjective norms</u>			<u>PBC</u>	<u>Expectations</u>	<u>Prototypes</u>	
	D/38	D/44	D/45	D/43	D/40	D/39(N)	D/39(P)
Parameters	Fixed effects coefficients						
Intercepts	4.14*** (0.14)	3.87*** (0.16)	4.40*** (0.14)	5.26*** (0.24)	3.20*** (0.13)	3.47*** (0.08)	2.29*** (0.07)
<u>Level 3 (between-groups)</u>							
Programme groups (Reference: controls)							
Group A	-0.32 (0.21)	0.28 (0.23)	-0.01 (0.20)	0.09 (0.37)	-0.17 (0.20)	0.02 (0.11)	0.02 (0.10)
Group B	-0.27 (0.18)	0.08 (0.21)	0.29 (0.17)	0.12 (0.32)	-0.10 (0.17)	0.08 (0.10)	0.01 (0.09)
Group C	-0.19 (0.20)	-0.11 (0.22)	0.08 (0.20)	0.32 (0.35)	-0.09 (0.19)	0.19 (0.11)	-0.08 (0.01)
Group D	-0.10 (0.21)	-0.06 (0.23)	-0.05 (0.20)	0.38 (0.37)	-0.66 (0.20)	-0.09 (0.12)	0.06 (0.11)
Group E	-0.73** (0.23)	-0.08 (0.25)	-0.04 (0.23)	0.45 (0.37)	-0.21 (0.21)	-0.02 (0.12)	-0.02 (0.12)
Slopes							
<u>Level-1 (intra-student)</u>							
New time	-0.50** (0.16)	0.58** (0.20)	-0.73** (0.20)	0.63* (0.24)	0.38** (0.10)	-0.27** (0.09)	-0.13 (0.09)
<u>Level 3 (between-groups)</u>							
Programme groups (Reference: controls)							
Group A	-0.12 (0.22)	0.01 (0.27)	0.05 (0.28)	-0.31 (0.37)	-0.27 (0.14)	0.20 (0.13)	-0.09 (0.12)
Group B	0.20 (0.20)	0.02 (0.24)	-0.24 (0.25)	-0.22 (0.32)	0.10 (0.13)	0.15 (0.12)	-0.07 (0.11)
Group C	0.09 (0.22)	0.01 (0.27)	-0.17 (0.27)	-0.38 (0.35)	0.02 (0.14)	0.11 (0.12)	-0.04 (0.12)
Group D	0.16 (0.23)	0.16 (0.27)	0.12 (0.28)	-0.25 (0.37)	-0.21 (0.15)	0.24 (0.13)	-0.01 (0.12)
Group E	0.43 (0.26)	0.40 (0.31)	0.29 (0.32)	-0.51 (0.38)	-0.06 (0.17)	0.30 (0.15)	-0.13 (0.14)
Variance components							
Residual (σ^2)	2.16 (0.09)	2.73 (0.12)	3.31 (0.14)	1.7 (0.07)	0.90 (0.04)	0.76 (0.03)	0.59 (0.03)
Individual (τ_π) [†]	0.39*** (0.08)	0.32*** (0.09)	<0.01 (0.10)	0.31*** (0.06)	0.46*** (0.04)	0.15*** (0.03)	0.11*** (0.03)
Intercept (τ_6)^{††}	0.03* (0.03)	0.04** (0.03)	<0.01 (0.02)	0.31*** (0.09)	0.06*** (0.03)	0.01 (0.01)	0.01 (0.01)
Slope (τ_6)^{††}	< 0.01 (0.03)	0.03 (0.04)	<0.01 (0.05)	0.26*** (0.09)	0.01 (0.01)	0.01 (0.01)	<0.01 (<0.01)
(cont.)							

Item	<u>Subjective norms</u>			<u>PBC</u>	<u>Expectations</u>	Prototypes	
	D/38	D/44	D/45	D/43	D/40	D/38	D/44

Model Summary							
Deviance statistic (-2*log likelihood)	9472.51	9053.32	9217.45	8118.43	7108.90	6274.56	5702.23
Comparison with Model 2							
Goodness of fit (χ^2) ^{†††}	18.05	6.00	7.91	7.70	9.67	13.48	4.18
Effect size (<i>pseudo R</i> ²)	<.01	.01	.01	.02	.01	.02	<.01

Note 1: Standard errors are in parentheses.

Note 2: Number of parameters in all models = 17.

† df = 1106: †† df = 32: ††† df = 10: *p < .05, **p < .01, ***p < 0.001.

