

An investigation into the potential of a nudging intervention model and implementation framework to alleviate academic amotivation in first-year undergraduate students.

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Peter Gillis - 10264651

Declaration

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Peter Gillis, BA Psy, MSc.

Summary

“One of the most prominent academic problems plaguing today’s teenage youth is a lack of motivation toward academic activities” (Legault, Green-Demers, & Pelletier, 2006, p.567).

This thesis investigates the potential of an intervention approach, directly with students, to alleviate academic amotivation, the negative form of academic motivation. The thesis’ literature review identified the area of academic amotivation in students as an under researched area, with significant gaps in current understanding of its treatment. In addition, the literature review revealed academic amotivation as a multifaceted construct comprising four subcomponents which are negatively held beliefs by students relating to, ability, value, effort, and task characteristics. This thesis focused on two of these subcomponents, namely Ability and Value.

In reviewing research methodologies for the thesis, a post-positivist approach, leveraging Design Based Research (DBR) emerged as an appropriate philosophy and design support and aligned well with the research. DBR takes an iterative approach where each experiment is seen as a learning opportunity and is developed in the further iterations. The intervention enabled a quantitative approach to pre- and post-being adopted.

The research identified nudges as an appropriate intervention approach. In particular ‘boost nudges’ which seek to build general skills like self-control and motivation.

An intervention model was designed to bring together the academic amotivation target and boost nudging intervention. The model served as a template for the experiments undertaken over the course of the research.

An implementation framework was also developed to facilitate the delivery and analysis of the interventions. The framework included a lecturer toolkit which supported lecturers in developing nudges directly linked to the module of study.

Following the DBR approach a series of three experiments were undertaken, each building on the previous. This led to the deployment of the final experiment with first year undergraduate students in Trinity College Dublin. The final experiment comprised 117 participants and looked at both academic amotivation measures and indicators of real-world behaviours. The real-world behaviours were associated with the two amotivation areas of interest, Performance linked to Ability and Maladaptive behaviours linked to Value. Based on Pre- measures of the students' amotivation at the subcomponent level they were assigned to either the Ability or Value nudge group. The students were also profiled by amotivation level based on their pre-scores in relation to academic amotivation. The groups were divided into thirds where the top third was identified as most amotivated in their class, the bottom third as least amotivated and the balance third as the middle group. The intervention comprised six nudges being sent to students over two weeks via text message. The students did not have to respond.

The results across the three experiments indicated support for the interventions having a positive, statistically significant, impact on students' amotivation, specifically those in the most amotivated groups. In the final experiment the intervention had a statistically significant positive impact on the most amotivated group at the general amotivation level. The targeted nudges each had a statistically significant effect on the targeted subcomponent of Ability or Value, while having no impact on the not targeted sub-component. This finding lends support for the ability to identify and target amotivation at the subcomponent level.

The results in relation to real-world behaviours were mixed and may be explained in part by the short duration of the experiment. However, real-world behavioural change was not the target of this research and was captured by way of opportunity. Even so there were some encouraging results from a positive behaviour impact perspective. In addition, from a correlation perspective, a statistically significant relationship between two Pre- amotivation measures and Pre- real-world behaviors were found.

This research was undertaken to investigate the potential of a nudging intervention model and implementation framework to alleviate academic amotivation in first-year undergraduate students. From this perspective the research has added to the existing literature

Abstract

Research shows lack of academic motivation as a major problem for undergraduates. Ultimately it can lead to multi-dimensional issues for, the student, the institution, and society. The negative form of motivation is amotivation. The focus of this study was to investigate the potential of an intervention model and supporting framework to provide targeted support for those affected by amotivation. A Design Based Research approach over three experiments, delivered targeted boost nudges to students, via text messages, based on their personal profiles. The intervention sought to alleviate amotivation. The final pre/post experiment with 117 students in a third level education institution in Ireland showed support for the concept at the amotivation level. Support was also shown for the ability of the intervention to impact targeted sub components of amotivation, negative beliefs around Value and Ability. Some support also emerged on the ability to impact real-world behaviours such as performance. The model and framework have shown potential to address what is understood to be a painful problem for today's students and society.

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It is said that the PhD is a solo effort, a marathon. I have not found this to be the case. The support of a team around me over this extended period, due to covid, has been invaluable.

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Declaration	2
Summary	3
Abstract	6
Acknowledgements	7
Chapter1 - Motivation for this research	20
1.1 Introduction	20
1.1.1 Motivation	21
1.1.2 The Intervention	22
1.3 Research Objectives.....	22
1.4 Contribution	23
1.4.1 The Intervention Model.....	24
1.4.1 The Implementation Framework.....	24
1.4.2 Presentations and papers	25
1.5 Methodology	26
1.5.1 Population sample	27
1.6 Thesis Structure	28
Chapter 2 - Literature Review.....	30
2.1 Introduction	30
2.2 Motivation in education	30
2.3 Amotivation	33
2.3.1 Amotivation as a researchable phenomenon.....	33
2.3.2 Student Amotivation underpinnings	35
2.3.3 Academic Amotivation as a multi-dimensional construct	36
2.3.4 Academic Amotivation Inventory (AAI).	38
2.3.5 Areas of current research	39
2.3.6 Amotivation-focused intervention studies	41

2.3.7 Motivation related intervention studies	43
2.4 Nudges.....	46
2.4.1 The ethics of nudging.	46
2.4.2 Nudging in Education.....	47
2.4.2.1 Non-educational Nudges	49
2.4.2.2 Situation specific nudges	49
2.4.2.3 Educational nudges.....	50
2.4.2.4 Social and Extrinsic Nudges	51
2.4.2.5 Psychological Nudges	52
2.4.3 Intervention studies leveraging nudges.	53
2.4.4 Intervention duration in nudging experiments.	55
2.5 Nudge design	57
2.6 Summary.....	59
Chapter 3 Methodology	62
3.1 Introduction.....	62
3.2 Amotivation	62
3.3 Research Philosophy.....	63
3.3.2 Post-positivist Quantitative approach	64
3.4 Research Design	64
3.5 Participant Sampling.....	66
3.5.1 The population	66
3.5.2 Sampling Design and Stratification	66
3.6 Data Collection Methods.....	68
3.6.1 Data sets	69
3.7 Data Analysis	70
3.7.1 Reliability and Validity	70

3.8 Participants	71
3.9 Pre-Pilot Study	72
3.10 Researcher Bias	72
3.11 Research Problems Issues.....	72
3.12 Summary.....	73
Chapter 4 - Conceptual Framework.....	74
4.1 Introduction	74
4.2 Student Academic Motivation Challenges.....	74
4.3 Dimensions of Academic Motivation.....	75
4.4 An amotivation approach to Academic Motivation.....	75
4.4.1 Identifying the parameters for the thesis.....	77
4.4.1.1 Considerations in selecting negative academic outcome indicators.....	77
4.4.1.2 Considerations in selecting amotivation sub-components.....	77
4.4.1.3 Amotivation and behaviour parameters for this research.	78
4.4.2 Measuring Amotivation	79
4.5 Indicators of Behaviour Change.....	80
4.5.1 real-world behaviour indicators	81
4.5.2 Self-report behaviour indicators.....	81
4.6 Identifying an intervention approach.....	82
4.6.1 A nudges approach	82
4.7 Nudge Design.....	83
4.7.1 Nudge Categories	84
4.7.2 Ability Nudges.....	85
4.7.3 Value Nudges.....	85
4.7.4 Lecturer Toolkit.....	86
4.8 Implementation Strategy.....	86

4.8.1 Data Collection	87
4.9. The Model.....	89
4.9.1 Towards an automated development of the model.....	90
4.10. Implementation Framework.....	90
4.10.1 Student PRE-self-report data on Amotivation and Behaviour.....	91
4.10.2 Student profiling and subsequent targeted boost nudge intervention.....	92
4.10.3 Student POST self-report data on Amotivation and Behaviour.....	93
4.10.4 Student real-world behaviour indicators PRE and POST	94
4.10.5 Analysis dataset and procedure	94
4.10.5.1 Data analyses.....	95
4.11 Summary.....	96
Chapter 5 – Experiment One, pilot study.	98
5.1 Introduction.....	98
5.2 Ethics	99
5.3 Participants and recruitment approach.....	99
5.4 Materials and methods.....	100
The survey 5.4.1	100
5.4.2 Defining groups.	101
5.4.3 The Nudges and Intervention	101
5.5 Data and Analysis - Amotivation.....	103
5.5.1 Descriptive Statistics.....	104
5.5.1.1 Interpreting scatterplots.....	105
5.5.2 Intervention impact on overall academic amotivation.	107
5.5.3 Intervention impact on sub-scales of academic amotivation.....	108
5.5.4 Intervention impact on academic amotivation by nudge type.....	110

5.5.5 Intervention impact on associated sub-scales of academic amotivation to nudge type.....	111
5.6 Data and Analysis – Self-report of behaviour intent	114
5.6.1 Indicators related to performance.	114
5.6.2 Indicators related to maladaptive behaviours.....	114
5.6.3 Indicators related to self-esteem and intention to drop-out.	115
5.7 Summary.....	117
Chapter 6 – Experiment Two	118
6.1 Introduction.....	118
6.2 Ethics	118
6.3 Participants.....	119
6.4 Materials and methods.....	120
6.4.1 The survey.....	120
6.4.2 Defining the nudge groups.	120
6.4.3 Defining amotivation level, groups.....	121
6.4.4 The Nudges	122
6.4.5 The Intervention	123
6.5 Data Preparation	124
6.6 Data Analysis - Amotivation.....	126
6.6.1 Descriptive Statistics.....	126
6.6.1 Intervention impact on overall academic amotivation.....	129
6.6.2 Intervention impact on sub-scales of academic amotivation.....	130
6.6.3 Impact on AAI and associated sub-scales scores of academic amotivation, by nudge type and across Amotivation Groups.	131
6.6.3.1 Discussing the results for each Group based on receiving Ability Nudges	133

6.6.3.2	134
6.7 Data and Analysis – Self Report behaviour intent	134
6.7.1 Indicators related to performance.	136
6.7.2 Indicators related to maladaptive behaviours.....	136
Chapter 7 – Experiment Three	137
7.1 Introduction.....	137
7.2 Ethics	137
7.3 Participants.....	137
7.4 Materials and methods.....	138
7.4.1 The survey	138
7.4.2 Defining the nudge groups.	139
7.4.3 Defining amotivation level groups.....	139
7.4.4 The Nudges.....	139
7.4.5 The Intervention	140
7.5 Real-world data collection.....	141
7.5.1 Real-world data for engineering students.....	142
7.5.2 Real-world data for computer science students.....	143
7.5.3 Real-world data conclusion	143
7.6 Data Preparation	143
7.7 Data Analysis - Amotivation.....	145
7.7.1 Descriptive Statistics.....	145
7.7.1 Intervention impact on overall academic amotivation.	148
7.7.2 Intervention impact on sub-scales of academic amotivation.....	149
7.7.3 Impact on AAI and associated sub-scales scores of academic amotivation, by nudge type and across Amotivation Groups.	151

7.7.3.1 Discussing the results for each Group based on receiving Ability Nudges	153
7.7.3.2 Discussing the results for each Group based on receiving Value Nudges	153
7.8 Data and Analysis on Self Report behaviour intent	154
7.8.1 Indicators related to performance.	154
7.8.2 Indicators related to maladaptive behaviours.	155
7.8.3 Indicators related to self-esteem and intention to drop-out.	156
7.9 Real-world Behaviour analysis	156
7.9.1 Defining the performance level groups for real-world data.	157
7.9.2 Engineering Students - MCQ Performance - associated with Ability Amotivation.	160
7.9.3 Engineering Students – Programming Test Scores - associated with Ability Amotivation.	161
7.9.4 Engineering Students – Mid-term and end-term results - associated with Ability Amotivation.	162
7.9.5 Computer Science Students – Practice Assignments Results - associated with Ability Amotivation.	163
7.9.6 Engineering Students – VLE access measure - associated with Value Amotivation.	164
7.9.7 Computer Science Students - VLE access measure - associated with Value Amotivation.	165
7.9.8 Computer Science Students - Optional test attempts - associated with Value Amotivation.	166
7.10 Correlations and Associations of Real-world data to Amotivation state	168
7.10.1 Correlations and Associations Measures	168
7.10.2 Analysing the real-world incidences	169

7.10.3 Engineering Students – Associations for ‘Pre-Ability-Amotivation * Mid-term results’	169
7.10.4 Computer Science Students – Associations for ‘Pre-Ability-Amotivation * Practice Assignments Results	171
7.11. Summary.....	172
Chapter 8 – Discussion of results.....	174
8.1 Introduction.....	174
8.2 Interpreting the Results.....	176
8.2.1 Results related to impact on General amotivation.....	177
8.2.1.1 Results related to impact on General amotivation by nudge type received.	179
8.2.2 Results related to impact on Amotivation subscales.....	181
8.2.3 Results related to targeting the sub components of amotivation.....	183
8.2.4 Investigating the results related to academic behaviours.....	187
8.2.4.1 Results related to impact on self-report behaviours.....	187
8.2.4.2 Results related to impact on real-world behaviours	189
8.2.4.3 Results related to impact on real-world performance behaviours.....	189
8.2.4.4 Results related to impact on real-world maladaptive behaviours.....	190
8.2.5 Interpretation of correlations between amotivation indicators and behaviour indicators	192
8.3 Implications of the Results	192
8.3.1 Implications related to amotivation	193
8.3.2 Implications related to behaviour	195
8.4 Limitations	195
8.5 Summary.....	196
Chapter 9 - Conclusion	197
9.1 Introduction.....	197

9.2 Findings.....	197
9.2.1 Findings for Objective 1	198
9.2.3 Findings for Objective 2	198
9.2.4 Findings for Objective 3	199
9.2.5 Findings for Objective 4	200
9.3 Suggestions for Future Research	202
9.3.1 Developments of the current research.....	202
9.3.2 New research inspired by the current research	202
9.3.3 Real world behaviour research	203
9.4 Implications for practice and policy.....	203
9.5 Contributions to the field	204
References.....	206
Appendix.....	219
Appendix A - Research Instrument 1 - Self-Report Questionnaire on Academic Behaviours.....	219
Appendix B - Research Instrument 2 – Academic Amotivation Inventory.....	220
Appendix C - Research Instrument 2 – Lisa Legault support for this thesis’ research and leveraging the 13 item self-report behaviour questionnaire.	221
Appendix D. Lecturer Toolkit.....	222
Appendix E - Griffith College Dublin Ethics Approval.	223
Appendix F - Griffith College Dublin Ethics Application.....	224
Appendix G - Experiment One – Analyses data on full AAI scores, Pre, and Post, split by Amotivated, Middle, and Not Amotivated, groups.	236
Appendix H - Experiment One – Analyses data on AAI subscale scores, Pre, and Post, split by Amotivated, Middle, and Not Amotivated groups.....	237
Appendix I - Experiment One – Analyses data on full AAI scores, Pre, and Post, split by nudge type sent, and Amotivated level groups.....	238

Appendix J - Experiment One – Analyses data on AAI scores, Ability and Value Subscales, Pre, and Post, split by nudge type sent and Amotivated groups.	239
Appendix K - Experiment One – Analyses data on Self-report measure associated with performance, split by Amotivation level groups and Nudge type.....	240
Appendix L - Experiment One – Analyses data on Self-report measures associated with maladaptive behaviour, split by Amotivation level groups and Nudge type.....	241
Appendix M - Experiment One – Analyses data on Self-report measures associated with Self-Esteem and Intention to Drop-out, split by Amotivation level groups and Nudge type.	242
Appendix N - Ethics Approval from the School of Computer Science & Statistics, Trinity College Dublin.....	243
Appendix O - Experiment Two - full data set used for analysis	244
Appendix P Experiment Two – Analyses data on full AAI scores, Pre, and Post, split by Amotivated, Middle, and Not Amotivated, groups.	244
Appendix - Q . Experiment Two – Analyses data on AAI subscale scores, Pre, and Post, split by Amotivated, Middle, and Not Amotivated groups.....	245
Appendix R - Experiment Two – Analyses data on AAI scores, Ability, and Value Subscales, Pre, and Post, split by nudge type sent and Amotivated groups.	247
Appendix S – Experiment Two Analyses data on Self-report measures associated with, performance, maladaptive behaviour, self-esteem, and intention to drop-out, split by Amotivated groups	249
Appendix T – Experiment Three - full data set used for analysis.....	253
Appendix U Experiment Three –Analyses data on full AAI scores, Pre, and Post, split by Amotivated, Middle, and Not Amotivated, groups.	253
Appendix - V. Experiment Three – Analyses data on AAI subscale scores, Pre, and Post, split by Amotivated Group, Middle Group, and Not Amotivated Group.....	254
Appendix W – Experiment Three Analyses data on AAI scores, Ability, and Value Subscales, Pre, and Post, split by nudge type sent and Amotivated groups.	255

Appendix X – Experiment Three Analyses data on Self-report measures associated with, performance, maladaptive behaviour, self-esteem, and intention to drop-out, split by Amotivated groups.....	257
Appendix Y – Experiment Three Engineering Students / Pre- MCQ Performance, frequencies, and distribution histogram	260
Appendix Z – Experiment Three Engineering Students / Pre- Programming Test Scores, frequencies, and distribution histogram	261
Appendix AA – Experiment Three Computer Science Students / Pre- Practice Test Scores, frequencies, and distribution histogram	262
Appendix BB – Experiment Three Engineering Students / Pre- VLE access, frequencies, and distribution histogram	263
Appendix CC – Experiment Three Computer Science Students / Pre- VLE access, frequencies, and distribution histogram	264
Appendix DD – Experiment Three Computer Science Students / Pre- Optional test attempts, frequencies, and distribution histogram.....	265

Chapter1 - Motivation for this research

“One of the most prominent academic problems plaguing today’s teenage youth is a lack of motivation toward academic activities” (Legault, Green-Demers, & Pelletier, 2006, p.567).

“there is a great need to look into academic amotivation..... the link between amotivation and performance is still underexplored” (Leroy & Bressoux, 2016, p.43).

“amotivation appears to be an active negative form of motivation rather than a lack of it, and possibly a more sensitive guide of engagement level, yet to date there appears to be little research into it as an independent motivation paradigm” (Gillis, 2013).

1.1 Introduction

The motivation for this research was to investigate the potential impact of a personalised nudging model and evaluate the implementation framework’s capability in alleviating academic amotivation for first year undergraduate students.

A report relating to first year students in the Australian university sector sees motivation as “critical for persistence and achievement” (Baik, Naylor, & Arkoudis, 2015, p.33). For new undergraduates motivation to study has shown to be an challenge, with over a third expressing difficulty in the area (Baik et al., 2015).

Negative Ability beliefs are one of the sub-components of academic amotivation, and one of the main areas of research in this thesis. An Irish study, in University College Dublin (UCD) reported concerns for 29% of first year students around their ability to cope with the workload in the first semester (Gibney, Moore, Murphy, & O’Sullivan, 2011). In conjunction with the researcher’s own lived experience, this directed the use case for this research as first year undergraduates.

1.1.1 Motivation

In discussing motivation toward academic activities, as it relates to undergraduates, most of the research tends to focus on the intrinsic and extrinsic aspects of motivation (Baik et al., 2015; D'Lima, Winsler, & Kitsantas, 2014; Gibney et al., 2011).

Intrinsic motivation is the desire to engage with a topic for personal development and generativity, while extrinsic is for some form of reward such as improving job prospects, receiving praise and other forms of reward (Deci & Ryan, 2008). These two concepts are cornerstones Deci and Ryan's (1985) well established and robust Self Determination Theory of Motivation. The theory contains a third dimension which tends to be overlooked in the aforementioned research.

Deci & Ryan (2008, p.182) refer to amotivation as “a lack of intention and motivation”. In relation to academic endeavour, Barkoukis, Tsorbatzoudis, Grouios, and Sideridis (2008) expand on this definition stating that academic amotivation goes beyond being just ‘a lack’. They hold that amotivation also involves a strongly held negative belief that the outcome is not desirable and that even with great effort successful completion is not possible (Barkoukis et al., 2008). Legault et al. (2006) devised a multi-component model of academic amotivation consisting of four sub components. The sub components were negatively held personal beliefs around, ability, effort, value and task characteristics. Legault et al. (2006) investigated and reported significant links between these sub components and four specific negative academic outcomes; performance, academic self-esteem, intention to drop-out and problem behaviours. Each negative academic outcome was significantly linked to one or more of the amotivation sub components.

Intrinsic and extrinsic approaches to motivation primarily focus positive interventions related to goals or solutions. An amotivation approach starts with the problem, the lack or negative form of motivation, and from there seeks to address the problem. It is through an amotivation lens this research seeks to investigate the potential of interventions, to remove the barriers to motivation. There are not many studies looking at amotivation in the education area and the ones that are published tend to focus on post-primary students (Cheon, Reeve, & Song, 2016; Legault et al., 2006; Leroy & Bressoux, 2016;

Mohammadi, 2014). The research that was found focused on training teachers rather than interventions with students directly. This research will take a unique angle from the perspective of adopting an amotivation, intervention approach, directly with first year third level students.

1.1.2 The Intervention

The research will seek to adopt a unique approach through the use of nudges delivered through technology to investigate the potential to positively impact academic amotivation in students. In educational settings nudges are interventions such as information provision and reminders intended to induce better decision making (Damgaard & Nielsen, 2018). Nudging has received recent attention as a means to improve educational outcomes including a European Commission report on the topic (Damgaard & Nielsen, 2017) and have been shown to have some success in the educational space. For instance, a single three week field experiment sending e-mail messages, encouraging out-of-class study, resulted in a significant increased exam performance by 0.2 standard deviation for the experimental group (O'Connell and Lang, 2018).

A subset of nudges, referred to as boost nudges, are of particular interest to this research. Boost nudges seek to assist in the development of the general skills required by students to succeed, and how to deal with barriers they may encounter. Unlike specific informational nudges, boost nudges seek to address issues such as self-control and motivation (Damgaard and Nielsen 2018). After an extensive research survey, no research found has sought to use boost nudges aligned to academic amotivation. The research in this thesis will seek to design an adaptive intervention boost nudge model based on students' profiles. To support this investigation, an implementation framework was researched and developed to deploy the interventions and analyse the results in seeking to support the intervention model.

1.3 Research Objectives

The research question being investigated in this thesis is "To what extent can a personalised boost nudge intervention reduce academic amotivation in first-year

undergraduate students?” The decision to take a nudging approach is explained in Chapter 4 and was based on investigating alternatives. To address this research question the four following objectives were developed.

Objective 1

Investigate the current state of the art in educational amotivation research, and carry out a literature review to examine the use of nudging technologies in education, and intervention studies in both areas.

Objective 2

Investigate the potential of amotivation focused boost nudges targeting amotivation levels, via a pilot experiment

Objective 3

Research and develop a model of personalised amotivation-focused boost nudges and investigate their potential to impact on specific aspects of a learner’s amotivation and subsequent behaviours.

Objective 4

Research and develop an implementation framework to support an intervention process, artefacts and instruments to allow further development and analysis of personalised nudging interventions on amotivation. Deploy the implementation framework and perform evaluation exercises to analyse the effects of the framework with regards to the effects on academic amotivation.

1.4 Contribution

In addressing the research question is “To what extent can a personalised boost nudge intervention reduce academic amotivation in first-year undergraduate students?” there were two main research contributions delivered across the course of this research, an Intervention Model, and an Implementation Framework.

1.4.1 The Intervention Model

A unique intervention model to support students affected by academic amotivation was developed following a literature review into both, academic amotivation, and nudging techniques, as they pertain to education support. The model is derived from insights gained from previous research into amotivation, its sub components and approaches to alleviate it. In addition, research into the use of nudges in the area of education as a means to provide support. The model acted as a template to inform the proposed research intervention approach to detect, profile, and address academic amotivation and its sub components. The model was developed to target amotivation at the module level and also to profile the prevalent sub component of academic amotivation.

The intervention model is built on research and is to some extent future looking in terms of its ambitions to potentially be deployed in a practical fashion to support first-year students in the real world. Therefore it was important to seek support for the approach. This was the main focus of the activities in the latter half of this thesis. To carry out meaningful investigation was required support in terms of a framework. The implementation framework is discussed in the next section.

1.4.1 The Implementation Framework

The contribution of the implementation framework is a unique and practical framework to support further research, by the researcher, and others into the applicability and potential of the intervention model.

To research the potential of the intervention model in this thesis it was necessary to devise an implementation framework. The implementation framework provided a step by step research approach to measure academic amotivation, and its sub components. A strategy to profile each student's amotivation levels. A design structure to develop informed and targeted nudges. The facility to deliver the targeted nudges to each student according to their profile, and the means to re-measure all aspects of their academic amotivation to investigate if there had been any impact as a result of the intervention.

Ultimately it might be expected that improved academic amotivation state might lead to real-world behaviour outcomes. While not the direct focus of this thesis the opportunity was taken to include in the implementation framework, tools to capture pre- and post-indicators of academic behaviour related to the specific sub components of academic amotivation. The behaviour measures were both real-world and self-report.

The implementation framework was deployed across three experiments and the results lend some statistically significant support for the model in reducing reported academic amotivation in line with the research question.

1.4.2 Presentations and papers

May 2019, '**Next Generation by Design**' conference, Barcelona. *Hosted by Universitat Oberta de Catalunya and organised by the Dxtera Institute.* (Invite)

Title: '*Nudge-nudge for amotivated students*'.

The presentation discussed the research from this thesis on academic amotivation and reported the findings from Experiment One.

July 2022, '**International Conference on Education and Training (ICET)**', Lisbon. *Hosted by the Instituto de Educaçao, University of Lisbon.* (Peer)

Title: '*An investigation into the potential of personalised nudging techniques on; amotivation state, associated negative beliefs and subsequent outcomes of amotivation in first year undergraduate students*'.

The presentation discussed both academic amotivation and the potential of nudges based on the literature review in this thesis and also discussed the results of Experiments One and Two.

October 2023, **Digital Universities Europe conference**, Barcelona. *Hosted by Times Higher Education.* (Invite)

Title: *'Creating strategies and digital tools to support student academic motivation in online and hybrid environments'*.

The presentation incorporated two main topics related to academic motivation. The first topic was a review of this thesis incorporating the motivation for the research, the relevant findings from Experiments One, Two and Three, and discussions on future research.

May 2024, **Education Sciences** Special issue, *'New Trends in Educational Technology after the Pandemic'* (Peer)

The researcher has been invited to submit a paper to this publication. It is the intention to produce an academic paper on this thesis and its findings and to submit it for consideration before March 2024.

1.5 Methodology

The motivation for this research, as stated in the research question, was to investigate to what extent can a personalised boost nudge intervention reduce academic amotivation in first-year undergraduate students?

On review of the research philosophies, a post-positivist approach aligned well with the ambitions of the research. Post-positivism looks to take a deterministic approach to cause and effect but at the same time accepts that when dealing with humans there can be confounding aspects. Within the post-positivist approach Design Based Research (DBR) emerged as an appropriate design support. DBR takes an iterative approach to research, where each step builds on the previous through a series of investigations. Finally, as the intended approach was intervention led, a quantitative approach to measurement was taken in a pre- and post- fashion to investigate for effect.

In line with the DBR approach a literature review of previous research of amotivation and nudges for education was performed with a specific focus on intervention studies. Informed by the literature review, a model for intervention was hypothesized and an implementation framework developed to allow detection and investigation of the

approach through a two-week intervention. Participants were recruited and ethics obtained.

The interventions were deployed in a DBR approach over three experiments as follows.

Experiment One was a pilot experiment. It investigated the utility and practicality of the implementation framework deployment. The experiment also investigated if the intervention influenced amotivation at the general level. Based on the evaluation, the implementation framework was revised and enhanced.

Experiment Two focused in to investigate two target sub-components of amotivation, namely negatively held Ability and Value beliefs. The experiment also investigated the impact on general amotivation.

Experiment Three retained the approach adopted in experiment two and added the component of investigating real-world data on students' performance and maladaptive behaviour. These are negative real-world outcomes directly related to Ability and Value beliefs. The experiment investigated if the intervention had an impact on the students' behaviour.

On completion of each experiment the data was collated, coded, and analysed to examine any significant changes in the pre and post measures of amotivation, amotivation sub-components, and real-world behaviours. The analysis in Experiment Three also took the opportunity to investigate correlations between amotivation measures and real-world activities.

1.5.1 Population sample

The nature of the research required convenience sampling. Participants in Experiment One were undergraduate and post-graduate students from Griffith College Dublin, a private third level college. Participants for Experiments Two and Three were first year

undergraduates from across two different computer science modules at Trinity College Dublin, a public university in Ireland.

1.6 Thesis Structure

The rest of this thesis is laid out as follows.

Chapter 2, Literature review. This chapter investigated current research across three themes, academic amotivation, nudges in the realm of education. The research focused on intervention studies for academic amotivation. The literature review provided insights to, identify and quantify amotivation levels and sub components, and intervention approaches which were leveraged to inform the development a unique intervention model.

Chapter 3, Methodology. The chapter investigated the potential options in terms of both research philosophy and research design. Chapter 3 presents insights that ultimately led to a post-positivist, Design Based Research(DBR) approach being selected, and presents how the DBR methodology was applied in this research.

Chapter 4, The Conceptual Framework. In bringing the findings from the literature review together with the ambitions of the researcher, this chapter discusses the insights that were synthesised and sets out the parameters and justification for the design approach. These are brought together in the intervention model. The chapter then discusses the design and development of the implementation framework which was the structure for the three subsequent experiments.

Chapter 5, Experiment One. The first, pilot experiment, is reported in detail. The main focus of Experiment One was to test the implementation framework, and investigate if any impact was seen at the general amotivation level. The experiment included a mix of post -graduate and under-graduate students. The procedures and results are reported.

Chapter 6, Experiment Two. In line with the iterative, DBR, approach the procedures and results are reported where the participants comprised only first-year undergraduate students. The intervention also progressed from Experiment One to targeting the sub

components of academic amotivation. Students were profiled and allocated to either Ability Nudge or Value Nudge groups based on their profile.

Chapter 7, Experiment Three. This chapter presents the final experiment and evaluation. Experiment Three followed the same approach as Experiment Two. However, it was iterated to add the significant new aspect of real-world measure indicators of academic behaviour. The purpose of including real-world behaviour measures was to investigate if there were any real-world behaviour impacts pre- and post- and related to the students' profile and subsequent intervention. In addition the real-world behaviour indicators were investigated for correlation with amotivation. This last investigation sought to identify the possibility of real-world behaviours' ability to detect the presence of amotivation at the sub component level.

Chapter 8, Discussion. Chapters 5, 6 and 7 report the results found. In Chapter 8 these results are brought together and discussed in terms of potential interpretations and implications. The chapter looks at General Amotivation, Targeted interventions at the sub component levels Ability and Value, Real-world behaviour impacts, and correlations. The chapter also discusses the limitations of the research.

Chapter 9. Conclusion. This chapter reviews the research undertaken and subsequent results against the ambitions of the research question and the four objectives set out in section 1.3. The chapter then discusses potential further direction for research building on this thesis.

Chapter 2 - Literature Review

2.1 Introduction

This research investigated the potential to support first-year undergraduate students in relation to their academic motivation. The approach is to focus on the area of negative motivation referred to as amotivation.

The chapter first introduces the area of motivation in education with a focus on Self Determination Theory (SDT). It introduces Amotivation, the negative form of motivation, which is a component of SDT. The chapter progresses to examine more deeply the area of amotivation as it relates to education. Then investigates the potential for focusing on amotivation as an individual construct in this thesis' research, including associated measurement tools. The research points to specific negative academic behaviours associated with amotivation, and amotivation as a multi-dimensional concept.

The subsequent sections of this chapter report on current research in the academic amotivation field, and progressively focus on intervention studies, in line with the ambitions of this thesis' research.

Behavioural economics, and specifically nudging techniques, were identified as a potential intervention technique. The chapter explores current research into different types of nudges and areas of impact related to education. The current research focuses on educational intervention studies. The section on nudges concludes with research into the area of developing effective nudges from both nudge design and intervention timing perspectives. Chapter 2 concludes with a summary of the research and identifies the gaps this research seeks to fill.

2.2 Motivation in education

The focus of this thesis' research is motivation, specifically first year undergraduate motivation toward academic studies. Motivation is "the process of instigating and sustaining goal-directed behavior" (Schunk, 2013, p.346). Motivation research has evolved significantly from early evolutionary adaptive theories, through drive theories

and into the behaviourist movement where motivation was not a focus for almost fifty years, to the modern concepts leveraged today (R. M. Ryan, Bradshaw, & Deci, 2019). The most significant development in progressing to the current thinking on motivation was the inclusion of 'self' and 'cognition' over 'drive' and 'reinforcement', in addition the concept of motivation as being 'situational' linked to the task at hand rather than a trait (Weiner, 1990).

Irvine (2018) sought to develop a framework on which modern theories of motivation, as they relate to education, could be mapped. The research framework's dimensions are based on two of the current well researched theories: Expectancy Value Theory and Intrinsic-Extrinsic motivation. Wigfield & Eccles (2000) refer to Expectancy as the belief an individual has that they can perform a certain task, while Value relates to the value an individual places on aspects of achieving the task. In switching to the Intrinsic-Extrinsic dimensions Ryan & Deci (2000) state "The most basic distinction is between intrinsic motivation, which refers to doing something because it is inherently interesting or enjoyable, and extrinsic motivation, which refers to doing something because it leads to a separable outcome" (p.55).

Irvine's (2018) framework manifests as a four-quadrant chart with Extrinsic to Intrinsic on the Y axis and Expectancy to Value on the X axis. The framework "provides a straightforward method for exposing the critical elements of the myriad of theories related to motivation and for gaining a clearer understanding of what causes students to engage or not engage in tasks related to their learning." (Irvine, 2018, p.14). In mapping eight motivation theories to the framework SDT emerges as one of the most central, incorporating all four quadrants (Irvine, 2018, p.27).

As discussed in the previous paragraph there are differences and similarities between theories of motivation, SDT is shown as a well-rounded theory covering the main four differentiating dimensions. There are many theories of motivation that could have been explored in pursuit of this thesis, however the researcher's specific area of interest within academic motivation was academic amotivation, a subcomponent of SDT, and not distinguishable in any other theories, on this basis the research adopted an SDT approach.

SDT “examines how biological, social, and cultural conditions either enhance or undermine the inherent human capacities for psychological growth, engagement, and wellness, both in general and in specific domains and endeavors. SDT research thus critically inquires into factors, both intrinsic to individual development and within social contexts, that facilitate vitality, motivation, social integration and well-being, and, alternatively, those that contribute to depletion, fragmentation, antisocial behaviors, and unhappiness” (Ryan & Deci, 2017, P.3).

SDT as initially developed by Deci and Ryan (1985) has developed to become one of the most widely researched and applied theories in the field of psychology because of its basic science approach to human motivation and its widely confirmed practical value across multiple domains (Ryan & Deci, 2019). Along with a strong focus on Education SDT is also deployed across many different domains including Disability, Environment, Health, Organisations and work, Psychotherapy and many others (“Centre for Self-Determination Theory,” 2023).

SDT is based on two distinct forms of motivation, the first is autonomous where individuals choose to engage in activities and feel competent in tackling them. The second is controlled where there is some aspect of ‘having to’ engage in an activity. As mentioned, underpinning SDT are three basic human psychological needs for: autonomy, competence, and relatedness. The theory holds that if these needs are fulfilled individuals will be self-determined to engage in activities and to improve performance (Gagné & Deci, 2005). SDT comprises three broad dimensions of motivation: intrinsic, extrinsic and amotivation (Kouml & Seoğlu, 2013). Gagné and Deci (2005) explain the theory posits that in the most positive form, intrinsic, the self-regulation to engage is autonomous, people choose to act toward achieving the goal of the motivation. At the other extreme, amotivation, the self-regulation is absent. Between intrinsic and amotivation is the extrinsic dimension, where individuals engage with an activity, not fully autonomously but to achieve a goal. In other words, it is an exchange that is seen as valuable. Extrinsic motivation in SDT comprises of four sub-categories allowing for the degree of controlled regulation required. Starting from the most regulated version of extrinsic the four dimensions of regulation are external, introjected, identified, and integrated.

In a comprehensive review of over 30 years of development in SDT, including how it relates to education, Ryan and Deci (2019) report that while there have been many research projects in the realm of education, there is still a lack of intervention studies. The authors also point to the work to date assuring that “When the focus is on nurturing and supporting the teacher’s and learner’s autonomy, relatedness and competence, the desired outcomes will be produced. Schools would in that case be preferred environments for students—that is, places they want to be” (Ryan & Deci, 2019, p.139).

Amotivation is seen as the negative form of motivation, the next sections take a closer look at amotivation as a concept and its relevance to education.

2.3 Amotivation

In a case study looking at second-language learning in third level, Mohammadi (2014) draws a distinction between amotivation and demotivation. The difference, with reference to the literature, lies mainly in the concept that amotivation is a personal held belief within the person, while demotivation refers to external events that lead to diminished behavioural intentions.

2.3.1 Amotivation as a researchable phenomenon

Amotivation is identified as one of three main elements in the motivation spectrum of SDT (Deci & Ryan, 1985). The three: intrinsic, extrinsic and amotivation have been traditionally viewed as a continuum, moving from amotivation at the lowest end, through extrinsic and ultimately to intrinsic. The continuum has been seen as consisting of varying degrees of internalized regulation, defined as engaging in an activity to satisfy an internal desire. A desire which is absent in amotivation and is the defining driver in intrinsic motivation (Chemolli & Gagné, 2014). In a study involving 2,063 participants Chemolli and Gagné (2014) evaluated the concept of motivation as a continuum. The research investigated the concept through two established motivation scales: the Multidimensional Work Motivation Scale (MWMS) and the Academic Motivation Scale (AMS). Leveraging the Rasch model to test for a continuum structure they found no evidence that motivation is a single continuum. Findings of the research showed strong empirical support for the three SDT elements of motivation being multi-dimensional

rather than uni-dimensional, they are contiguous rather than continuous (Chemolli & Gagné, 2014). Rather than their finding being an issue, Chemolli and Gagné view this approach as offering a 'rich and useful conceptualization of motivation based on different internalization processes' (Chemolli & Gagné, 2014). These findings lead the way for the study of motivation under any or all the components that make up SDT as constructs, each with individual unique properties.

Subsequent research from (Litalien et al., 2017) sought to investigate support for the continuum using exploratory structural equation modeling, looking at both general and specific factors contained in the AMS. The study took the general factor as overall score on the AMS and the specific factor as looking at scores on the individual sub-scales, for example, amotivation. With 1,118 participants the results showed support for the concept of the continuum at the general factor level, but interesting to note, the general factor did not predict performance, where the specific factors, including amotivation, did. The researchers conclude that the results show the importance of considering specific motivation types in explanatory models.

Research undertaken by Leroy and Bressoux (2016) developed the idea of different forms of SDT motivation being adjacent constructs, each with different cognitive and behavioural effects. "for junior high school students, amotivation seems to play a more important role on subsequent mathematics achievement than any other motivation forms do" (Leroy & Bressoux, 2016, p.51).

1,082 first year junior-high students across 15 schools in the Grenoble region of France participated in Leroy and Bressoux's, schoolyear long, experiment. The experiment was looking at the relationship between the forms of SDT of motivation and academic performance. The study was interested in the trajectories of different forms of motivation over the period and their associated link to academic achievement in mathematics.

Leroy and Bressoux had three hypotheses; 1. Autonomous (intrinsic led) motivation would decrease over the year while controlled (extrinsic led) would increase. 2a. Initial status of motivation and rate of change over the schoolyear would be related to achievement. In more detail, initial autonomous will be associated with positive test outcomes, controlled

forms (extrinsic) and amotivation will be associated with negative test outcomes. The less the autonomous declines, the better the outcome, the more the other forms increase the poorer the outcomes. 2b. If amotivation increases across the year it will be most predictive of a negative outcome.

In their findings, overall, all forms of autonomous and controlled motivation decreased over the year while amotivation increased (Leroy & Bressoux, 2016). In relation to the findings linking motivation type to end of year performance, compared to prior achievement, amotivation is the only form which showed significant association (Leroy & Bressoux, 2016).

The results also showed some support to the contiguous constructs concept, where an increase in amotivation was not necessarily linked to a change in the other forms of motivation (Leroy & Bressoux, 2016).

The authors refer to the large amount of research to date in the academic arena looking at the forms of motivation, noting there is little looking directly at amotivation, “indeed, there is a great need to look into academic amotivation the link between amotivation and performance is still under explored” (. The authors conclude by calling for practical work to be undertaken investigating, in the mathematics arena, interventions that might catch amotivation early, identify the reasons for the onset of amotivation and ways to reduce it, “poor mathematics achievement seems to be predominantly a function of academic amotivation rather than a consequence of controlled forms of motivation” (Leroy & Bressoux, 2016, p.51).

Across the research reported in this section there are differing views on the extent of the continuum nature of SDT. However, across all reports there is support for the importance to consider the specific motivation types.

2.3.2 Student Amotivation underpinnings

“Student amotivation is both a difficult motivational deficit to address and one that is strongly associated with a wide range of important maladaptive outcomes” (Cheon & Reeve, 2015, p.109).

The three base psychological needs, associated with, and underpinning, the SDT of motivation are Autonomy, Competence and Relatedness. Fulfilling these three needs has been shown to be linked with psychological well-being, and to be consistent across cultures (Deci & Ryan, 2008). In Cheon and Reeve's (2015) work they report that if there is 'need frustration' fulfilling one of the basic needs, it results in amotivation. Need frustration in autonomy and/or competence leaves negative affects including anger and anxiety. An observation here would be that feelings like frustration and anxiety are strong emotions, point to amotivation as a strongly held set of negative beliefs, beyond just being a lack of motivation.

A study with 380 first year undergraduates looking at motivational predictors of Grade Point Average, College Match, and First-Year Retention showed the strongest relationship for Amotivation, greater than both Intrinsic and Extrinsic motivation (Norvilitis, Reid, & States, 2022).

2.3.3 Academic Amotivation as a multi-dimensional construct

"One of the most prominent academic problems plaguing today's teenage youth is a lack of motivation toward academic activities" (Legault et al., 2006).

Legault et al. (2006) looked at amotivation in the academic setting and sought to develop a taxonomy of the reasons that cause the onset of amotivation. In addition, they sought to investigate social influences that cause amotivation and academic consequences of the onset.