Table 10.40 IP model 5: Between-student factors for attitude towards speeding variables

Item	<u>Subjective norms</u>		D/45	<u>PBC</u>	<u>Expectatio</u> <u>ns</u>	<u>Prototypes</u>	
	D/38	D/44		D/43	D/40	D/39(N)	D/39(P)
Parameters	Fixed effects coefficients						
Intercepts	3.90*** (0.06)	3.75*** (0.08)	n/a	5.43*** (0.12)	3.04*** (0.05)	3.37*** (0.04)	2.38*** (0.03)
Level-2 (between-students)							
Location Rural (Reference; Urban)					0.16** (0.06)		
Gender Female (Reference; Male)		0.31** (0.10)				0.26*** (0.05)	-0.18*** (0.04)
Exposure to aberrant driving	0.43*** (0.09)			-0.38*** (0.08)	0.64*** (0.06)	-0.22*** (0.04)	0.24*** (0.03)
Experience with vehicles					0.24*** (0.04)		
Impulsiveness	0.40*** (0.08)	-0.44*** (0.09)			0.28** (0.06)	-0.19** (0.05)	0.18*** (0.05)
Sensation seeking	0.33*** (0.08)						0.16*** (0.05)
Agreeableness					-0.14** (0.05)		
Slopes							
Level-1 (intra-student)							
New time	0.14* (0.06)	0.36*** (0.08)	n/a	0.14 (0.11)	0.16*** (0.04)	0.18*** (0.03)	-0.05* (0.03)
Level-2 (between-student)							
Exposure to aberrant driving							
Variance components	Random effects coefficients						
Residual (σ^2)	1.99 (0.09)	1.08 (0.04)	n/a	0.20 (0.01)	0.75 (0.02)	0.59 (0.02)	0.42 (0.02)
Individual (τ_π) [†]	0.59** (0.08)	1.60*** (0.09)		1.99*** (0.07)	0.45*** (0.03)	0.19*** (0.02)	0.13*** (0.02)
Intercept (τ_0) ^{††}	0.04** (0.03)	0.05** (0.03)		0.43*** (0.08)	0.03** (0.01)	0.01 (0.01)	0.01 (0.01)
Slope (τ_6) ^{††}	0.01 (0.02)	0.06** (0.03)		0.47*** (0.10)	<0.01 (0.01)	0.01 (0.01)	<0.01 (0.01)
Model Summary							
Deviance statistic (-2*log likelihood)	9412.98	9058.71	n/a	7038.91	7397.73	6396.96	5552.58
No. of estimated parameters	10	9		8	12	10	11
							(cont.)
Item	<u>Subjective Norms</u>		D/45	<u>PBC</u>	<u>Expectatio</u> <u>ns</u>	<u>Prototypes</u>	
	D/38	D/44		D/43	D/40	D/39(N)	D/39(P)
Comparison with Model 2							
Goodness of fit (χ^2) ^{†††}	21.12*	29.29*** (2)		24.11*** (1)	222.61*** (6)	125.23*** (3)	152.98*** (4)

Effect size (<i>pseudo R</i> ²)	.02	<.01	<.01	<.01	.05	.08

Note 1: Standard errors are in parentheses. † df = 1212; †† df = 32; ††† df = 10; *p < .05. **p < .01, ***p < 0.001.

Table 10.41 IVF model 5: Between student factors for attitude towards speeding variables