They hypothesized four distinct subcomponents of general amotivation for their taxonomy based on previous work on environmental amotivation. The four were negatively held, ability beliefs, effort beliefs, value placed on task, and characteristics of task. In relation to amotivation Legault et al. (2006) define these four further as follows. Ability beliefs relate to an internal belief that the task at hand cannot be achieved, failure is seen as the most likely outcome. Value placed on the task relates to the idea that the outcome is not relevant or integral to the individual's current or future situations. Finally, task characteristics relate to the structure of the academic endeavor. Effort beliefs focus on the individual's belief that they can neither, initiate or maintain the required effort to

achieve the task. If the task is seen as arduous, boring, or tedious the amotivation level will be high.

Legault et al. (2006) developed an instrument to measure each of the four subsets and to combine them to show overall general amotivation, their research showed significant support for these constructs in three separate studies comprising a combined sample of 1,441 mixed gender, high-school students in Canada.

Legault et al. (2006) predicted, and showed support for, the subsets in turn being statistically significantly linked to four negative academic outcomes. The four outcomes were, poor academic performance, low self-esteem, intention to drop-out and maladaptive behavior. The research showed poor academic performance was linked to both effort and ability beliefs. Low self-esteem was linked, significantly, with ability beliefs only. Maladaptive behavior was linked to value placed on task, effort commitment and characteristics of task. Finally, intention to drop out was linked to ability beliefs and value for the task, where value placed on task showed the stronger correlation (Legault et al. 2006).

Education does not take place in a vacuum: social interactions with teachers, peers, and influencers such as parents, all play a part in the motivational state of a student. To look at ways in which social support might alleviate amotivation the study looked at three aspects of social support; autonomy, competence, and interpersonal effects. The research showed modest to moderate correlations between all four subsets of amotivation and the three social supports.

The subsections of amotivation, the identification of related negative academic outcomes, and the link to social supports that underlie aspects of each, could provide a granular insight into intervention approaches that could be developed to alleviate aspects of amotivation and to an extent inform the basis for this research.

For Legault et al.'s (2006) research a self-report measure of intent toward the negative academic outcomes was developed. The measure leveraged previously validated tools and some custom elements capturing; grade-point average, weekly hours of study, frequency of late for class, frequency of skipped classes. In addition, using 7-point Likert

scales: rate of own perceived proficiency, four self-esteem related items, and three intention to drop out items, were evaluated.

The instrument developed to measure amotivation and its four subsets was the Academic Amotivation Inventory (AAI) a 16 item self-report questionnaire, which is discussed in the next section.

2.3.4 Academic Amotivation Inventory (AAI).

Legault et al.'s (2006) study saw the initial development of the AAI by motivational experts over three studies with a total of 1,441 participants. The AAI consists of 16 statements around reasons to not engage in academic endeavours. Participants rate themselves from 1 to 7 on a likert scale for each statement. An example statement from the AAI is “Because studying is not important to me”. Students rate themselves as follows: 1 = does not correspond at all, 4 = corresponds moderately, 7 = corresponds exactly. The scale consists of four subscales, of four statements each, measuring each of the four subcomponents discussed in the previous section.

In 2008 further research was undertaken to investigate the AAI's robustness across gender and grade through factorial structure for invariance with 3,417 high school students. The results showed support for the four-factor structure of the AAI as a satisfactory representation of amotivation for both genders and across Grades 8 to 12 (Green-Demers, Legault, Pelletier, & Pelletier, 2008).

The AAI has received support across education domains in research including: e-learning (Fryer, Nicholas Bovee, & Nakao, 2014); 1st year university students, goal setting, across disciplines (Fryer, Ginns, & Walker, 2014); Physical Education (PE) (Cheon & Reeve, 2015) and Language Studies (Lucas, Bernardo, & Rojo-Laurilla, 2016). A review of the literature on quantifying motivational deficits describes that the AAI ‘showed strong correlations with academic self-esteem, lack of academic interest, academic anxiety and indifference regarding academic achievement’ (Weiser & Garibaldi, 2015).

2.3.5 Areas of current research

In reviewing the recent literature on amotivation as it relates to the academic and the wider educational setting, three recurring themes emerge: modeling and correlation of amotivation, amotivation in physical education, and amotivation in second language learning. In addition, and as might be expected, amotivation receives significantly less attention than other forms of motivation. Moreover, there is very little evidence of direct intervention research to date on seeking to alleviate amotivation.

In a comparative study looking at links between academic amotivation and identity formation Cannard, Lannegrand-Willems, Safont-Mottay, and Zimmermann (2016), found evidence linking amotivation with ruminative exploration. The ruminative exploration cycle is self-focused, and “is a type of negative, chronic, and persistent self-attentiveness motivated by fear and perceived threats, losses, or injustices to the self” (Luyckx, Schwartz, Berzonsky, Soenens, Vansteenkiste, Smits, & Goossens, 2008, p.61). Cannard et al. (2016) proposed promoting proactive identity exploration, a sense of security and support for personal growth to counter ruminative exploration. The paper is indicative of others exploring the correlates and underlying models that influence amotivation including: gender (Shen, 2015); social support (Legault et al., 2006) and perceived psychological need support (Jackson-Kersey & Spray, 2016).

The transition from elementary school to middle school is identified as a critical transition where academic motivation is a prominent issue. A study involving 311 middle school students investigated the links between the subcomponents of Amotivation and Performance, looking at the role of Absenteeism as a mediator. A mediator variable can be full or partial and is met when it complies with four criteria:

- (a) the dependent variable is predicted by the independent variable
- (b) the mediator variable is predicted by the independent variable
- (c) the dependent variable is predicted by the mediator variable,
- (d) if a mediator variable is included in the model, the effect of the independent variable on the dependent variable is reduced. (İlter, 2023).

The hypotheses were that absenteeism would act as a mediator for the relationship between each of the four amotivation subcomponents and academic performance (İlter, 2023).

Pearson product–moment correlations were deployed to analyse correlations. Results for the Value, Ability and Effort subcomponents all showed a statistically significant direct negative relationships with academic performance and absenteeism. All three also showed a partial mediation effect for absenteeism. Of the three, the Ability subcomponent predicted highest negative performance ($\beta = -.30$, $p < .05$) and highest absenteeism ($\beta = .21$, $p < .05$) (İlter, 2023). The findings for the Task Characteristics subcomponent did not show a statistically significant relationship with academic performance but did with absenteeism.

İlter (2023) concludes on the importance of decreasing amotivation and absenteeism to improve outcomes for these middle school students in transition from elementary school.

In earlier research with 342 Middle school students İlter (2021) also found a statistically significant correlations between academic amotivation and each of the four subcomponents with academic achievement. In addition, academic amotivation as a significant predictor of academic achievement.

İlter's (2021, 2023) studies were both correlational, in his implications he states “To eliminate academic amotivation of students, there is a need for interventions to support their engagement and academic achievement that take into account their psychological needs, including ability beliefs, effort beliefs, and academic value beliefs” (2021, p.400).

PE is a domain that arises frequently in the literature on amotivation (Shen, Wingert, Li, Sun, & Rukavina, 2010), (Jackson-Kersey & Spray, 2016), (Moreno Murcia, Parra Rojas, & Gonzalez-Cutre Coll, 2008). Cheon and Reeve (2015) proposed the high level of interest in researching amotivation as it pertains to PE might be aligned to three aspects particular to the subject. First, a self-fulfilling aspect that there is a lot of previous research looking at amotivation in relation to PE. Second as PE is not mandatory for entrance to third level it is not considered as important and therefore has an amount of amotivation associated with it. Third, the more academic subjects are required to gain access to better, higher

education institutions. Therefore, they tend to attract less amotivation and are more supported by extrinsic motivation, the need to get good grades to progress.

Second language learning, mainly English as a foreign language, is also a focus for amotivation research. The research again focuses mainly on correlates and causes. In looking for explanations as to why there is a focus in this area, Burden (2015) holds that at third level the negative impact is led by poor experiences of language learning at second level. Lucas et al. (2016) looked at correlates in relation to surface-learning in class and real-world opportunities to use the second language outside the classroom.

2.3.6 Amotivation-focused intervention studies

The search for intervention studies, directly intervening with students, and focused on amotivation reduction yielded very few results.

In an intervention research project, Saravanan and Kingston (2014) sought to reduce psychological distress, increase intrinsic and extrinsic motivation and decrease amotivation using psychological interventions. The participants in the study were first year medical students.

The focus of the research was Test Anxiety which is considered to have several detrimental effects on graduate students. Effects include reduced motivation and the ability to negatively affect academic performance. As the name suggests test anxiety refers to extreme anxiety before and during a testing situation, but is not limited to formal examinations, it can also occur in relation to presentations or answering questions in front of others (Saravanan & Kingston, 2014).

The intervention consisted of a three-pronged psychological approach. The first intervention was psychoeducation for participants to understand the relationship between negative exam thoughts and potential psychosomatic symptoms. The second was Progressive muscle relaxation therapy (PMRT) to help participants relax, and the third was systematic desensitization.

Individually each of these had been shown to influence test anxiety. Saravanan and Kingston hypothesized that a one-to-one intervention using all three approaches,

consisting of five sessions over three weeks, could manage test anxiety, reduce amotivation and reduce psychological distress. The difference between and within groups of participants was shown to be significant across all dimensions of SDT; intrinsic and extrinsic motivation were improved and amotivation was reduced (Saravanan & Kingston, 2014). This held true for experimental versus control groups of participants, and for pre and post intervention scores within the experimental group. Saravanan and Kingston (2014) suggest that the intervention should be carried out early in the semester, and that managing test anxiety may also be associated with managing performance anxiety and provide benefits in areas such as problem-based learning, a learner-centered approach where students are asked to develop a solution to a given problem through research and integrating theory and practice (Savery, 2006).

Another study found did look at an intervention directly with students to reduce amotivation. The participants were 92 students from the hospitality industry. The research showed interesting results leveraging an intervention not far removed from nudging.

Terrier, Rech, Marfaing, and Fernandez (2018) investigated the potential of an 'action identification' intervention to reduce amotivation and improve performance. Action identification is how an individual describes an intended action and can consist of low or high identification. Low identification is concrete and descriptive where high identification is more abstract and around why an action might be carried out (Dar & Katz, 2005). The study was based on providing students with an option to sign a commitment to behave in a certain way during upcoming training. It is worth noting important components of such a commitment are that the commitment is made freely, and without threat or reinforcement (Terrier et al., 2018). These aspects are similar to concepts associated with nudges, which will be discussed later in this chapter.

In the study students were in one of three groups; no signed commitment, voluntary sign up to a low-commitment stating they will follow the rules and respect the teachers, and voluntary sign up to a high-commitment pledging to develop skills and complete their studies.

Results showed a significant, positive, difference in the reduction of amotivation for the two 'commitment' groups versus the 'no commitment' group' (Terrier et al., 2018). In comparing the 'low' and 'high' commitment subsets, while high-commitment showed a more positive effect than low commitment the difference was not significant (Terrier et al., 2018).

The performance measures included practical real-world behaviours including the ability to follow procedures and effective use of equipment. Performance was shown to improve across all three groups after training. The results showed a significant, positive, difference in the performance improvement for the two 'commitment' groups versus the 'no commitment' group (Terrier et al., 2018). An investigation into correlations showed amotivation as a significant predictor of performance, where reductions in amotivation lead to increases in performance (Terrier et al., 2018).

2.3.7 Motivation related intervention studies

Cheon and Reeve's (2015) research contained amotivation as one measure in an autonomous support intervention with teachers, not students. They identified six aspects of a controlling-style of teaching that can lead to student amotivation, the six were not taking students' views into account, shouting, asserting their power, intimidation, trying to change students' beliefs and behaviours, and enforcing compliance. Their work looked at an intervention that would embrace an 'autonomous-supportive' approach to teaching. As a measure of impact in autonomous support, it was decided to use engagement levels as they correlate strongly to level of motivation. Engagement has four identified pathways that are measurable, behavioural (involvement), emotional (interest), cognitive (learning strategy) and agentic (proactive) (Cheon & Reeve, 2015).

Based on a meta-analysis of autonomous support intervention studies by Su and Reeve (2011), Cheon and Reeve designed an autonomy-supportive intervention program (ASIPs). The ASIPs incorporated five validated autonomy-supportive instructional behaviors for teachers, and six design features for the intervention.

The five teacher behaviours were.

1. Vitalizing rather than neglecting students' inner motivational resource (e.g., using instructional strategies to involve a psychological need, to piqué curiosity, or to introduce an intrinsic goal)
2. Relying on informational rather than on controlling language (e.g., saying "you may" rather than "you have to"),
3. Providing rather than neglecting explanatory rationales for teacher requests and assignments,
4. Displaying patience rather than pressuring students to produce the right answer or a prescribed behavior, and
5. Acknowledging and accepting students' complaints and expressions of negative affect rather than trying to change it into something more acceptable to the teacher. (Cheon & Reeve, 2015).

The six design features of the teacher training intervention were.

1. The full range of the five autonomy-supportive instructional behaviors.
2. Multiple sessions (2 prior to semester and one during), rather than a one-off workshop.
3. Group discussion to identify concerns and share ideas.
4. Skill-based training to help teachers develop, their skill in autonomy-supportive instruction.
5. Addressed teachers' pre-held beliefs that might be contrary to the training (e.g., won't work with my students).
6. Research team visits during the semester to observe and to provide supplemental support. (Cheon & Reeve, 2015).

The domain for the study was second level schools PE in Korea. The study involved 16 teachers, randomly assigned, providing eight in the experimental group and eight in the control group. The final number of student participants was 292 experimental and 306 control. The intervention ran during the Korean spring semester, which is March to July.

During the intervention, raters highly trained in both SDT and PE instruction, rated the teachers. The experimental group was rated as highly autonomy supportive across all five

teacher behaviours. The teachers in the control group were rated as 'neutral', neither controlling or autonomy supportive. The students reported a similar experience with experimental group teachers identified as becoming more autonomy-supportive across the semester, while control group teachers remained identified as per their baseline style.

Students in experimental showed increases in need-satisfaction for the two SDT basic psychological needs of autonomy and competence. There was a statistically significant decrease in experimental students' amotivation across the four subcomponent measures of Ability, Value, Effort and Task Characteristic. The amotivation decreased more toward the end of the semester, indicating that the decrease was built on over time, as they experienced autonomous-supportive instruction. These students also showed increased classroom engagement. Across most measures the students in the control group stayed at a constant level (Cheon & Reeve, 2015).

The research looked at teaching interventions to improve autonomy support for students in PE; an approach that has been repeated several times showing successful results (Edmunds, Ntoumanis, & Duda, 2006) (Cheon, Reeve, & Moon, 2012) (D. J. Perlman, 2015).

With a lack of intervention studies directly focused on amotivation found, inspiration from the previous study and the literature search was expanded to autonomy support for this thesis. As reported in Section 2.2 autonomy is one of the three basic psychological needs underpinning SDT. A meta analyses of teacher led ASIPs identified just 16 cases from 206 initial search results fitting the three criteria: includes an intervention; set in an educational context, and evaluated the effect (Gustavsson, Jirwe, Aurell, Miller, & Rudman, 2016). Of the 16, ten were in PE and looked at measuring an increase in student academic motivation with nine showing positive outcomes (Gustavsson et al., 2016).

As discussed, to date there is very little evidence in the literature of adopting test/experimental research into possible interventions to alleviate amotivation directly with students. In widening the search criteria to motivation in general the results improve dramatically. Lazowski and Hulleman (2016) carried out a meta-analysis of 92 published intervention studies to try find an answer to the question, is there a link between

motivation and performance? The results overall showed that across the 38,377 participants covered in the studies there was a robust effect size of nearly half a standard deviation ($d = 0.49$). From the perspective of the intended research for this thesis it is interesting to note the word 'amotivation' does not feature once in this report (Lazowski & Hulleman, 2016).

2.4 Nudges

Nudging emerged in 2008 through Behavioural Economics. In a review of Thaler and Sunstein's book 'Nudge', Leonard (2008) explains nudging involves liberal paternalism where, instead of mandating choices, experts guide individuals to make better choices, as defined by the experts. The liberal aspect is through guiding people to make the right choice through the design of different ways in which choices can be presented, called the 'choice architecture' (Leonard, 2008). The benefit claims are that people are still free to make their own choices and considering that choice architectures must be provided anyway, why not provide the most beneficial ones?

2.4.1 The ethics of nudging.

While nudging has received much attention in relation to its effectiveness, concerns around the ethics associated with the approach has also been well reported. Schmidt and Engelen (2020) identify four areas of ethical concern related to nudges. The first is freedom of choice, relating to the choice being easily resistible. The second is volitional autonomy, the idea that the choice is truly the desired choice of the target. The third is rational agency, if a decision is made through nudges, is it truly the rational decision of the target. The fourth is absence of domination, the concept in this aspect is related to nudging being leveraged as a tool of control by others, including governments.

In reviewing the positive and negative aspects related to the ethical concerns around nudging Schmidt and Engelen (2020) conclude that the nudging should not be rejected outright, but ethics should be considered on a case-by-case basis.

Hausman and Welch (2010) question the approach in terms of how liberal the paternalism is. If some adjustment of the choice environment is used to cause uptake of a certain

desired behavior, is this the same as rationally laying out the reasons and asking the individuals to make an informed decision, “shaping people’s choices for their own benefit seems to us to be alarmingly intrusive” (Hausman and Welch, 2010, p.131). However, with some observations they conclude that in most cases liberal paternalism as defined by Thaler and Sunstein is “unobjectionable” (p.136).

In 2015 Sunstein defended the use of nudges as follows:

“Nudges and choice architecture are hardly new; they are built into the fabric of human society, even when they seem invisible. Default rules – found in families, in customs, in norms, in law – cannot be blinked away, and they can greatly influence ultimate outcomes. What is new is sustained attention to a series of policy tools that often have large effects while preserving both human agency and freedom of choice.” (Sunstein, 2015, p.528)

2.4.2 Nudging in Education

Nudging has received attention as a potential means to improve educational outcomes. Nudging in education is still a recent phenomenon. Mette Trier Damgaard and Helena Skyt Nielsen have produced two significant publications looking at this area. In 2017 they published a European Commission (EC) report on the topic (Damgaard & Nielsen, 2017). A follow up meta paper provides a valuable source to investigate many of the initiatives to date (Damgaard & Nielsen, 2018). The paper sought to identify the circumstances under which ‘nudging’ proves effective in education. The paper identified 122 studies on nudging interventions in the education area (Damgaard & Nielsen, 2018). Of particular interest to the authors are the conditions under which nudging proves effective; the how? when? and why? It is worth noting that while framed as nudges in the education arena, several of the projects researched were about making good choices around the broad education area, rather than impacting education outcomes. For example, some interventions were around selecting an appropriate college or finance and therefore not directly involved in the teaching and learning aspects of education. The two Damgaard and Nielsen publications, one which builds on the other, provide a rich vein to be explored in framing the nudges in education paradigm in what is an emerging area of research.

In looking at the behavioural barriers to education attainment Damgaard and Nielsen (2018) identify six individual areas for consideration: Self-control; Limited attention and cognitive ability; Loss aversion; Default bias linked to the previous three; Self and social image and social norms; and Biased beliefs. The author is struck by the similarity of these barriers to the previously mentioned four subsets of amotivation: effort beliefs, ability beliefs, value beliefs and task characteristics.

Damgaard and Nielsen (2018) identify five categories of nudge intervention and seek to identify if the form of intervention can be linked to the behavioural barriers. The five identified categories, with 12 sub-categories (see Fig. 2.2) , refer to: ‘non-educational’ incorporating defaults, framing and peer manipulations; ‘situation specific’ such as deadlines, goal setting and reminders; ‘educational’ including, information, assistance, and boost nudges to identify and help learners overcome behavioural barriers; ‘social and extrinsic’ nudges appeal to the desire for external reward recognition; ‘psychological’ nudges target mindset and belonging to help self-reinforce (Damgaard and Nielsen 2018). Damgaard and Nielsen (2018) point out that efficacy is more likely to be shown for “specific groups constrained by a behavioural barrier” (p.314). In this research project the specific group were first year undergraduate students, and the focus was on amotivation which links with aspects of the six behavioural barriers mentioned. The next sections look at the five identified categories in some more detail, to understand the affordances of each approach.

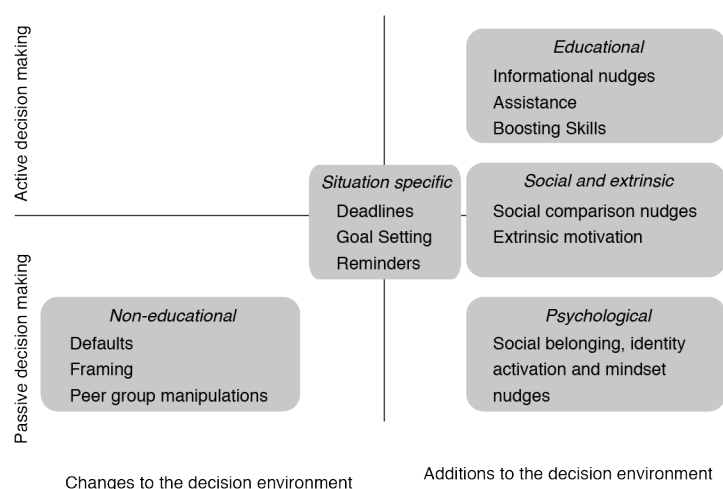


Fig. 2.2. Typology of nudging interventions considered in the review (Damgaard and Nielsen, 2018)

2.4.2.1 Non-educational Nudges

Three non-educational nudges are identified: Default, Framing, and Peer Group.

Default nudges involve manipulating a default value, for example opt-in or opt-out. Default was shown as effective across two studies to positively influence behaviour (Damgaard & Nielsen, 2018).

Framing nudges involve “small deliberate changes to the choice environment” (Damgaard & Nielsen, 2018, p.317). One example looked at either giving students a starting point of zero and telling them they can gain points for correct answers or giving them a number of points to start with and tell them they can lose points for wrong answers. The results were mixed; aspects related to finance for education showed the strongest results (Damgaard & Nielsen, 2018).

Peer group manipulations such as pairing high performing students with low performing students have not proved very effective. Poorest results were with pairings that were forced and not given specific instructions (Damgaard & Nielsen, 2018).

2.4.2.2 Situation specific nudges

Three situation specific nudges are covered: Deadlines, Goal setting and Reminders.

Deadlines involve introducing interim deadline nudges to improve grades or completion rates. The results showed reasonably positive for grades, however Damgaard and Nielsen (2018) point out the cases involved high stakes exams that already motivate students to study.

Goal Setting nudges are based on specific tasks or performance levels and should be self-set. The risk of others setting goals for an individual is that they may be too unachievable in the individual’s mind and therefore do not get buy-in. In looking at the research there are mixed results and no clear evidence of whether task or performance goals work better. What evidence there was indicated that goal setting seems to work better with low performing students who may be prone to procrastination (Damgaard & Nielsen, 2018).

Reminders, as the name suggests, provide nudges that bring to the fore tasks, deadlines, or benefits the individual may have been aware of but may have forgotten. Looking at the research in this area the results show evidence of short term gains, but not lasting effects when looking at engagement (Damgaard & Nielsen, 2018). The strongest evidence was in the area of college enrolment where students did benefit from reminder nudges in both choosing a college and seeking financial aid for same. Of note is that the effect was strongest with students from a lower socioeconomic status (SES) (Damgaard & Nielsen, 2018).

There have been reasonably consistent positive effects shown for reminders sent to parents rather than students. The projects were all focused on school age children from primary and secondary and involved literacy, homework, and absenteeism topics (Damgaard & Nielsen, 2018).

2.4.2.3 Educational nudges

The paper identifies three forms of educational nudges: Informational, Assistance and Boost.

Informational nudges look to assist attention deficits and behavioural aspects in one (Damgaard & Nielsen, 2018). In looking at beliefs, several studies have shown benefits where the intervention sought to provide feedback to narrow the gap between students perceived ability and their actual ability. One example looked at interventions on a Massive Open Online Course (MOOC). The nudge promoted the idea that students who choose to do the quizzes later perform worse than those who do them earlier. The impact was positive on both grades and course completion (Damgaard & Nielsen, 2018).

Assistance nudges seek to provide information where it may have been received but is no longer in their cognition. The idea is basically providing a form of one-to-one assistance, the papers covered were more to do with college applications and seeking financial assistance and the findings of effect were mixed (Damgaard & Nielsen, 2018).

Boost nudges seek to assist in the general area of skills required by students to succeed, and how to deal with barriers they may encounter. Unlike specific informational nudges,

boost seeks to address issues such as self-control. Topics covered in boost nudges have included: grit, goal setting, time management and motivation. All studies showed positive effects and, in some cases, a lasting effect up to a year over the control group (Damgaard & Nielsen, 2018). To be clear, unlike the aforementioned 'Goal setting nudges' the boost approach to goal setting is about teaching the general skill rather than setting specific goals.

The paper does mention one large-scale intervention that did not yield positive results for boost nudges. The case focused on goal setting with an additional goal of developing a growth mindset. It should be noted, in retrieving and reviewing to the original paper, Mora-Villalobos, Oreopoulos, and Petronijevic (2017) posit ideas why they did not find results. The reasons include the fact that in their study the participants were enrolled, they did not volunteer. In relation to the growth mindset aspect they put forward that the short duration of the intervention may have been a factor (Mora-Villalobos et al., 2017).

In contrast, the Damgaard and Nielsen (2018) paper refers to a large-scale boost nudge experiment with 720 first year business school undergraduates, again based on goal setting skills. Schippers, Scheepers, and Peterson (2015) ran a short intervention over the first seven weeks of the first semester. The intervention used three years data from previous students on the same course for comparison. The target was the entire student population with a focused interest on ethnicity and gender. The research showed positive results for performance and retention with all participants that also endured over time. In relation to the specific focus area, ethnic minority males earned 44% more credits, and the retention rate increased by 54%.

2.4.2.4 Social and Extrinsic Nudges

As the title suggests, the two nudge types in this category are: Social Comparison and Extrinsic Motivation.

Social Comparison nudges seek to improve performance by making students aware of how they are performing in relation to relevant others. Adherence to social norms and social pressure being the drivers. It is an approach that can have negative consequences when the approach seeks to use tools such as leader boards where performance is public

(Damgaard & Nielsen, 2018). Several research projects are referred to showing negative impact of such approaches, and in one case a 24% decrease in performance (Damgaard & Nielsen, 2018). Looking at studies involving relative feedback the results were mixed and in many cases short lived (Damgaard & Nielsen, 2018). If using relative feedback it was understood that allowing time between feedback and subsequent tests was important (Damgaard & Nielsen, 2018). One reported social comparison nudge that did show significant positive results. The research involved a prompt sent to applicants for the 'Teach for America' initiative. The applicants were told 84% of successful candidates had taken up the post. The results were significant and positive (Damgaard & Nielsen, 2018). It should be noted that in this case the target students' own performance was not being compared with others and may be a key to why the other approaches have not been as successful.

Extrinsic Motivation nudges seek to associate reward with performance improvement. The paper looks only at non-monetary rewards and found a diverse range of effects both positive and negative. The diversity may be linked to the concept that as with social comparison the reward is public and for the same reasons can have mixed effects. Where extrinsic nudges appear to work better is with primary children of a lesser academic ability (Damgaard & Nielsen, 2018).

2.4.2.5 Psychological Nudges

Under this category the nudges are grouped as Social-belonging, identity, and mindset nudges. In the first aspect of social-belonging most of the reported research is focused on third level students where the approach in general is that the students are not the first ones to walk this path, others have struggled before them and got on fine. In general, this approach has delivered positive effects (Damgaard & Nielsen, 2018).

In relation to identity nudges the target is identity activation, to promote being the best they can be, the results were mixed and seemed to work better where there may be stereo-typing issues such as female students in typically male dominated science and technology classes (Damgaard & Nielsen, 2018).

In relation to mindset nudges, as might be expected the positive results seem to depend on the characteristics of the individual to start with. For instance, while there is support for mindset nudges as an intervention, they work better if the student has a fixed mindset to start with (Damgaard and Nielsen 2018).

The paper concludes that while there is evidence for some effectiveness of nudges in education the need is for research looking at “the underlying behavioural mechanisms including what behavioural barriers are targeted and what the theory of change for a given intervention is” (Damgaard & Nielsen, 2018, p.339).

2.4.3 Intervention studies leveraging nudges.

A regional university in Australia carried out a series of three nudge interventions to improve engagement with the online resources available. The students were largely a mature cohort studying via online courses. The research was action based, the researchers were also teaching practitioners, and each intervention built on lessons learned from the previous (Brown, Lawrence, Basson, Axelsen, Redmond, Turner, Maloney & Galligan, 2023). The nudges were sent to students via the LMS in the first five weeks of the semester.

The first intervention showed significant increase in resource usage over data from the previous year where there had been no intervention. In qualitative feedback it was revealed that students felt there may have been too many nudges. This finding was echoed in the second iteration which involved eight courses ($n = 1176$), where the course receiving six nudges, the least number across the eight courses, showed the best improvement at 13.9% (Brown et al., 2023). In the third iteration fewer key resources were supported and an average of six nudges were sent per course, leading to an 18.7% increase in resource engagement one week after the nudge (Brown et al., 2023). Based on their findings Brown et al. (2023) suggest there is a ‘sweet spot’ in the number of nudges deployed on a course between being seen as supportive and becoming a ‘nag’.

Blumenstein, Liu, Richards, Leichtweis, and Stephens (2018) reported on four case studies into practical use of nudges to promote undergraduate engagement at universities in New Zealand and Australia. Engagement is a multi-faceted, complex meta-construct, distinct

from motivation. The four studies involved lecturers as the choice architects supported by technology. Two of the case studies feature an open-source Student Relationship Engagement System (www.sres.io).

The studies sought to support lecturers in their nudge strategies through learning analytics profiles of their students. Mostly, the nudge content was left to the discretion of the lecturers. The delivery mechanism across the studies was e-mail.

One of the case-studies, at Macquarie university, identified the cruciality of the wording used in the nudges. To improve the efficacy and reduce the effort required by the teacher they developed a themed nudge bank for staff (Blumenstein et al., 2018).

While none of the four case studies showed significant performance results linked to the interventions, they did quote positive qualitative results from lecturers and students and do provide an interesting insight to the types of data used to profile students (Blumenstein et al., 2018). Across the four studies, measures included; attendance, interim grades, online resource usage, posts to discussion forums, submissions (on-time), syllabus viewed, lecturers' view of student, and finally in one study a low stake early activity comprising quiz and participation activities (Blumenstein et al., 2018).

At Dublin City University, a research project looked at fully automating weekly support nudge emails to first year, first semester students. The content of the emails was personalised based on comparing the students' Virtual Learning Environment (VLE) activity with historical data and exam records, to act as a predictor of at-risk students (Corrigan, Smeaton, Glynn, & Smyth, 2015). The measures of VLE activity were, log in count, average time, weekend vs. weekday logins, and 'off' versus 'on' campus log-ins.

The results showed the participant students, from 10 modules, scored on average nearly 3% higher in end-of-module examinations, than those who did not participate. Corrigan et al. (2015) do point to a potential confounding aspect of this research when they say, "this opt-in method may have other issues, such as motivation differences, compared to a truly randomised group" (p.52). In other words, the profile of students who opt-in for such activities may be different than students who do not, and therefore they do not make an ideal comparison cohort.

In terms of looking at low-cost ways to implement a nudging experiment in the education sector, O'Connell and Lang (2018) used simple e-mail prompts to see if they could influence study time and potentially exam performance. The results of a three-week field experiment showed a significant .2 standard deviation increase in exam performance by the experimental group (O'Connell & Lang, 2018). The finding suggests that while there was no significant increase in study time that there was an increase in cognitive effort during study. Note that the reminders in this study simply relayed the average amount of study the class as a whole were doing. They were personalised only by adding the last time the student had logged in. In the study, the use of a platform that gave similar detail to a Learning Management System gave access to information about log-in/log-out times and page views which provided rich data for analyses allowing for such comparisons. The data included when students were studying, and how long after the nudge they logged in (O'Connell & Lang, 2018).

Castleman and Page (2015) investigated the potential for text messaging to deliver nudges to students over the summer prior to entering college. The goal was to see if they could improve college enrollment. The nudges were delivered on average one every five days, mainly in the form of reminders and links to relevant information. The research took place at three different sites in the US. The results were positive, however statistical significance was shown in the locations considered less well supported from availability of counselors and finance perspectives. At best the results showed a significant 7.1% increase in intention to enroll in college (Castleman & Page, 2015). In conclusion the authors point out that the mechanism at play is unclear and may be reducing complexity, increased awareness, increased parent awareness, reduced 'hassle', and/or reducing procrastination.

2.4.4 Intervention duration in nudging experiments.

Nudges are prompts to guide people to make the right choices, as defined by another person. They operate through both 'automatic systems' and 'reflective systems' (Thaler, Sunstein, & Balz, 2014). In reference to education Weijers, de Koning, and Paas (2021) refers to two types, Type 1 - automatic, where the nudge operates at the unconscious level, for example your attention being drawn to a loud noise. Type 2 – reflective, which

requires some conscious effort, for example considering two alternatives. Both types use automatic processes and are distinct from traditional instruction, but Type 2 seek to promote deliberate actions and choices (Weijers et al., 2021).

The articles and case studies reviewed in this thesis have indicated varying degrees of efficacy in relation to the deployment of intervention nudges. One of the major calls for further research is around the ability for nudges to provide long term effects. It is hypothesised that potentially changing habits in the long term for education is better through a scaffolding technique where the supports can be reduced over time until the habit takes hold (Weijers et al., 2021).

As mentioned, there is a limited amount of research in relation to educational intervention studies leveraging nudging techniques. In a meta-analysis of 212 studies investigating the effectiveness of nudges the category 'education' does not appear (Mertens, Herberz, Hahnel, & Brosch, 2022). Across the wider research available there are many different intervention durations reported. Aligned with the concerns above around long-term effects of single interventions and looking to wider nudging experiments, there is evidence of research projects using shorter periods, either individually or sequentially. Purohit, Barev, Schöbel, Janson, and Holzer (2023), deployed a two-week intervention with university graduate students to reduce both the instances of Instagram use and amount of time spent on Instagram. The first week was the baseline measurement and the second was the intervention, the results showed statistically significant reductions in both time on Instagram and instances of use.

Olson, Sandra, Chmoulevitch, Raz, and Veissière (2022) investigated the reduction of screen time with a population consisting mostly of students. The intervention consisted of taking a baseline measure and then, leveraging nudging techniques, participants were offered two options: a two-week intervention and a six-week intervention. Both options led to statistically significant reductions in screen time and there was an effect of up to six weeks post intervention (Olson et al., 2022).

A research project investigating healthy lunch choices deployed a two-week experimental phase where students used a pre-order lunch app. The control group used the app to

order lunch while the experimental group did the same but also received nudges based on United States Department of Agriculture recommendations. The results showed a statistically significant positive increase in the ordering of fruits, vegetables, and low-fat milk within the experimental group over the control group (Miller, Gupta, Kropp, Grogan, & Mathews, 2016).

These studies indicate that nudges tend to have impact with near immediate effect. Given the intended function of nudges this is probably not surprising, as the nudge is usually not something to be studied, rather to be experienced and as a result influence behaviour.

2.5 Nudge design

When designing a nudge intervention there are two routes to the same target. One is to promote the desired choice, for example 'vegetables are good for you'. The other is to play down the undesired behavior, for example 'too many sweets rot your teeth and are not healthy'. Research indicates that promoting the intended behaviour is the more effective way to motivate individuals toward a specific behaviour (Marchiori, Adriaanse, & De Ridder, 2017).

In the context of education, Blumenstein et al. (2018) recommend if nudges are to work in conjunction with, or be informed by learning analytics, tools need to be kept simple for teachers. In addition, they should keep in mind the importance of small data as opposed to aggregated large data, focusing in on the student in context.

The purpose of this thesis was to focus on nudges related to the amotivation beliefs. In looking to the literature there was very little aligned to the concept of nudges in relation to the field. Extending the research to academic motivation nudges in general, some work was uncovered. Nudges related to Keller's (2010) ARCS motivation model of instructional design, where the acronym relates to four motivational aspects of Attention, Relevance, Confidence and Satisfaction. Some studies used e-mail nudges to motivate in line with the four subsets of the ARCS model (Huett, Kalinowski, Moller, & Huett, 2008; C. Kim & Keller, 2008; C. M. Kim & Keller, 2011). Other investigations used mixes of greeting cards and letters (J. Visser & Keller, 1990; L. Visser, Plomp, Amirault, & Kuiper, 2002). Common

across most of the research was the targeting of each component of ARCS with different nudge strategies to approach, Attention, Relevance, Confidence and Satisfaction.

Keller and Suzuki (2004), describe Confidence as “confidence... is accomplished by helping students establish positive expectancies for success and to then experience success under conditions where they attribute their successes to their own abilities” (p.231). They go on to describe Relevance as follows, “relevance results from connecting the content of instruction to the learners’ future job or academic requirements or to intrinsically interesting topics” (p.231). From these definitions Relevance and Confidence show alignment to the amotivation beliefs of Ability and Value respectively and provide some insight as to how nudges could be constructed.

As the common phrase goes, people tend to have ‘confidence in their ability’. Design strategies aligned to confidence relate to improving a student’s belief in positive expectations of success. The goal being clearly signposted step by step and portrayed as achievable though their effort (Keller, 2010). Again van der Meij et al. (2015) point to the link “Learning is at risk when students exert little effort because they lack confidence in their ability to complete inquiry activities successfully” (p.382).

Value is focused on the utility of an activity to the individual, like ARCS’ Relevance. Design strategies associated with Relevance include relating the area of study to a student’s goals both near term and in the future, also looking to identify can the area of study be linked to the student’s interests and past experiences (Keller, 2010). van der Meij, van der Meij, and Harmsen (2015) in their research on animated pedagogical agents to promote student engagement also draw alignment to the two concepts,

“Task values have to do with incentives or reasons for task engagement. A commonly used term for the concept that refers to these values is task relevance, which can be defined as a person’s valuation, interest, and commitment to achieving a particular goal”(van der Meij et al., 2015, p.385).

2.6 Summary

Initially this chapter looked at SDT, a broadly accepted global theory of motivation. Ryan and Deci (2019), the originators of the theory, identified that there is a need for more SDT intervention studies in the realm of education. The call was reinforced by Leroy and Bressoux (2016) in relation to amotivation and the link to academic performance.

To investigate amotivation it is important to understand if that is feasible given the traditional SDT view of amotivation being an element of the SDT spectrum. Several studies have shown support for the concept of the main three elements being contiguous rather than continuous, including research specifically focused on performance (Chemolli & Gagné, 2014; Leroy & Bressoux, 2016; Litalien et al., 2017).

This thesis is focused on investigating supports for first level undergraduates, in both improving their amotivational beliefs and the associated negative academic behaviours. Research has shown evidence that amotivation contains four sub-categories: value, effort, ability, and task characteristics, each linked to one or more negative academic outcomes comprising performance, maladaptive behaviour, intention to drop out, and self-esteem (Legault et al., 2006). In addition the validated AAI scale of academic amotivation provides a self-report measure at both the general and four sub component levels (Green-Demers et al., 2008). This AAI provides the tools to investigate both the profile of students and measures of any effect from an intervention.

Looking to intervention studies in relation to academic motivation, as reported earlier in this section there is a dearth. A meta study of 92 motivation studies relating to motivation and performance did not feature the word 'amotivation' (Lazowski & Hulleman, 2016). There are amotivation studies on correlation, and many focus on the domains of physical education, and second language learning.

Cheon and Reeve (2015) did conduct research on reducing student amotivation, with successful significant results where the intervention was focused on teacher training, and was repeated successfully several times. Saravanan and Kingston (2014) also show support for amotivation interventions related to test anxiety using a three-pronged psychological approach. Terrier et al. (2018) found significant positive results in research

focused on training in the hospitality industry. The intervention was based on a voluntary commitment, which is akin to nudges in that they consist of a choice being made as opposed to mandated. The research was also related to performance as an indicator of progression. While none of the intervention studies found are close to the research focus here, it is encouraging to find some successful research in the space, and they provide signposts to a potential intervention design.

In early discussions with colleagues, nudges were identified as a potential intervention technique that might suit this research.

In looking at the philosophy behind nudging it aligns well with the concept of autonomy and motivation. Nudging impacts the choice architecture, influencing those experiencing the choice architecture to make the right choice, rather than mandating behaviour change. Nudging has been deployed in many realms including education.

Damgaard and Nielsen (2017, 2018) provide strong insight into the use cases and types of nudges that have been leveraged in education. In looking to the types of nudges used in the education realm Boost nudges, a subset of Education nudges, align well with the ambitions of this research along with possibly elements of psychological nudges.

Looking to educational research leveraging nudge interventions, mixed results are shown. However, several important lessons are learned from the examples found. Blumenstein et al. (2018) leveraged the VLE to provide insights into student real-world behaviours and identified the importance of the design of the nudge nudges. The research also highlighted the need to be aware of lecturer time available, addressed by providing a nudge bank of crafted nudges. Corrigan et al. (2015), O'Connell and Lang (2018), and Schippers et al. (2015) also profiled students via VLE indicators and used past student results as a predictor of current students' performance.

As mentioned in the section 2.5, nudge design was seen as important, in this research there is interest in understanding amotivation at the sub-component level, to this end the structure and nature of the nudges is critical. If the nudges do not align to the target they cannot succeed. The research on motivation messaging revealed good alignment between

the work of J. M. Keller (2010), based on his ARCS model which in turn provides direction and rigor to designing nudges.

From a practical perspective it needs to be understood what duration of intervention is required for a nudging intervention. The research shows the nature of nudges contain a level of automatic processing and therefore interventions of a shorter nature are not seen as prohibitive with some interventions indicating a two-week period as appropriate (Miller et al., 2016; Olson et al., 2022; Purohit et al., 2023).

The literature review has provided valuable insights to all aspects of this project. There is research evidence to support all the components required to carry out this project.

However, there is no evidence of research directly linked to an investigation into the development of a model for a personalised 'nudging' approach to alleviate amotivation in undergraduate students.