	<u>Subjective norms</u>			<u>PBC</u>	<u>Expectations</u>	<u>Prototypes</u>	
Item	D/38	D/44	D/45	D/43	D/40	D/39(N)	D/39(P)
Fixed effects coefficients							
Intercepts	3.89*** (0.06)	3.73*** (0.07)	4.47*** (0.06)	5.47*** (0.11)	3.05*** (0.05)	3.40*** (0.03)	2.39*** (0.03)
<u>Level-2 (between-student)</u>							
Location Rural (Reference: Urban)					0.11* (0.06)		
Gender Female (Reference: Male)		0.36*** (0.09)				0.22** (0.05)	-0.20*** (0.05)
Exposure to aberrant driving	0.39*** (0.09)			-0.24*** (0.06)	0.65*** (0.08)	-0.27*** (0.05)	0.33*** (0.05)
Experience with vehicles					0.22*** (0.04)		
Impulsiveness	0.41*** (0.08)	-0.44*** (0.09)			0.21** (0.04)	-0.21** (0.05)	0.14** (0.04)
Sensation seeking							0.10* (0.04)
Agreeableness					-0.19** (0.05)		
Slopes							
<u>Level-1 (intra-student)</u>							
New time	-0.49*** (0.08)	0.67*** (0.08)	-0.77*** (0.08)	0.37** (0.11)	0.30*** (0.04)	-0.13** (0.04)	-0.10* (0.07)
<u>Level-2 (between-student)</u>							
Exposure to aberrant driving					0.29*** (0.07)	0.17* (0.07)	0.20** (0.06)
Impulsiveness			0.34** (0.12)	-0.23* (0.09)			
Random effects coefficients							
Variance components			3.29	1.69	0.89	0.76	0.59
Residual (σ^2)	2.14 (0.09)	2.73 (0.12)	(0.14)	(0.07)	(0.03)	(0.03)	(0.02)
Individual (τ_π) [†]	0.33** (0.08)	0.27*** (0.08)	<0.01 (0.10)	0.29** (0.06)	0.33*** (0.03)	0.13*** (0.03)	0.09*** (0.03)
Intercept (τ_0)^{††}	0.04* (0.03)	0.05** (0.04)	0.02 (0.02)	0.34 (0.13)	0.03** (0.02)	0.01 (0.01)	0.01 (0.01)
Slope (τ_0)^{††}	< 0.01 (0.03)	0.03 (0.05)	0.03 (0.04)	0.28*** (0.16)	0.01 (0.01)	0.01 (0.01)	<0.01 (0.01)
Residual (σ^2)	2.14 (0.09)	2.73 (0.12)	3.29 (0.14)	1.69 (0.07)	0.89 (0.03)	0.76 (0.03)	0.59 (0.02)
(cont.)							

(cont.)

Item	<u>Subjective norms</u>		D/45	<u>PBC</u>	<u>Intention</u>	<u>Prototype</u>	D/39(P)
	D/38	D/44		D/43	<u>s</u>	<u>s</u>	

Variance components	Random effects coefficients						
Model Summary							
Deviance statistic (-2*log likelihood)	8499.03	9021.4	9217.27	8101.14	6913.08	6212.29	5579.78
No. of estimated parameters	10	9	8	9	13	11	13
Comparison with Model 2							
		66.61***		24.86***	190.16***	75.75***	126.11***
Goodness of fit (χ^2) ^{†††}	21.12*	(2)	8.09** (1)	(2)	(6)	(4)	(6)
Effect size (<i>pseudo R</i> ²)	.02	.10	.02	<.01	.12	.04	.07

Note 1: Standard errors are in parentheses.

† df = 1106: †† df = 32: †††df = 10: *p < .05.

p < .01, *p < 0.001.

10.17 Appendix P. Teacher interview

The semi-structured teacher interviews were based on 13 questions. At the beginning of each interview the teacher was informed about the purpose of the interview and provided with assurances of confidentiality and were informed about their right to withdraw their consent as follows;

“Thank you for agreeing to do this interview. The questions that I intend to ask are mainly related to quality of the PLDE programme that you have taught recently. I appreciate your help and I value your ideas and suggestions. Your name will not appear in connection with any of the data that you provide and you are at liberty to stop this interview or to have any data destroyed if you wish to do so in the future.”

Questions

1. Can you tell me a bit about the PLDE course that you taught recently?

Probes

Over how many weeks did it run?

How many class periods per week were scheduled?

Do you feel that this pace was too fast or too slow?

Was there enough to cover the entire course?

Did you leave out any sections/parts? Which sections? Why?

Did you cut short any parts of the programme? Which parts? Why?

Did you cover the Driver Theory Test? To what extent?

Did the students do any other PLDE courses?

2. Now I would like to talk programme materials and activities.

Probes

How satisfied were you with the course materials?

Can you talk a bit about programme activities?

Were those activities beneficial from the perspective of teaching and learning?

Which ones worked well? Did any activities not work well?

How could they be improved?

3. Did you use any of the recommended guest speakers during the year and if so what how would you rate their contribution?

Probes

If not what were the obstacles?

How would you rate the quality of their presentations?

How would you rate their delivery technique?

How did the students react?

4. Which sections of the course were most important in your own opinion? Why?

5. Could you talk a bit about student reactions to the course?

Probes

What sections did they find most interesting? Why?

What did they find least interesting? Why?

Could you suggest anything that would help to capture their interest?

6. Were there any aspects of the programme that need improvement from an instructor's perspective?

Probes

Resources?

Time available for teaching the course?

7. Do you feel that there is anything missing from the course?

Is there anything else that you would like to add that might be useful?

Thank you very much that has been really helpful.