Chapter 3 Methodology

3.1 Introduction

This chapter describes how an investigation of research methodologies options led to the selection of a post-positivist philosophy being adopted for this research. A Design-Based Research (DBR)¹ approach aligned well with the goals and objectives. DBR is iterative by nature, through three rounds of design the project sought to iteratively investigate the potential of an implementation framework to support students. Chapters 5, 6, and 7, are each dedicated to one of the experiments. The Participant Sampling, Data Collection, and Analysis for each will be covered in detail in the relevant chapters. However, at a methodology level, each will be discussed in this chapter. This chapter also briefly recaps the motivation for the research, provides insight into the Philosophy and Design choices, considering alternatives. Finally, the chapter looks at the limitations of the research, and actions taken to minimise their effect, including a pilot study, and dealing with research bias.

3.2 Amotivation

The focus of this research was to understand the students' amotivation based on their self-reports and behaviour profiles. To investigate the design of a model to provide targeted support through text nudges delivered via mobile phone and linked to their needs. The goal was to see if these processes might have some impact in reducing the students' academic amotivation.

Amotivation is the negative form of motivation and comprises four negatively held personal beliefs around; Value of the subject, Ability to participate, Effort commitment and the boring nature of the Task Characteristics (Legault et al., 2006). Within the scope of this project, the research focused on two of these, Value and Ability. These two are

¹ DBR blends empirical educational research with the theory-driven design of learning environments(C. Hoadley et al., 2002)

chosen due to the distinct nature of each from the other; the value a student places on a task and their belief around their ability to undertake a task.

In relation to the other two beliefs. Effort could be seen as quite closely aligned to Ability. To fulfil Task Characteristics would require significantly more input from lecturers to influence change in this area which was seen as beyond the reach of this project but valuable for future research.

3.3 Research Philosophy

In this research the baseline questions to be investigated were around the degree to which a theory-led intervention might influence the amotivation level of amotivated students. An analogy to this might be research into a new medicine's efficaciousness based on scientific study. While aspects like delivery method (tablet, injection, solution etc.) may be important and relevant, the first step would be to analyse the effectiveness. This is the same, and within the confines of this project, the investigation of the efficacy of the intervention on amotivation levels was paramount with further research open to adaptations to align with student and lecturer needs and preferences around delivery.

As mentioned, this project adopted a post-positivist approach, alternatives were considered and rejected as outlined in the following paragraphs.

Constructivism at its heart seeks to evolve truth through interaction between the researcher and participants. This approach, by its nature, includes qualitative aspects (Guba & Lincoln, 1994), and was not aligned with the ambitions of this interventionist research project.

Pragmatism could appear as an appropriate philosophy as the interest for pragmatist researchers is in the what and how (Creswell & Creswell, 2018). However, pragmatism tends, in the main, to be a mixed-methods approach to better understand the problem at hand (Creswell & Creswell, 2018), which is not the philosophy of this research.

A **positivist** philosophy is one where there is an assumed world truth, and the function of the researcher is to remove themselves from the scenario and seek to uncover the way

things are in a reductionist and deterministic fashion (Guba & Lincoln, 1994). This is not appropriate as this investigation seeks to take individual context and state into account.

Under further review, **post-positivism** emerges as a philosophy that aligns well with the approach and ambitions of this research. Creswell and Creswell (2018) give an overview of the approach as one that, as the name suggests, comes after the positivist view of empirical knowledge. It accepts that there is room for doubt when dealing with humans but still retains a deterministic view seeking to understand aspects of cause and effect. As such, post-positivist approaches tend to leverage designs such as experiments to test hypotheses using objective measures of real life.

3.3.2 Post-positivist Quantitative approach

In relation to educational research, there emerge some alternative views where the use of mixed-methods is seen as the preferred approach under post-positivism (Panhwar, Ansari, & Shah Asif Ali, 2017; Ryan, 2006). However even here, Panhwar et al. (2017) refer to the dominance of quantitative over qualitative in post-positivist studies to support validity, and objectivity of findings.

Phillips and Burbules (2000) refer to the many tools available to researchers adopting a post-positivist approach with rigour, and therefore improving the outcome more 'likely' to be true when they state, "seeking appropriate and adequate warrants for conclusions, on hewing to standards of truth and falsity that subject hypotheses (of whatever type) to test and thus potential disconfirmation, and on being open-minded about criticism" (Phillips & Burbules, 2000, pp.86-87).

It is on this basis that quantitative post-positivism was identified as the right choice for this research. The hypotheses have been arrived at through the researcher's previous studies and the literature review. The objective of this research was to see if there was an impact, in the real world. Or not!

3.4 Research Design

The research adopted an intervention to assess its effectiveness. In this light an 'experimentation' design might have been seen as appropriate. However, the ambitions

of this research required; close involvement and contribution from lecturers, the results accepted as being specific to the cases in hand and not global, openness to direction from interim findings to inform future iterations, and a willingness to accept the intervention's alignment with theory is not a given but there to be tested. These are not typical components of experimentation (C. M. Hoadley, 2004), therefore an alternative design approach was sought.

Design experiments were developed to carry out formative research to test and refine educational designs based on principles derived from prior research. More recently the term 'design based research' has been applied to this kind of work (Collins, Joseph, & Bielaczyc, 2004). Within the post-positivist philosophy, this research sought to test hypotheses around a model derived from motivation/amotivation theory. Within amotivation there are levels of efficacy to be looked at in the research. To do this effectively the research takes steps through these aspects building on what is learned from the previous. For example, first, to what extent can the intervention influence amotivation? If so, can the intervention influence the subcomponents of amotivation? This step-by-step, iteration approach aligns well with the characteristics of **Design Based Research** (DBR) referred to by Collins et al. (2004) as "progressive refinement" (p.18). DBR was "developed as a way to carry out formative research to test and refine educational designs based on principles derived from prior research" (Collins et al., 2004, p.15). The formative process of not seeing an experiment as a final step, rather a step to be taken, learned from, and built on.

DBR also aligned well with this research as DBR has been focused on the field of education from its inception in the early nineties by Brown and Collins (Collins et al., 2004).

Looking back to Brown's original seminal work, the alignment is strengthened by two quotes "Another critical tension in our goals is that between contributing to a theory of learning, a theoretical aim that has always been a keystone of our work, and contributing to practice" and "intervention should be able to migrate from our experimental classroom to average classrooms operated by and for average students and teachers" (Brown, 1992, p.143).

These two conditions apply directly to this research as outlined in the introduction to this section.

An iterative based approach can imply that such projects need to be long term, however DBR has been shown as a suitable model for shorter term projects such as PhD dissertations, so long as the cyclical approach is adhered to (Pool & Laubscher, 2016). Having defined the philosophy and design approach, the next sections look at the approach to participants and sampling for this DBR approach.

3.5 Participant Sampling

This section looks at the methodologies adopted to identify and access the participant population, and how the participants were stratified for the interventions. As mentioned previously, more detailed descriptions of Samples and Data treatments are provided in the individual chapters on the experiments, however, in this and subsequent sections of this chapter an overview and justification of the approaches are provided.

3.5.1 The population

This research looked at the impact of academic amotivation on first year undergraduate students, in this case specifically looking at the Irish context. The Higher Education Authority reported the total size of this population at just less than 46,200 for the academic year 2020/21 (O'Shea, 2021).

3.5.2 Sampling Design and Stratification

Single stage sampling is when data is available for the entire population of interest and can be definitively random sampled. The alternative to this is cluster sampling (Creswell & Creswell, 2018). A cluster sampling approach was required due to the many elements blocking a true random sample, including data access, institution collaboration, ethics, and others.

The researcher found that, certainly in Ireland, there is quite a demand for first year students and other years to participate in various research projects from business,

education, psychology, and other faculties. This limited the availability of potential participant classes.

There was a need in this research for the lecturer to be a contributory partner to the research, assisting with the development of the support nudges and in certain cases accessing data for the researcher from the VLE. This was another factor that proved challenging in terms of gaining support for participation.

In the end, and across the various experiments, the sampling, by necessity, became one of convenience. Engaging with lecturers from various colleges to identify potential partners and on agreement seeking ethics approval from that institution.

As mentioned, details on each experiment will be covered in the relevant chapters however the sample sizes had to be determined by the number that were a) accessible at each stage and b) completed the post surveys. In situations where it is hard if not impossible to influence the number of participants it can be advisable to look to 'rules of thumb' (Wilson Van Voorhis & Morgan, 2007). Leveraging this approach Wilson Van Voorhis and Morgan (2007) point out, a) when measuring group differences a cell size of 30 should lead to about 80% power, and cell size should be no lower than 7, b) when looking to examine relationships and correlations they suggest a minimum of 50 participants and cite Green's (1991) formula; $N=50 + 8m$ where 'm' refers to the number of independent variables being analysed. In this research there is one independent variable, but with two dimensions, the 'ability' and the 'value' nudges, again this will be elaborated on in each of the experiment chapters.

Based on the above the minimum participants would emerge as 66. In Brief, the following participants were recruited for this project. The following completed both the pre and posttests; Experiment One recruited 34 participants, Experiment Two recruited 54 participants, and Experiment Three recruited 117 participants. Note as a design issue, in each trial a substantially higher number took the pre survey but did not complete the post survey. For example, in the second experiment 89 completed the pre survey but only 54 completed the second, a 45 fall off from the number who committed at the start. While

the pilot test was below the parameters set out above, the second was close and the third was well above those required for the power structures above.

Stratification in this research for participants in Experiments One, Two and Three involved analyses of the results from the pre survey, and prior to sending out nudges. The stratification looked first to identify those who registered in either the higher or lower half of the amotivation scale. Those in the lower half, deemed not to be amotivated, were not excluded but were treated as 'control' participants. Of the amotivated students, in Experiments Two and Three they were again stratified into either the 'value' or 'ability' group based on the higher score they reported in the relevant subscales.

3.6 Data Collection Methods

The general data collection approach across all experiments was to leverage pre and post data from the participants via a Qualtrics survey that took on average seven minutes to complete. In terms of personal information, the survey captured students' college email as an identifier, and mobile phone number to send the nudges to during the experiment. The two main areas of interest captured in the survey were the participants' self-report views on negative academic behaviours associated with amotivation state, and measurement of their current academic amotivation state at both the general and subcomponent levels of Ability and Value. The survey was sent via a link to students when they signed up to participate and again after the intervention.

For the third experiment only, certain data was collected on students' activities on the Virtual Learning Environment (VLE) and other college systems and was retrieved by the students' lecturers. This activity was designed and approved by the School of Computer Science and Statistics TCD (SCSS) ethics committee and agreed to by the students. This data looked at pre and post performances in continuous assessment exams and attendance. The purpose of this data was to look for correlations to the self-report behaviours. To gather this data the researcher supplied the relevant lecturer with a list of the students' college e-mails (used as the initial identifier), the lecturer then compiled the relevant data and returned it to the researcher. This approach was chosen to avoid the need for the researcher to gain access to the college systems.

On compilation of all data the participants' emails and phone numbers were removed, and the participants allocated a participant identifying code thus meaning all participants were anonymised from this point.

3.6.1 Data sets

Each participant supplied the data below twice, once prior to the experiment and once after to facilitate the longitudinal nature of this research.

1. **Participant identifier.** Participants supplied their college e-mail address to facilitate retrieval of VLE data as detailed in point 5 below, and to provide a link to match pre and post data.
2. **Participant Mobile Phone number.** The experiment delivered the nudge nudges via text. To facilitate this each participant supplied their mobile phone number.
3. **Self-report views on negative behaviours associated with amotivation state.** The participants self-reported how they currently feel around the predicted behaviours associated with amotivation and linked to negative ability and value beliefs. This data was captured through a Likert question tool based on Legault et al.'s (2006) research on amotivation sub components. The questionnaire provides self-reports around course; performance, self-esteem, problem behaviours and intention to drop out (see Appendix A). The data were used to compare self-report behaviours with amotivation state.
4. **Measurement of their current academic amotivation state.** Participants' amotivation state was be measured leveraging the Legault et al. (2006) 16 item Academic Amotivation Inventory (AAI) (see appendix B). This Likert scale inventory assesses current academic amotivation levels and provides four subscales around the negative belief components of amotivation: ability, value, effort, and task characteristics.
5. **VLE activity, test scores, test attempts.** In Experiment Three only. Identifiers of participants' behaviour was provided by the participants' lecturers from the VLE. This approach was adopted to remove the need for the researcher to obtain access to the VLE.

3.7 Data Analysis

As discussed in Chapter 1 and supported in Chapter 2, academic amotivation is a debilitating academic condition with potential negative outcomes for students and others. The purpose of this research was to investigate a model and implementation framework to reduce amotivation in a targeted fashion. To try have an impact at the general amotivation level, and also specific subcomponents related to negative beliefs around ability and value. The analysis leveraged the pre and post data described in section 3.6. The data was analysed to investigate if the intervention had an impact on the participants' general amotivation, the subcomponent levels of ability, and value, and behaviour. The research was comparing two related samples of data, pre and post, a 'within subjects' design. The self-report data was mainly from Likert scales, therefore ranked, and non-parametric. Across the experiments some of the groups being analysed were small. Given all these conditions a Wilcoxon signed-rank test which allows researchers to analyse changes in ordinal data from repeated measures was used to investigate significance of change. The Wilcoxon is often referred to as the non-parametric t-test. The Wilcoxon test also carries fewer assumptions around data distribution, providing an alternative where data is not normally distributed (Gray, Colin & Kinnear, Paul, 2012). The analysis also looked for correlations between these aspects and was carried out through the IBM SPSS statistical software programme. Others that arose over the course of the analyses, including self-reports of behaviour, were investigated as ad-hoc results and the statistical approaches are discussed in the relevant chapters.

As a DBR project the analysis built from one experiment to the next across the three rounds of design experiments. The analysis for each experiment is detailed and elaborated on in the experiment Chapters 5, 6 and 7.

3.7.1 Reliability and Validity

In terms of validity, good research practice seeks to ensure the instrument measures what is intended to be measured, while reliability looks at the ability for the instrument to measure the same concept repeatedly assuming nothing else has changed (Creswell &

Creswell, 2018; Heale & Twycross, 2015). In dealing with these two concepts this research leveraged instruments that have been previously deployed in the investigation of Academic Amotivation and were therefore validated with comparable groups.

In relation to amotivation the instrument used was the Academic Amotivation Inventory (AAI), as detailed in the Chapter 2, the AAI is a well-established and accepted measurement of academic amotivation that has shown robustness across many different forms of education research. The 'Academic Consequences' instrument for gathering self-report on negative behaviours was taken from Legault et al.'s (2006) research into academic motivation with 741 students. Permission was sought and received to use the instrument in this research from the lead researcher, Lisa Legault (see Appendix C). The instrument leverages other well established instruments including the Rosenberg Self-Esteem Scale and the work of Vallerand and colleagues looking at Academic Motivation (Legault et al., 2006)

3.8 Participants

Specific detail on participants in each experiment will be detailed in Chapters 5, 6, and 7. As referred to in section 3.5.2 above, the sampling was convenience based and had its own difficulties. The students were all third level full time students.

In the first trial there was a combination of undergraduate and post graduate students in a private college in Dublin. 63 participants agreed to participate in the study and received the nudge nudges, 34 completed the second survey which provided the working sample. 11 of the 34 were in the amotivated category.

The second trial participants were from a single first year class of engineering students in a computer science module at a public college in Dublin. 89 participants agreed to participate in the study and received the nudge nudges, 54 completed the second survey which provided the working sample. 17 of the 54 were in the amotivated category.

The third trial participants were two first year classes in computer science modules at a public college in Dublin. 185 participants agreed to participate in the study and received

the nudge nudges, 117 completed the second survey which provided the working sample. 39 of the 117 were in the amotivated category.

All participants were over 18 years of age.

3.9 Pre-Pilot Study

A short pre-pilot study was deployed with work colleagues, knowledgeable in research. The pilot was to test the instruments and identify any technical or data issues with the design. Some minor flow and logic issues were identified and amended prior to first deployment.

3.10 Researcher Bias

The researcher on this thesis has undertaken previous work looking at motivation in relation to its impact on modality effect where evidence showed amotivation as a more sensitive indicator of motivation than intrinsic or extrinsic motivation (Gillis, 2013). This work may bias the researcher's view of the data. However, the quantitative nature of this research and the leveraging of validated instruments are seen as going a long way to overriding this concern.

3.11 Research Problems Issues

1. The research was focused on student academic amotivation, but of course not all students are amotivated. It could not be predicted what effect, if any, the intervention would have on such students, but they were seen as acting as a valuable control group for the amotivated students.
2. Aligned to the previous point, the second and third experiments leveraged students from Ireland's leading university who were participating in focused courses in engineering and computer science. It might be expected there would not be much amotivation in these cohorts. To compensate for this, and in discussion with the participating lecturers, modules were chosen that might not be seen as the most favourable for the students. For example, the computer programming module was for engineering students who might have felt this

module did not align as well as others in their programme with their future employment intentions.

3. This research was quantitative. Typically DBR is associated with a mixed methods approach to data collection and analysis (Anderson & Shattuck, 2012) however the pragmatic nature of DBR also allows for the discretionary use of either depending on the research question(s) in hand (Alghamdi, 2013).
4. In their review of 47 highly cited articles over ten years Anderson and Shattuck (2012) report that there is strong evidence that DBR interventions have positive outcomes and while scalability has been a challenge it is emerging as a best practice method in educational settings. The use of technical tools in this research are seen as providing potential for scale in future work.
5. Participants signed up and participated via a launch session with the class, where the information sheet was explained to them. This led to good participation rates. However, to be considered in the research participants needed to complete the post-survey. As mentioned in section 3.4.2 there was significant drop off in final numbers for analysis.

3.12 Summary

The objectives and nature of this study were clear in the author's mind. In aligning these to the research, a post-positivist philosophy, with quantitative student pre and post self-report measures, leveraging a strategy of DBR emerged as a strong fit. In Chapter 4 the methodological decisions from this chapter will be synthesised with the insights from Chapter 2 to define the conceptual framework for the thesis. The conceptual framework will describe the design of both a hypothetical model which acts as a guiding light, and an implementation framework to support the practical investigations across three experiments.

Chapter 4 - Conceptual Framework

4.1 Introduction

In this chapter, the theories and concepts discussed in Chapter 2 are brought together to provide a conceptual framework under which the DBR approach detailed in Chapter 3 will operate. A conceptual framework is an important way to align all elements of the research, from the researcher's own views, through to the literature review and methodology "to create a compelling argument for why the topic of the study is significant, and the means proposed to study it are appropriate and rigorous" (Antonenko, 2015, p.55).

In pursuit of developing the conceptual framework, this chapter looks at the issues around student academic motivation. From here, it investigates academic amotivation, its sub-components and associated outcome behaviours. The next section identifies a way to measure amotivation and its sub-components to support a pre and post approach to experiments, and a way to evaluate any motivational impact. If there is an impact, it would be expected that it could also lead to a behaviour change, so the next section examines ways to measure any impact on behaviour, both self-reported and real-world observed. Having discussed the measurement aspects, the chapter then looks at the intervention possibilities, and how nudges emerge as a suitable approach. In identifying nudges as a suitable strategy, the chapter looks at the benefits of such an approach including effectiveness, time to efficacy, and method of delivery. As the intervention was intended to work at the module level, the next section looks at the design strategy for the nudges, leveraging motivation theory, and the development of a nudges toolkit for lecturers. Finally the chapter closes with a description of the completed conceptual framework comprising of both an intervention model and implementation framework.

4.2 Student Academic Motivation Challenges

Chapter 1 introduced existing research which has shown the significant challenges of poor academic motivation in undergraduate students (Baik et al., 2015; Gibney et al., 2011).

Ultimately undergraduate amotivation can lead to undergraduate dropout which has been shown to have the negative effects across;

- the student - from a psychological perspective,
- the institution - from revenue and reputation perspectives,
- society - from a labour supply point of view (Sarraf, Fontanella, & Di Zio, 2019; Sosu & Pheunpha, 2019; Ulriksen, Madsen, & Holmegaard, 2010).

In Chapter 1, an Irish research paper showed 29% of undergraduate students reported academic motivational challenges (Gibney, Moore, Murphy, and O'Sullivan, 2011). On this basis it was to be expected that most students who participated in this research might not be affected by academic amotivation. This was seen as a double-edged sword; from a positive perspective it would provide a readymade control group for comparison. From a negative perspective, it would make it more challenging to obtain a workable sample showing academic amotivation.

4.3 Dimensions of Academic Motivation

Deci and Ryan's SDT is one of the major theories of motivation frequently applied, with success, to academic endeavours (Reeve, 2002). It contains three main motivation dimensions. The first two, extrinsic and intrinsic are well reported in the literature. Extrinsic is reported as engaging with learning driven by what it can deliver to the participant. What reward it can bring, including grades, praise, recognition and others. Intrinsic is seen as engaging with learning for its own sake, out of interest for the topic (Deci, Vallerand, Pelletier, & Ryan, 1991). However, the third dimension, amotivation is the negative form of motivation, it is the motivational lack and is where the motivational problems lie. To date, amotivation has not been researched as much as the other two in relation to learning (Leroy & Bressoux, 2016).

4.4 An amotivation approach to Academic Motivation

Taking an innovation perspective, this thesis investigated a 'problem-first' approach to tackle academic motivation. To investigate the possibility of removing the barriers to

motivation, namely amotivation, rather than try raise the levels of extrinsic or intrinsic motivation.

To look at the issue through an amotivation lens means it should be researchable as an independent entity, rather than one extreme of an academic motivation spectrum including extrinsic and intrinsic. In Chapter 2 several studies showed support for the concept of the three as being contiguous, with amotivation as the most distinct of the three (Chemolli & Gagné, 2014; Leroy & Bressoux, 2016; Litalien et al., 2017).

In addition to being a distinct aspect of motivation toward academic endeavours, Legault, Green-Demers, and Pelletier's (2006) research identified four sub-components of academic amotivation linked to four negative outcomes. The four sub-components were negatively held beliefs around; the ability to undertake the task, committing the effort required, the value placed on the outcome, and the task characteristics perceived as unappealing. The research indicated that each of the four beliefs were correlated to one or more negative academic outcomes around; poor academic performance, low self-esteem, intention to drop-out and maladaptive behaviour. Statistically significant links were shown between the amotivation beliefs and negative academic outcomes as shown in Fig.4.1.

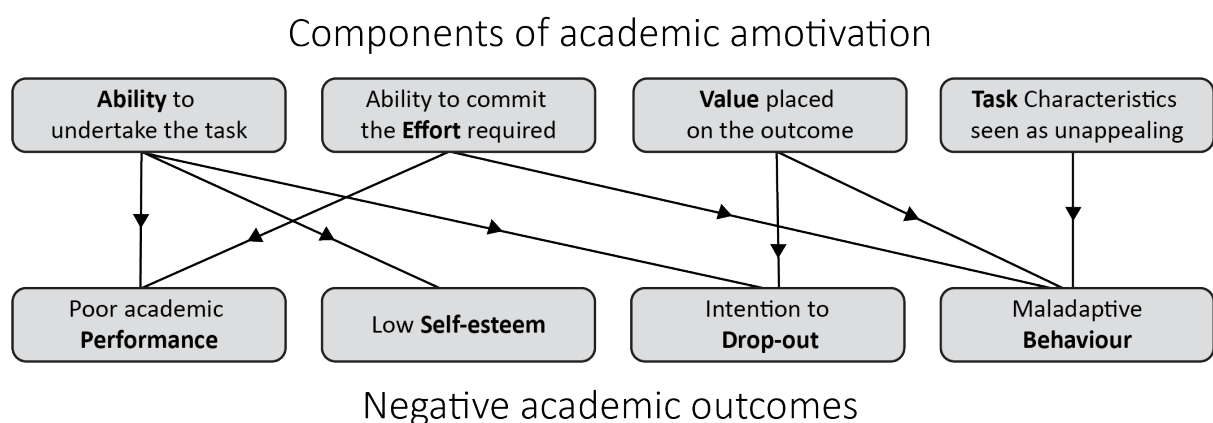


Fig. 4.1 Significant associations between amotivation subtypes and consequences (Legault, et.al. 2006)

4.4.1 Identifying the parameters for the thesis.

General academic amotivation is one identified aspect of investigation for this research. Fig. 4.1 indicates there are four sub-components of amotivation linked to four negative academic outcomes. This affords additional opportunities to research the ability to detect and target academic amotivation at the sub-component level. In addition, the identified negative academic outcomes provide guidance on measures from real-world behaviour that could indicate behaviour problems and any change resulting from intervention. The following sections look to identify what aspects of the negative academic outcomes and sub-components of amotivation might be suitable for inclusion in this thesis.

4.4.1.1 Considerations in selecting negative academic outcome indicators.

From Chapter 2, observed real world behaviour in relation to the negative academic outcome 'performance' was identified as researchable through students' scores on both continuous assessments and summative exams. This data is accessible via institution VLEs and other systems. While accessing this data requires certain ethical challenges, and a level of trust on behalf of the participants, it was deemed a workable method to gain pre- and post- measures of performance.

Real-world indicators of the negative academic outcome 'Maladaptive behaviour' were identified as class attendance and time spent on the VLE. On this basis Maladaptive behaviour was seen as a workable indicator to measure in a Pre- and Post- context.

The negative academic outcomes 'Self-esteem' and 'Intention to drop-out' provide more challenging aspects to observe in real-world behaviours as they are related to inner held beliefs. As a result, it was decided to omit these two negative academic outcomes in this thesis.

4.4.1.2 Considerations in selecting amotivation sub-components.

The previous section discussed the four negative academic outcomes which are linked to four sub-components of academic amotivation. For this thesis each sub-component of academic amotivation was evaluated for its appropriateness to this research in terms of,

generalisability across modules, need for external input and weight of impact on negative outcomes.

To research impact on the sub-component 'task characteristics' would involve interventions involving teaching and learning task re-design. This would mean the need for subject matter expert input from lecturers, which would bring a variable into play that could be seen as inconsistent across trials. In addition, interventions around task characteristics would involve substantially more time input from the lecturers and may negatively affect their willingness and ability to participate. To this end task characteristic was omitted as a focus for the research.

Ability and Effort can be seen as similar dimensions, relating to beliefs around a student's capabilities and capability to commit. However, they have different dimensions, 'ability' links to self-belief in one's capability to complete the task, while 'effort' is focused on committing the time needed. Of the two, ability has the stronger link to the negative academic outcome 'performance' and is seen as repeatable across domains and without the need to create any increased workload intervention. To this end 'ability' was seen as the preferable research focus from these two sub-components

Value was seen as a distinct sub-component among the four and worthy of inclusion. It relates to the idea of what value, or not, the student places on successful completion of the module. It is shown to be associated strongly with the negative academic outcomes 'intention to drop-out', and 'maladaptive behaviour'. In the previous section it was explained that 'intention to drop out' was not a feasible negative academic outcome to include in this thesis. Indicators of maladaptive behaviour include missing both class and submission dates (Legault et al., 2006). As discussed above, information from VLEs could provide real world data, in a readily accessible fashion, to provide measures for aspects of maladaptive behaviour with no requirement for intervention input from the lecturers or students.

4.4.1.3 Amotivation and behaviour parameters for this research.

In considering sections 4.4.1.1 and 4.4.1.2 the identified parameters for further investigation in this thesis were identified as:

- General academic amotivation,
- Ability amotivation with real-world indicators of performance
- Value amotivation with real-world indicators of maladaptive behaviours.

4.4.2 Measuring Amotivation

Legault et al.'s (2006) research referred to above involved the development of the Academic Amotivation Inventory (AAI), a scale to measure academic amotivation. The scale contains subscales for each of the amotivation sub-components, Ability, Value, Effort and Task Characteristics. Chapter 2 reported that the AAI has been subjected to numerous rigorous examinations resulting in the scale being recognised as a robust measure across many domains, cultures and age profiles (Cheon & Reeve, 2015; Fryer, Nicholas Bovee, et al., 2014; Green-Demers et al., 2008; Legault et al., 2006; Lucas et al., 2016) including several first-year undergraduate courses (Fryer, Ginns, et al., 2014). The AAI is structured as 16 Likert questions. Its results provide a measure of general academic amotivation (Appendix B). The 16 questions comprise four blocks of four questions, each block provides the scale for the four sub-components. On this basis the AAI was seen as a useful scale to deploy in this research.

The ambition of this research was to investigate the potential of an intervention strategy of targeted nudges. To detect and measure evidence of impact from an intervention there were several aspects that needed to be measured. The AAI 16 item self-report questionnaire was leveraged to measure the three areas of interest, General academic amotivation, Ability amotivation and Value amotivation, in a pre- and post- intervention approach. The Effort and Task Characteristics sub-components would be measured as a matter of course and would be available for ad hoc analysis.

The AAI does not provide a scale point at which one might be considered amotivated. The AI comprises 16 statements each answered by a seven point Likert response. This gives a range of 97, with a minimum score of 16 and a maximum score of 112, where the higher score indicates more amotivation present.

For the purposes of this research participants in all three experiments were categorised by ranking their scores on the overall AAI scale, Pre intervention, and from there dividing

them into three groups. The highest scoring third represented the most amotivated within each class and were labelled as 'Amotivated'. Similarly, the lowest scoring third represented the least amotivated in each class and were labelled 'Not Amotivated'. The remaining middle third were labelled as the 'Middle Group'. The target group of interest in this research is the 'Amotivated', however the Middle and Not Amotivated groups are analysed across this research to investigate for impact, positive or negative within these groups. The two groups also provide a control group for the Amotivated participants. From a pragmatic approach, in line with DBR, this guaranteed equal numbers of students in each group. From a practical perspective this approach also serves to investigate situations where the overall cohort may be more, or less, amotivated overall. The pre-data was used to both detect the presence of amotivation and identify its nature in relation to Ability and/or Value negative beliefs. The post- data provides the ability to compare with the pre- data to investigate any impact that may have occurred linked to the intervention.

An alternative approach to categorization was also investigated. This approach would have divided the range of scores available into thirds, where those scoring in the highest third would be categorized as amotivated. This approach would not control for the number of participants that would end up in each category. In looking at the largest sample in this research from Experiment Three, as discussed in Chapter 7, this approach would have led to the following:

- Not Amotivated Group: 51 participants, scoring between 16 and 47,
- Middle Group: 51 participants, scoring between 48 and 80.
- Amotivated Group: 4 participants, scoring between 81 and 112.

This is the biggest group of participants, even in this group, it would not have led to any meaningful results as the Amotivated category is too small.

4.5 Indicators of Behaviour Change

Motivation is “the process of instigating and sustaining goal-directed behaviour” (Schunk, 2013, p.346). In reducing academic amotivation it could be hypothesised that behaviour would improve. The nudge interventions in this research are envisaged as one-off and reasonably short. Behaviour change leveraging nudges can take time (Parnell, Fernandes,

Walker, Suchard, & Wilson, 2014). However, the opportunity to investigate if the intervention had impact at the targeted behaviour levels of performance and maladaptive behaviour could be explored.

4.5.1 real-world behaviour indicators

Fig 4.1 shows there is a significant link between Ability amotivation and Performance. Participants were asked to provide access to data on performance scores both in terms of continuous assessments and summative exams from the VLE. This data provided indicators of Performance related to the subcomponent Ability. To avoid the need for the researcher to gain access to the VLE the data was gathered by the lecturer and shared with the researcher.

In terms of Value amotivation, Fig. 4.1 shows a significant link to Maladaptive behaviours. Once again participants were asked to provide access to data. The VLE could provide indicative data around amount of time spent on the VLE and attendance records. This data provided indicators of Maladaptive behaviours related to the subcomponent Value. Once again, the lecturers could gather the relevant data and share it with the researcher.

A similar categorization as discussed in section 4.4.2 was adopted in categorizing real-world behaviour indicators for Chapter 7. Participants were allocated to one of three groups based on ranked real-world behaviour indicators of Value and Ability to High, Middle, and Low. In contrast to the measures discussed for Amotivation in section 4.4.2 the high scores meant High Ability, or Value and the Low scores meant Low Ability, or Value.

4.5.2 Self-report behaviour indicators.

In addition to real-world measures of behaviour there was the opportunity to behaviour self-report measures from participants. As referred to in section 3.6.1, there exists an eleven item self-report tool to measure students' intent in relation to the four negative academic outcomes in Fig.4.1. The tool was not itemised in the original Legault paper or supplied as an appendix. The researcher contacted Lisa Legault from the original study, obtained her support for the research (see Appendix C) and with her assistance, was able

to recreate the questionnaire (see Appendix A). By way of completeness, the questionnaire was deployed in full to include all four negative academic outcome elements of the self-report to allow for ad-hoc investigations as the research progressed.

The two approaches above provided the ability to investigate findings of both real-world and self-report indicators of behaviour for both Pre- and Post- impact, and links to General, Ability, and Value amotivation profiles.

4.6 Identifying an intervention approach.

Chapter 3 discussed how an experimental design was appropriate to investigate if student academic amotivation could be reduced. This research did not initially set out with an identified method of intervention. The researcher was open to understanding what interventions could be leveraged for the duration of the project that would have the potential to have impact both within and potentially beyond the project. The literature review showed there were very few direct intervention studies from current research linked directly to academic amotivation. Cheon and Reeve (2015) and others did show some success with PE teacher training to develop an 'autonomous-supportive' approach to teaching (Edmunds et al., 2006; D. Perlman & Caputi, 2017). Saravanan and Kingston (2014) investigated interventions directly with students to address test-anxiety incorporating a three pronged approach of psychoeducation, muscle relaxation therapy and systematic desensitization. Terrier, Rech, Marfaing, and Fernandez (2018) deployed an action-identification intervention, which significantly reduced amotivation across students from the hospitality industry. The 'action identification' approach involved students voluntarily signing up to a course of study at varying levels of commitment. The approach borrowed some components from behavioural economics, was time efficient, and had significant impact. Looking at the options above from, alignment, practicality and efficacy perspectives, it was decided to investigate the usefulness of a behavioural economics/nudges approach.

4.6.1 A nudges approach

As discussed in Chapter 2, nudges seek to guide people to make the right choice, rather than mandate change, through the design of different ways in which choices can be

presented (Leonard, 2008). Damgaard and Nielsen's (2018) report into the use of nudges in education identifies areas for consideration as, Self-control; limited attention and cognitive ability; loss aversion; default bias linked to the previous three; self and social image; social norms; and biased beliefs. These link well with the four sub-categories of amotivation discussed above.

The same report identified categories of nudges within education, two of which aligned well with this thesis' ambitions. Boost nudges, rather than providing specific educational information, these nudges focus on goal setting, time management and motivation. The second are category are psychological nudges which seek to influence aspects including mindset, considered a valuable component in this project. A combination of these two approaches was seen as appropriate for this thesis.

Nudges can be delivered in many ways, including email, in person, text nudges and many more. The text nudges approach was shown in Chapter 2 as an effective method of delivery (Castleman & Page, 2015) and appeared appropriate for this case. Text nudges allowed for segmentation in an experimental approach, did not require access to college systems and provided participants with an ease of withdrawal. It was understood the approach would require obtaining participants' personal phone numbers which would bring associated ethics and data privacy aspects into play. However, it was believed the effort would be beneficial to the outcome.

4.7 Nudge Design

The focus areas for this research were students' negatively held beliefs around, general amotivation, ability to engage with the course, and the value placed on the course. In Chapter 2, Keller's (2010) ARCS model of instructional design, provided a useful framework to work with in relation to nudge design. ARCS is an acronym for the four-motivation based instructional design components of Attention, Relevance, Confidence and Satisfaction. Previous work had shown success in leveraging the model at the component level (Huett et al., 2008; C. Kim & Keller, 2008; C. M. Kim & Keller, 2011). The component of Confidence aligns well with the amotivation sub-component Ability and Relevance with the subcomponent of interest Value. The literature from Keller was

leveraged and adapted in designing the nudges for each category and is discussed further in sections 4.5.2 and 4.5.3.

To maximise the potential impact of the nudges they should resonate as much as possible to the students' own situation. For example, in working with undergraduates in Ireland it can be expected the nudge "Every year the Turkish Computer Science school hosts a computing careers event! Bringing in employers to meet students just like you!" will have little effect. By contrast, an example of a nudge that was used with students in Trinity College Dublin, School of Computer Science and Statistics was "Every year your school hosts a computing careers event! Bringing in employers to meet students just like you!". This nudge is in the Value category, showing students a tangible longer-term benefit and opportunities of completing their studies with the school.

There can be negative effects from well-intentioned motivation messages. In discussing motivation for academic studies Schunk (2013) refers to the over-justification hypothesis, where students who find a topic interesting can have that interest diminished if the activity is linked to extrinsic outcomes, such as a means to an end. Haimovitz and Corpus (2011) showed process praise linked to effort, as more effective than person praise linked to ability for enhancing intrinsic motivation among college students. However, for first year students there was no distinct effect, including a no praise cohort. In considering the result they posit "Upon entering a new and challenging environment that calls into question their academic competence, they may have a less firmly established self-concept, and thus do not internalise either type of praise as genuine or meaningful." (Haimovitz & Corpus, 2011, p.606)

4.7.1 Nudge Categories

Over the course of the research two categories of boost nudges were developed. One set focused on improving Ability amotivation and another on Value amotivation.

Within each category there were two types of nudges. Type A nudges were designed to work across different modules and were focused on the institution, general or regional level. Type B focused into the module level and were developed in conjunction with the lecturer on the module in question.

4.7.2 Ability Nudges

Ability beliefs, as the name suggests, centre around the students' inner sense of having the competence to successfully engage in a certain activity (Laforce, Noble, & Blackwell, 2017), or in this case module.

In terms of strategies to support ability beliefs the Type A, general nudges, focused on general study tips such as "100 years of research and hundreds of experiments show that 'practice testing' enhances learning and retention. So, get some past papers and give it a go!". These nudges were developed through investigations into literature aligned with supporting academic ability. Strategies around allowing students to understand the task is achievable, with reference to approaches and study tips (Belland, Kim, & Hannafin, 2013; J. Keller & Suzuki, 2004).

Type B, module nudges, provided insights to support ability beliefs with the specific module. They were developed in conjunction with the lecturer. An example of a Type B nudge is "The final examination in 'Module-X' will be similar to the weekly programming assignments. Spending time on the weekly assignments now will be a big help in preparation for the examination".

4.7.3 Value Nudges

Value beliefs relate to the reason a student might have to engage with an activity or subject. They tend to focus on the task's relevance to achieving a desired goal (van der Meij et al., 2015). Value beliefs or relevance can be either, short term e.g. next semester, or longer term e.g. career opportunities (J. M. Keller, 2010).

To support value beliefs Type A, general nudges, focused on the benefits of achieving their qualification in general, with some reference to their institution/location, and were mainly long term. The Type A nudges were developed by the researcher through research into both the local institution and economic affordances in this space. An example of a Type A was "Your school ranks 1st in Ireland, and in top 25 in Europe. Graduates from your school are highly sought after and demand is continuing to grow."

Type B, module nudges in this category, focused on the value of the specific module. They were developed with the lecturers and were mainly focused on short term goals. An example of a type B was “Concepts from ‘Module-X’ will support your study of many other areas in computer science, including concurrency, parallel processing, networking, operating systems, and representation of many kinds of data in binary form”.

4.7.4 Lecturer Toolkit

To be effective and to be acceptable it is important to scaffold lecturers, to make it easy on them to deploy, and where possible focus in on data related to individual students (Blumenstein et al., 2018). To this end a lecturer toolkit (see Appendix D) was developed to support lecturers in the design of the module specific Type B nudges.

The toolkit provided guidance around the general concept of nudges; keeping the nudge short, focusing on positives, targeted to the module, and focusing on challenging areas they were aware of associated with the module. They were provided with an example of both an Ability and Value nudge.

The toolkit also provided specific support around the development of both the ability and value categories of nudges.

In relation to ability nudges lecturers were asked to consider what aspects of the module assessment have been considered difficult in the past, and what specific strategies they might recommend that would support the students’ beliefs that they can accomplish the result.

In relation to value, lecturers were asked to structure the nudges on the near-term value of successfully completing the current module. What will success in the module deliver to the student that is meaningful to them in the next stages of their study.

4.8 Implementation Strategy

In this section the strategy of implementation is discussed. The specific detail of each experiment’s implementation is discussed in Chapters 5, 6, and 7. This section serves to discuss the design decisions associated with the interventions.

The strategy deployed boost nudges that were Type 2 in nature. As discussed in section 2.4.3. Type 2 reflective nudges promote deliberate actions on behalf of the students. If nudges promote an impact it tends to be reasonably immediate. Several studies reviewed in Chapter 2 successfully leveraged a two-week intervention period using pre- and post-measurements (Mertens et.al., 2022; Olson et.al., 2022; Purohit et.al., 2023).

On this basis the intervention was designed to involve the students in three steps as follows (See Fig. 4.2).

20 minute in-class recruitment and Pre- survey session. The session comprised a 10-minute briefing from the researcher on the information sheet and consent form. Both were also available as pdfs on the VLE. The students were then invited to participate, a link to a Qualtrics survey was provided. The second half of the session gave the participants time to complete the Pre- survey which comprised demographics, the AAI and the 11 item self-report on behaviour.

Delivery of text nudges each week over two weeks. The nudges were sent to the students' phones between 9.30am to 5pm Monday to Friday to avoid impinging on student personal time.

15 minutes debrief in-class and post-survey session A second in-class session to debrief the students and give them time to complete the post version of the same Qualtrics survey.

Type 2 nudges can be challenging in relation to long-term effects, lasting effects are thought to be achievable through repeated shorter interventions (Weijers et al., 2021). However, as the post measurement was immediately following the intervention this was not seen as a barrier to looking at amotivation level impacts.

4.8.1 Data Collection

The students' college email was used as an identifier till all data was collated, at that stage the student e-mail was replaced with a participant number, thus anonymising the data.

The student scores in the pre- AAI, facilitated the detection of general amotivation and a profile of the sub-components, ‘Ability’ and ‘Value’ amotivation. In turn this informed which category of boost nudge each student received over the two-week intervention. Following the third step in 4.6, the post-survey data was downloaded and combined with the Pre- data set to facilitate investigation of pre- post- effects.

In Experiment Three the college email addresses of the participants who completed both the pre- and post- surveys were sent to the participating lecturer. Over a period of approximately two weeks, or longer if there was an assessment due. The lecturer gathered the agreed real-world behaviour indicator data, as discussed in section 4.3.1, associated with performance and maladaptive behaviour. The data for participating students was gathered, from periods pre- intervention and post- intervention, on continuous assessments, summative assessments, and VLE activity, as was available. The data was then returned to the lecturer for analysis.

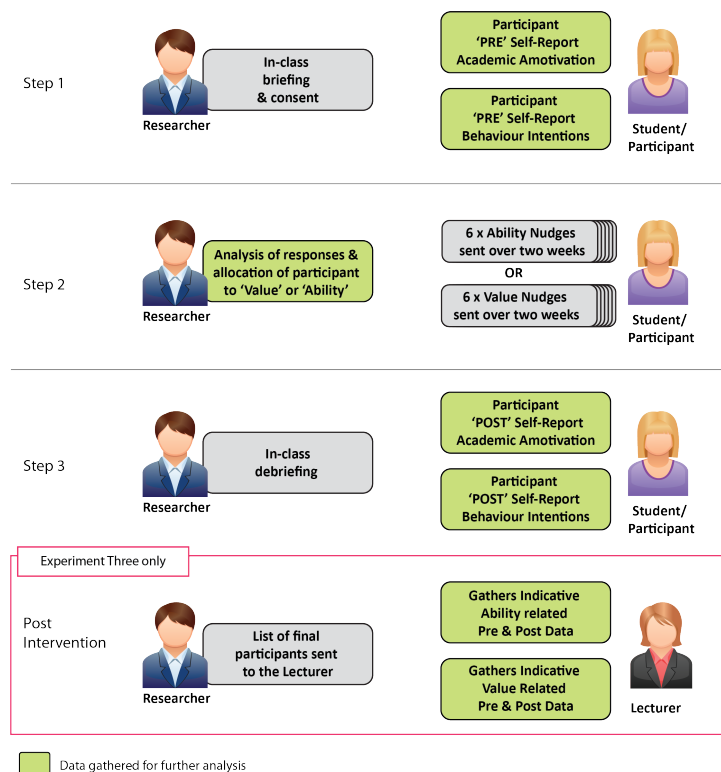
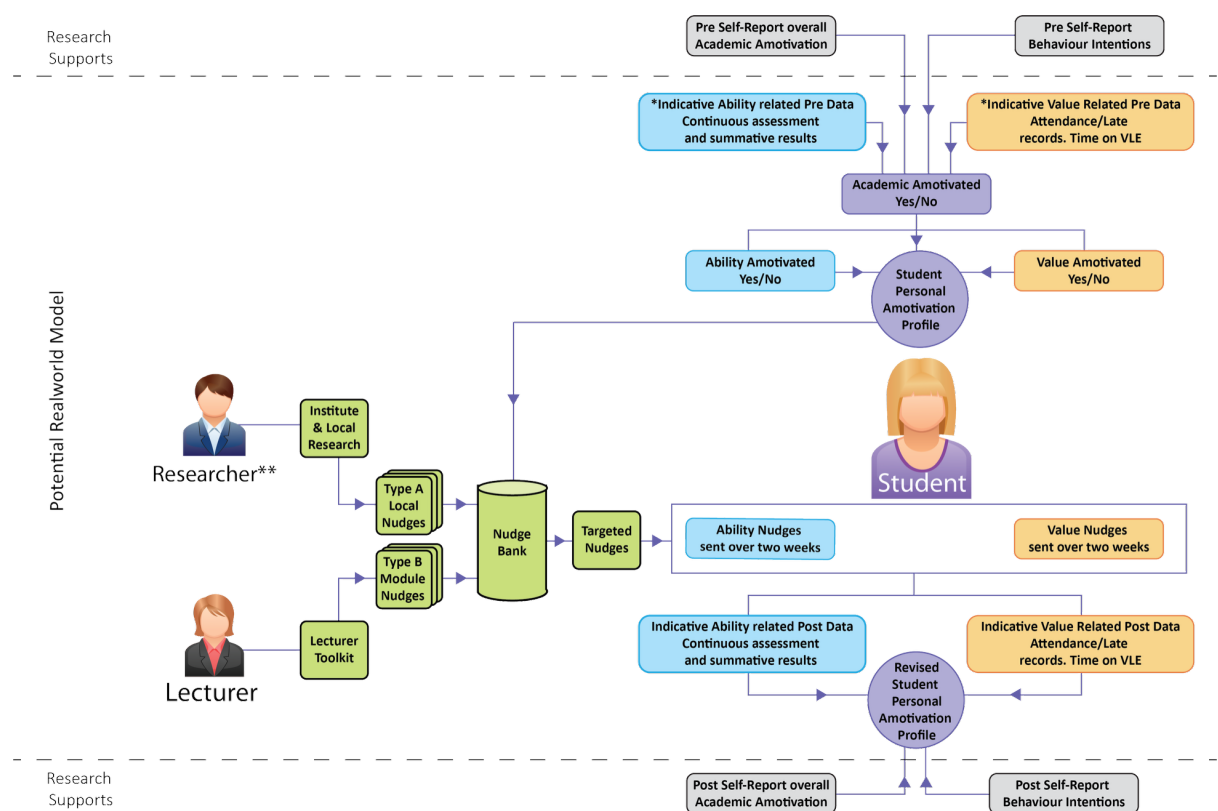


Fig. 4.2. Data capture flow for each experiment during the research project.

4.9. The Model

Integrating the research in this Chapter informed the design of an intervention model to support undergraduate academic amotivation. It has the potential to detect amotivation, profile students amotivation at the subcomponent level and deliver focused boost nudges aligned to their profile.

In its current form, the model is designed to work specifically at the General Amotivation, Ability, and Value levels. The model, as represented in Fig. 4.3, is designed to operate at the module level.



* For the research project this data was collected post intervention ** In a real-world deployment the researcher could be replaced by faculty staff leveraging a toolkit.

Fig. 4.3. The intervention model for the detection and profiling of participants' amotivation, defining and delivering targeted interventions and reassessing their profile across amotivation and behaviour for indicators of impact.

In Fig. 4.3, the model currently consists of pre- and post- supports to carry out research, represented in grey at the top and bottom of the figure, namely the AAI and the 11-item

behaviour questionnaire. These proven tools provide self-report measures of academic amotivation and intention toward negative academic behaviours. From the perspective of this research, they serve to both support and provide an additional lens when analysing outcomes from the intervention. These items would not be envisaged as necessary in more developed iterations of the model as discussed in the next section.

4.9.1 Towards an automated development of the model.

College systems, such as VLEs, provide real world data on behaviours of students such as test scores which are significantly linked to 'ability beliefs'. These systems can also provide data on VLE activities significantly linked to 'value beliefs'. In this research the data on real-world behaviour indicators were gathered post the intervention. This was to avoid gathering data on students who may start but not complete the experiment.

The intervention boost nudges are served from the nudge bank. In the current version of the model the nudge bank is populated by both the researcher and the module lecturer. The researcher, researches and develops the 'Type A' value and ability nudges at the institution and local economic affordances level. The module lecturer, supported by the lecturer toolkit develops the module specific 'Type B' nudges, again both ability and value versions.

4.10. Implementation Framework

In line with the DBR approach, three iterative experiments were planned to investigate the potential of the model described in the previous section. To facilitate repeatable, efficient, and reliable investigation into the potential of the model it was necessary to develop an implementation framework (see Fig. 4.4).

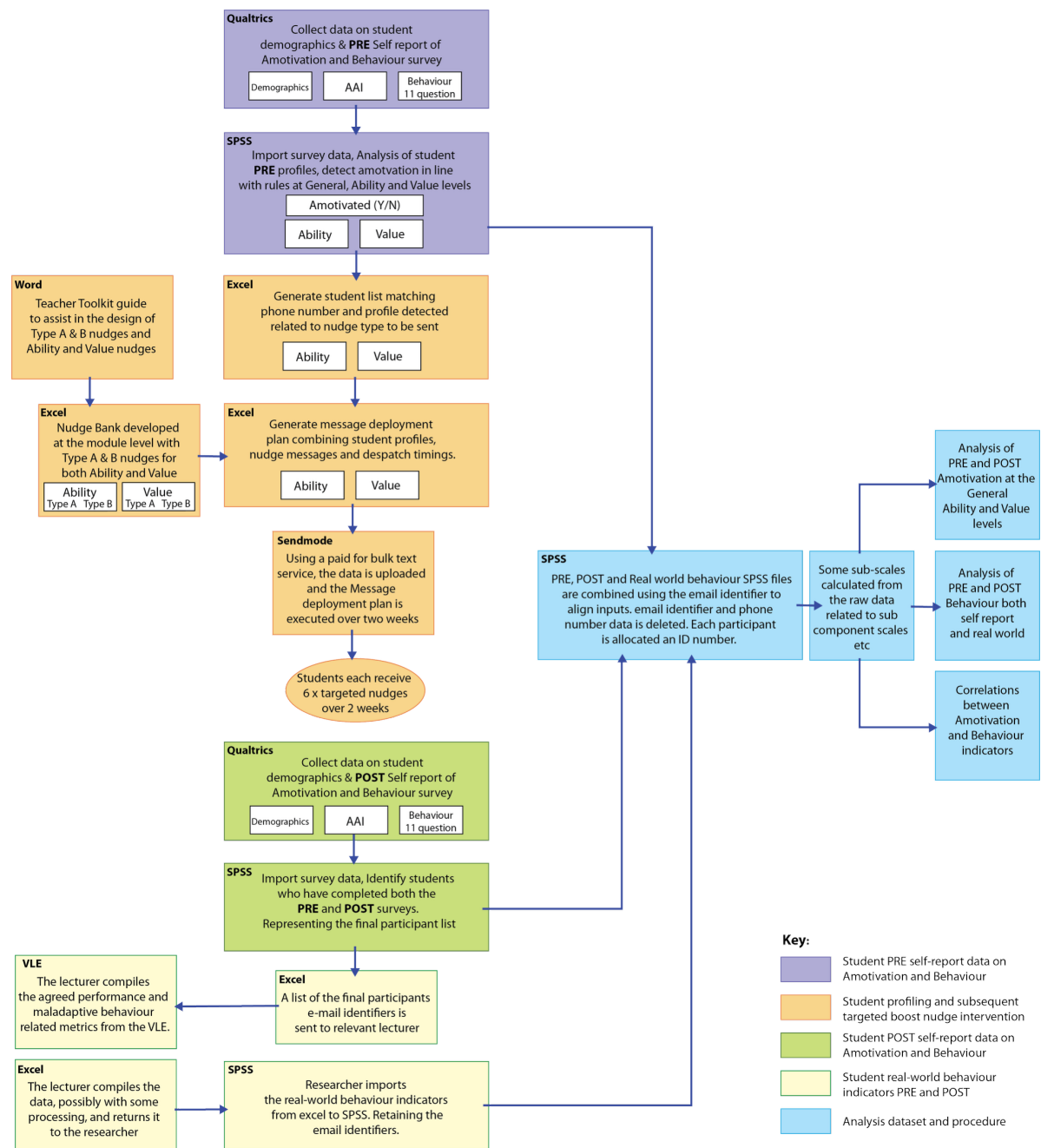


Fig. 4.4. The implementation framework design.

The implementation framework involved working with several technologies and software packages and was structured under five main areas of requirement. The following sections give a description of each area and its contribution to the research.

4.10.1 Student PRE-self-report data on Amotivation and Behaviour

This aspect of the framework supported the gathering of Pre- intervention data required. The data was to serve three distinct purposes as follows. To gather the demographics

required for the research including college e-mail as an identifier, and phone number to facilitate nudge delivery. The AAI 16 item questionnaire to baseline profile participants in terms of their amotivation levels at both the general and subcomponent levels. The eleven-item questionnaire referred to in section 4.3.2 to profile participant self-report views on the negative academic behaviours of interest to the research.

The three datasets were captured through the development of a survey in Qualtrics. The survey took an average of seven minutes to complete. The first question was a yes/no answer and was phrased 'I have read the information sheet and consent form for Peter Gillis' research project and agree to participate as per the information explained to me'. This was the only 'required' response.

From a data protection perspective, no data provided in the survey was recorded until the student agreed to submit and clicked the submit button. This approach avoided trapping any data from incomplete responses and ensured the data that was gathered was done so consensually. The full survey can be seen in Appendix A.

4.10.2 Student profiling and subsequent targeted boost nudge intervention

All participants needed to be allocated to either the Ability or Value boost nudge group in line with the strategy described in section 4.2. The Ability and Value amotivation subcomponent scores each require adding the response scores to four specific questions from the AAI together. These new variables were calculated. These variables in turn facilitated the creation of a Nudge-Type Variable where 1=Ability, 2=Value. This process identified which aspect of the two amotivation sub-components, Ability or Value, was more prevalent for each student. The participants were then split according to this variable.

In SPSS the student phone number data was standardised to a format that would work with the bulk text nudge service, an example would look like 00353871234567. An excel spreadsheet was generated comprising an Ability and a Value list of participants and their phone numbers.

Prior to the intervention the researcher researched the positive affordances of the host institution and developed Type A boost nudges to support both Ability and Value amotivation. There were four Type A nudges for Ability and four for Value. Also prior to the intervention, the researcher briefed the lecturers, and supported by the lecturer toolkit (see section 4.7.4), the lecturers developed the module specific Type B boost nudges to support both Ability and Value amotivation. There were two Type B nudges for Ability and two for Value.

The nudges were brought together in a nudge master-sheet, interspersing the Type B among the Type A nudges in a delivery plan. The master sheet also set out the timings for the delivery of the nudges for each group across the planned two-week intervention cycle.

For Experiment Three, research into bulk-text services identified an Irish supplier, Sendmode (sendmode.com) as a reliable supplier. The researcher set up an account and was able to design a 'campaign'. The campaign facilitated the generation of an Ability and a Value group. The phone numbers for each group were imported, the nudges uploaded, and the timing strategy set out for the two weeks. This facility meant the researcher had only to set the campaign up once, and then monitor it to ensure it was delivered to plan. The campaigns were successful, and this concluded the intervention aspect.

Note the nudges appeared as coming from the researcher's phone. While participants were told there was no need to respond to nudges there were one or two witty responses across the experiments.

4.10.3 Student POST self-report data on Amotivation and Behaviour

This aspect of the framework supported the gathering of post-intervention data required. The post-data serves to investigate any potential impact by comparing the data with the same Pre- data captured in 4.10.1. To this end the structure of the tool for this aspect was a duplicate copy of the same survey and approach used in 4.10.1.

The second function of the post-data survey was to identify and quantify the final participants. Participation was voluntary. Those who completed the Pre- survey did receive the boost nudge intervention but did not necessarily complete the post-survey.

Monitoring the responses as they came in, the researcher was able to send a couple of reminders, again via Sendmode, to those who had not yet completed the post-survey.

Ultimately, and as will be discussed in Chapters 5,6, and 7, the fall off was approximately 40%. The remaining 60% representing the final participant list. The data of the participants who only completed the Pre- survey was deleted from the Pre- SPSS file.

4.10.4 Student real-world behaviour indicators PRE and POST

The real-world behaviour indicators were only captured in Experiment Three. The identifying emails of the final participants were compiled in excel and sent to the appropriate lecturer. The lecturers ran queries on the VLE, Blackboard in the case of Experiment Three, and retrieved historical data from both Pre- and Post- intervention periods. They retrieved data related to pre agreed strategies on Ability and Value indicators. However, they had the latitude to identify what data on their module aligned. The specifics are discussed in Chapter 7. The data was returned to the researcher in excel and imported into SPSS.

4.10.5 Analysis dataset and procedure

At this stage there were three SPSS files, Pre- and Post- survey data, and the data on Real-world behaviour indicators.

Using the email identifier, the three SPSS files were combined into one. In experiments where there was more than one module participating it was important to be able to distinguish which module each participant was taking. For Experiments One and Three a coded variable was created for 'module', for Experiment Three this was a simple 1=Engineering, 2=Computer science approach. After combining, and checking the alignment of the data to participants, the email identifiers and phone number variables were deleted, and each participant assigned a participant ID.

Following the approach described in 4.4.2, the participants General Amotivation was calculated into a new variable adding all Pre 16 AAI scores together. In turn this facilitated the creation of an Amotivated Variable, where 1=Amotivated, 2= Middle Group and 3=Not Amotivated. This was important as the Amotivated group were the target of this research,

and the other two acted as a control groups and options for deeper understanding of any effects. The Post 16 AAI scores were also added to provide the data for indicators of any impact post intervention.

The four subcomponent scales, Ability, Value, Effort and Task Characteristics, were each calculated into new variables by adding the relevant four questions from the AAI. This process was carried out for both the Pre- and Post- survey data.

In relation to self-reports on behaviour a similar approach was taken to create measures of the four self-report negative academic outcome measures; performance, maladaptive behaviour, self-esteem, and intention to drop-out. The performance indicators comprised a self-reported proficiency measure in the specific module. The Maladaptive behaviour measures involved, number of hours studied, and adding the scores from two Likert questions on frequency of, late for class, and skipping class. The self-esteem scale added scores from four related Likert questions. The Intention to drop-out score added scores from three Likert questions. These scores were calculated for both Pre- and Post-.

The real-world indicators of behaviour related to performance and maladaptive behaviour were captured only in Experiment Three. The data returned by the lecturers was in some instances different and bespoke to the module. The data was provided Pre- and Post-. The specifics and interrogation of the data is discussed in full in Chapter 7.

4.10.5.1 Data analyses

The details of each experiment's analyses are contained in Chapters 5, 6, and 7.

In broad terms the analyses of the final dataset investigated four areas related to supporting the potential of the intervention model. This section gives an overview of the analysis's approaches related to amotivation, self-report behaviour, real-world behaviour, and correlations.

The first was the intervention's impact on academic amotivation, pre- and post-. The focus of the analysis was the three types of amotivation: general, ability and value. Analysis sought to investigate if there were statistically significant reductions in post-versus pre-measures. Also, how did any change compare to the other groups, who acted as the

control group. As discussed in section 3.7 a Wilcoxon Test was chosen as the appropriate measure for these analyses.

The approach described in the previous paragraph was also leveraged in looking at the second area of interest, the self-report measures of negative academic behaviour.

The third main area of interest for analyses was looking for impact on real-world behaviour indicators related to performance and maladaptive behaviour. These were only carried out in Experiment Three. Measures of real-world behaviours pre- and post- are challenging. To take an example, if the pre- measure provided was student scores on 4 Multiple Choice Question (MCQ) tests taken early in the semester. Next, to consider if the post- measure was the same students' scores on MCQ tests taken later in the semester. While they are both MCQ results from the same students, there is no way to define which may have been the more challenging set of MCQ tests. Therefore, there would be little benefit to directly comparing a student or student group's Pre- and Post- directly. What was deemed useful was the ability to compare among groups. To stick with the example given. The real-world behaviour measure described was 'performance' related. As discussed in section 4.4, Performance is related to Ability. So, in analysing pre- and post-scores, it would be hypothesised that the group receiving the ability boost nudges would have a more significant improvement than those receiving the value nudges. This approach and variations are discussed in Experiment Three.

Finally, analyses looked at correlations between real-world indicators of change and amotivation. This analysis was investigating support for the model around the ability of real-world indicators to detect the presence of academic amotivation. The data were reviewed visually with a scatterplot and tested for significance using Pearson R and Lambda measures.

4.11 Summary

This Chapter has brought together the literature review findings to underpin the design of an intervention model to potentially impact academic amotivation at a targeted level. The model is based on profiling students based on behaviour indicators. To investigate the potential of the model, in the scope of this thesis, an implementation framework was

designed and discussed. The implementation framework supported three rounds of experimental research which will be discussed in depth in the following three Chapters.

Chapter 5 – Experiment One, pilot study.

5.1 Introduction

The second objective of this thesis was “through initial experiment, investigate the potential of amotivation focused boost nudges, targeting amotivation levels and subsequent outcomes”. It was deemed important to understand if the deployment of nudges would have any impact at the general academic amotivation level. This Chapter will discuss the process undertaken in part fulfilment of this second objective and continued in Chapters 6 and 7.

An additional purpose of the Experiment One was to test the utility of the basic design elements in delivering nudges and receiving survey feedback. The experiment sought to measure self-report academic amotivation levels, and self-report measures of negative academic behaviours linked to amotivation. The experiment explored the technical aspects of running the trial, to inform later studies regarding appropriate practice and implementation.

The Chapter discusses the procedures followed, including participant recruitment, and the interventions performed. The Chapter also discusses the materials developed for this initial experiment, the analysis approach taken to investigate the findings, and presents the results regarding both self-report, amotivation, and behaviour levels.

The setting for the initial study was Griffith College Dublin (GCD), a private, third level college in Dublin, Ireland, with approximately 7,000 students. The college provides internationally recognised postgraduate and undergraduate degree programmes across a broad range of subjects including accountancy, computer science, business, journalism, design, and others. As a private college, the lower entry points requirements can be a route for those students who may not have earned enough points at second level for a similar course in the public universities in Ireland.

5.2 Ethics

The necessary ethical permission was sought and received from GCD (see Appendix E). No participants were under the age of 18. An information sheet explained to participants the background and purpose of the research and the intended use of any data collected. Participants had access to a printed copy of the information sheet. They then signed informed consent sheets to agree to participate in the surveys and to receive text nudges during the experiment (see Appendix F for full ethics submission to GCD).

5.3 Participants and recruitment approach

Following an approach by the researcher, GCD expressed interest in the research and agreed to enable access to the following three, degree awarding classes, 1st year BA Journalism, MSc Data Science, and MA Business Studies. It should be noted that while the focus of this thesis is undergraduates, the inclusion of two post-graduate classes was not seen as an issue given the objectives of the initial pilot experiment as the main goal was to test the tools and the approach.

An in-class time slot at the start of a lecture in each of the three classes was provided to brief the students about the experiment, circulate an information sheet, and ask them to sign a consent form if they wished to participate.

The total sample that consented to participate was 61. Over the following two weeks the participants received five nudges in the form of text nudges sent to their phones and as described in section 5.4.3.

On completion of the intervention, the participants were required to complete a post-trial questionnaire. An email with a link to the Post survey was sent to each participant following the intervention. 34 of the initial 61 participants completed this stage and therefore represented the usable number of participants for analysis.

5.4 Materials and methods

The following sections describe the artefacts developed to execute Experiment One, in line with the implementation framework, and the step-by-step description of the process taken to capture the data for initial analysis.

The survey 5.4.1

The same questions were used in the pre and post surveys. The surveys were developed as online artefacts in Qualtrics. Each survey contained three sections as follows, contact details, a self-report of participants' views in relation to the negative academic behaviours, and the 16 questions from Academic Amotivation Index (AAI) (See Appendix B).

The first few questions of the survey captured participants' contact details, comprising college email and mobile phone number. As there were three different classes taking part, the survey also asked participants to indicate which course they were taking.

The second section of the survey was a thirteen-item questionnaire that captured participants' self-reports on negative outcomes associated with academic amotivation. These items were focused on the course of study level, (an aspect that focused on the module level in Experiments Two and Three) and covered, academic performance, maladaptive behaviour, self-esteem, and intention to drop out. As reported in Chapter 4 the survey was developed based on the work of Legault et.al. (2006). Eleven items had a seven-point Likert scale. An example of a question related to maladaptive behaviour using the seven-point Likert scale is "*This term, how frequently were you late for class?*", where 1 = Never, 4 = Sometimes, and 7 = Frequently. The other two, non-Likert, questions asked participants to report hours studied per week and average grade. The full survey is available in Appendix A.

The AAI, as discussed in Chapters 2 and 4 provided the content for the third section of the survey. This established self-report 16 item questionnaire was used to measure participants' academic amotivation at the point in time when it is completed. Each item was rated by the participants concerning the degree to which each item corresponded to

their view of the statement as it related to themselves. Each Response captured their rating on the Likert scale where 1 = does not correspond at all, 4 = corresponds moderately, and 7 = corresponds exactly. The scale also comprises four subscales looking at the sub components of Ability, Value, Effort, and Task Characteristics (Legault et al., 2006).

An example of a statement in the Ability category was “Because I don’t have what it takes to do well in college.” and an example in the value category was “Because, for me, college holds no interest”. The full survey is available in Appendix B.

The URL for the survey was converted to a shorter version using tinyurl.com and was presented to the participants in class for them to complete on either their mobile devices or laptops. The survey took seven to ten minutes to complete.

5.4.2 Defining groups.

The initial experiment sought to investigate the potential for boost nudges to have an impact on amotivation state. However, it was decided to take the opportunity to investigate the potential of both ability and value nudges as they represented the two areas of interest for Experiments Two and Three. To facilitate this, two groups were created.

The participants provided a mobile phone number in the survey. The number was to allow for the receipt of the text nudges but also provided a convenient tool to randomise the allocation of participants into two groups. The procedure was as follows. When all mobile phone numbers had been gathered, and converted into the same format, the participants were sorted in Microsoft excel by mobile phone number, irrespective of course. The ordered list was then divided as follows. The first five were allocated to ‘Value’, the second five were allocated to ‘Ability’ and then this process was repeated to include all the 61 initial participants.

5.4.3 The Nudges and Intervention

As described in the previous section the participants for each of the two nudge groups were randomly allocated. This approach meant that each group contained participants

from the three academic courses referred to above. Therefore, the nudges developed for this experiment were all Type A as discussed in Chapter 4, designed to work across different modules and were focused on the institution, general or regional level. The researcher leveraged the Nudge Design process developed in Chapter 4 to produce five nudges for each of the two categories (table 5.1).

Ability Nudges	Value Nudges
The word "study" is too generic. When planning your time, use words like, "review," "read," "work on problem," etc. This will help you focus and to become more creative and flexible	Did you know 71 percent of Griffith graduates are currently working in a job related to the course they studied.
Time between classes can be great to review notes, practice problems, or organise yourself. If you discount these smaller pockets of time, you could waste hours of potential study time	Jump ahead in your career! 93 percent of Griffith graduates, are currently in employment or have progressed to further study
Your mind needs time to process new information. Make your study sessions no longer than 2 hours without a break. Take a 30-minute break to recuperate.	You can earn more money! A US report finds Bachelor's graduates earn an average of 63% more than high school graduates per year
You really do need to sleep. Sleep helps your brain and body restore and recover from the day's activities. It also helps you be more productive and eat healthier,	The personal touch! Griffith class sizes are small, and lecturers give students personal attention that you just won't get anywhere else. That kind of dedication to our students is your advantage.
Remember that it's not too late to start studying. You will be amazed at how much you'll learn and retain in an intense and short space of time. If you think you are behind the rest of your class, you probably aren't	Data shows that in an economic recession, college graduates are less vulnerable to layoffs. The people who suffer the most from job cuts are lower level employees with second level education.

Table 5.1. Amotivational support ability and value boost nudges sent in the initial experiment.

Over the two-week period following the completion of the pre-survey, the Ability group received five text nudges focused on boosting beliefs in their academic ability to complete the course. Likewise, the Value group received five boost nudges via text nudge, seeking to improve their beliefs around the value of taking and completing their course.

The nudges were sent via the researcher's own phone account through the Vodafone webtext facility. The nudges were spread out, three the first week and two the second, and were sent during normal college hours. A sixth, final nudge in the second week, the message thanked the participants, provided them with a link to the post-survey and asked them to complete it. The initial response rate was poor. Over the following week, two reminder emails were sent to those participants who had not responded, encouraging a few more responses. The final number of participants completing both the pre and post surveys was 34, a response rate of 56% of the original 61 signed up participants.

5.5 Data and Analysis - Amotivation

The pre and post surveys were compared using a Wilcoxon signed-rank test to investigate if the intervention had improved self-reported academic amotivation via the scores on the AAI. Also, to see if either the 'Ability' or 'Value' nudges had a more significant impact on the AAI scores.

In addition, the groups were analysed using the subscales, to see did the intervention have a more significant effect on the relevant subcomponent of Ability or Value, within and between groups. For example, did the 'Value' subscale improve more than the other subscales within the Value nudge group, and did the 'Value' subscale move more for the 'value' group than for the 'ability' group.

The process described in section 4.4.2 was followed to allocate the participants to the Amotivated (N=11), Middle (N=11), or Not Amotivated (N=12) groups, based on their ranked scores on the AAI. The intervention is designed to potentially support participants showing academic amotivation, therefore it would be hypothesized that participants who

do not measure as being amotivated from the Pre scale, should show little benefit from the intervention as they are not amotivated to start with. However, the thirds groups were analysed throughout Experiment One, and the other experiments, to investigate potential impacts among other groups and to provide control data.

5.5.1 Descriptive Statistics

34 participants completed both the pre and post surveys representing the usable sample. Across the three courses, Fig. 5.1 shows there were 11 from the BA Journalism, 8 from the MSc Data Science, and 15 from the MA Business Studies. Fig.5.1 also shows the number in each class by Amotivated level as defined by the process described in section 4.4.2.

For the MSc Data Science and the MA Business Studies groups there was reasonable split between the two nudge groups as shown in Fig. 5.2. The BA Journalism, group had over twice as many Ability nudge participants than Value nudge, see Fig. 5.2. It should be noted that because participants are allocated to their nudge group pre the intervention it is not possible to control for the final number in each group as it is a factor of how many complete the Post survey.

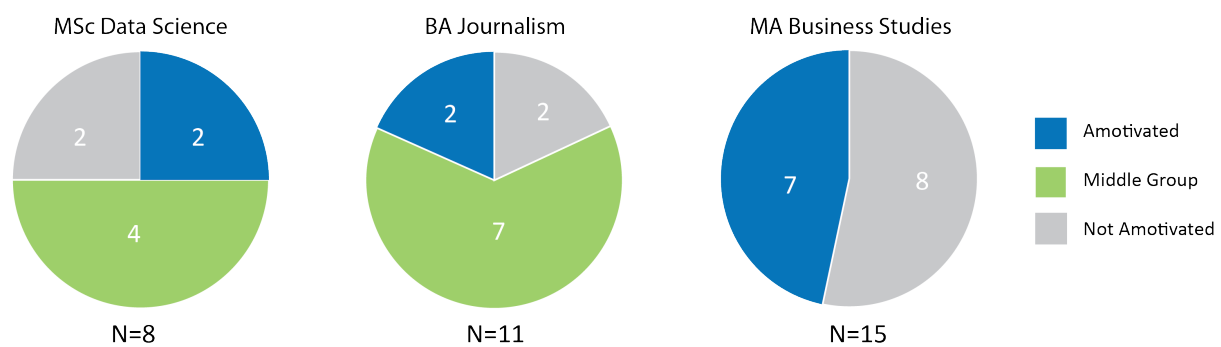


Fig. 5.1. Experiment One participants split by course and amotivation group.

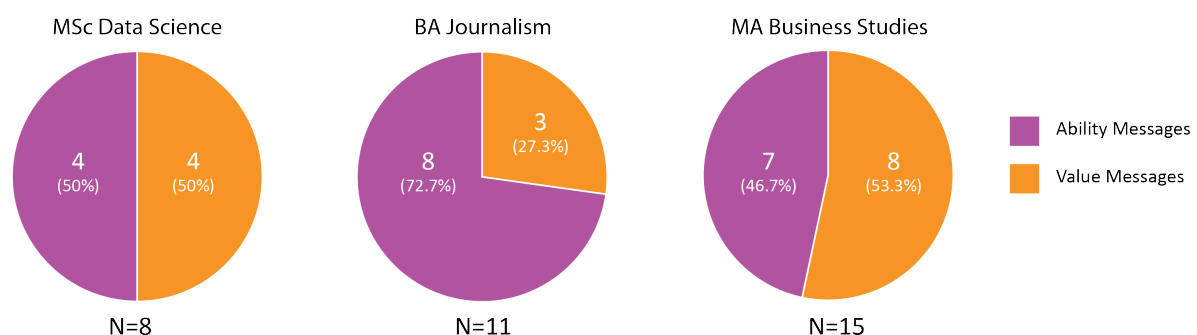


Fig. 5.2. Experiment One participants split by course and nudge type received.

The scatterplot in Fig. 5.3 provides a snapshot of the trajectory of impact for all participants between the pre and post self-reports on amotivation as represented by scores on the AAI. One BA Journalism student did not provide a post amotivation score, leaving 33 cases in pre and post.

In the scatter plot, the participants' AAI 'pre' score is represented on the Y axis. The X axis presents the participants' 'post' scores on the AAI. In the pilot experiment each of the 16 questions in the AAI questionnaire used a five-point Likert scale, giving a range of 16 to 80. Note that the AAI is more usually deployed as a seven-point Likert. The 11 cases represented as blue dots in Fig. 5.3 are the Amotivated Group as defined in section 4.4.2. The yellow dots represent the Middle Group, and the red dots represent the Not Amotivated Group.

5.5.1.1 Interpreting scatterplots

A scatterplot will be shown for each of the three experiments. To this end a small number of words are allocated here to explain what it shows. One of the amotivated cases has been circled in red to identify it as an example case. Looking at this case the participant scored 42 on the Y axis, indicated by the horizontal dashed red line, representing their score on the AAI Pre intervention. Following the dashed red line down from the example case to the X axis they scored 28 on the AAI Post intervention. This represents a positive 14-point reduction in their AAI general amotivation score from Pre to Post. The diagonal orange line represents where participants who scored the same in the Pre and Post surveys would plot to. Cases sitting on the diagonal line in Fig. 5.3 indicate no change between pre and post amotivation scores. Cases above the orange diagonal indicate a post intervention reduction in amotivation while those below indicates a post intervention increase in amotivation.

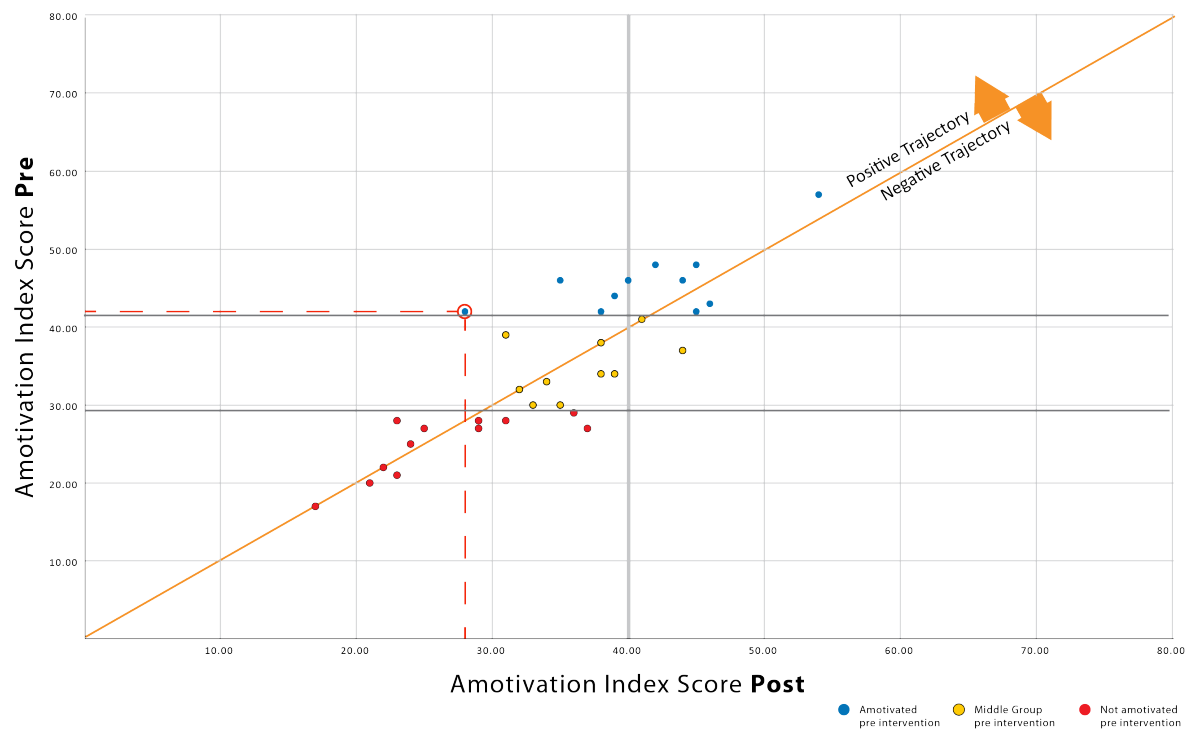


Fig. 5.3. Scatterplot showing the self-report pre and post measurements of overall academic amotivation.

The 'Amotivated Group' are the main group of interest in this research, represented by blue dots. Fig. 5.3 shows eight moved in a positive direction, and two moved in a negative trajectory.

By contrast for the 'Middle Group', represented by yellow dots, only had one case move in a positive direction, three stayed the same and six moved in a negative direction.

For the 'Not Amotivated Group', represented by the red dots, three cases moved in a positive direction, one stayed the same and seven moved in a negative direction.

Scatterplots provide a quick visual method of surveying results. From the scatterplot in Fig. 5.3 it can be seen that the Amotivated Group appear to have benefitted more from the intervention than the other groups, and that the other two groups appear to have had a more negative response; however, the next sections will investigate these results for statistical significance.

5.5.2 Intervention impact on overall academic amotivation.

Experiment One was to test the materials and process, and to see if boost nudges had impact on overall self-report general academic amotivation. Fig. 5.4 below represents the mean AAI scores for the three groups Pre and Post intervention.

The Amotivated group were the experimental group, where it was hypothesized the intervention might have an impact. The data in Fig. 5.4 shows a reduction in amotivation from a mean of 45.82 to 41.45 a reduction of 4.37 (9.5%).

In testing for significance in the reduction of general amotivation within the Amotivated group, a Wilcoxon signed-rank test showed that a 2-week, 5 x nudge nudges intervention elicited a positive, statistically significant, change in AAI for 'Amotivated' participants ($Z = -2.324$, $p = 0.02$). Median was 46 pre- and 42 post-nudges.

The participants in the Not Amotivated group were considered the control group. They were not showing strong indications of amotivation therefore it was hypothesized that an amotivation intervention would have little or no effect. The data in Fig. 5.4 shows a statistically insignificant slight increase in amotivation from a mean of 24.92 to 26.42 an increase of 1.5 (6%).

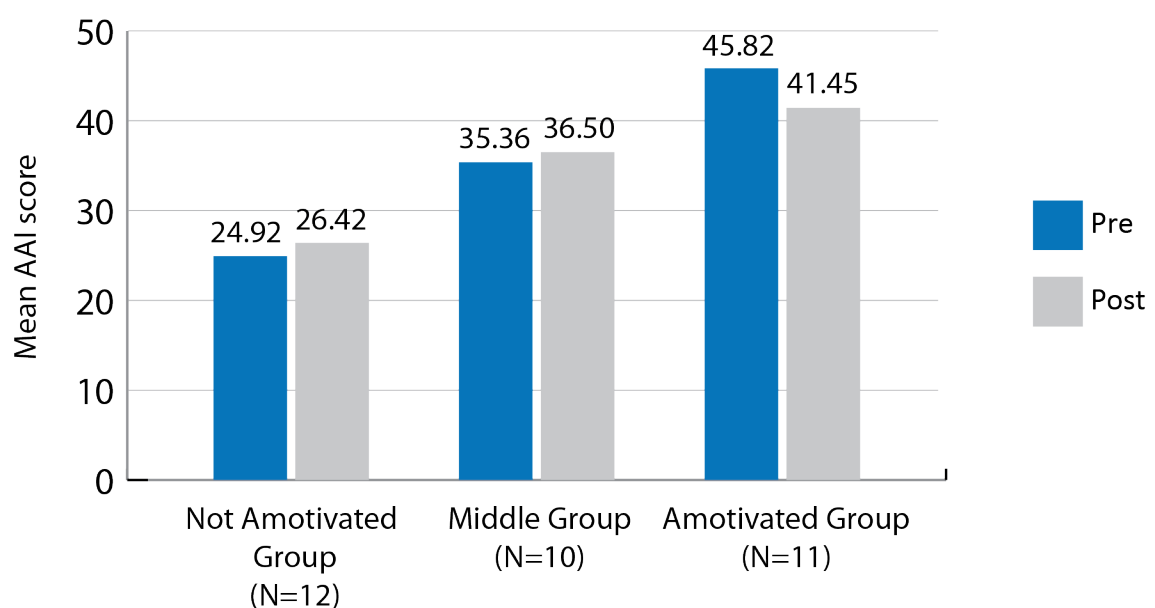


Fig. 5.4. AAI Pre and Post mean scores by Amotivation group.

The participants in the Middle Group also showed a statistically insignificant slight increase in amotivation from a mean of 35.36 to 36.50 an increase of 1.14 (3%).

It should be noted that throughout this thesis effect sizes, like the change in medians reported here, might not resonate as very large, but they are statistically significant. The effect sizes need to be viewed in the context of resulting from a short two-week intervention with no prior or follow up supports in place. (see Appendix G for full statistical analysis).

5.5.3 Intervention impact on sub-scales of academic amotivation.

The AAI contains four subscales which measure the amotivation levels associated with the subcomponents of, Ability, Value, Effort, and Task Characteristics. Each subscale is calculated by adding a different four items of the 16-item AAI providing four items per subscale. The full results are shown below in fig. 5.5, and the full analysis is contained in Appendix H.

The Amotivated Group, the target category, showed a reduction of 1.81 (19.4%) Pre and Post for the Ability subscale mean score. The Value mean reduced by 1.00 (9.9%), the Effort mean reduced by 1.74 (12.8%) and the Task Characteristic reduced by 0.18 (1.4%).

In testing for significance in the reduction of amotivation within the Amotivated Group by subscale, a Wilcoxon signed-rank test showed that a 2-week, 5 x 'boost nudge nudges intervention elicited a positive statistically significant change in Ability subscale for participants from the Amotivated group ($Z = -2.155$, $p = 0.031$), median was 9 pre- and 8 post intervention. A statistically significant change in Effort was also found for the amotivated group ($Z = -2.155$, $p = 0.037$), median was 14 pre- and 12 post intervention. No significance was shown for the other two subscales.

The Not Amotivated group showed increases across the Ability, Value and Task subscales Pre and Post mean scores. In testing for significance, a Wilcoxon signed-rank test showed that a 2-week, 5 x 'boost nudge nudges intervention elicited a negative statistically significant change in the Ability subscale for participants from the Not Amotivated group ($Z = -1.983$, $p = 0.047$), median was 5 pre- and 6 post intervention.

The Middle Group showed increases across the Value, Effort and Task subscales Pre and Post mean scores. In testing for significance, no statistically significant results were found.

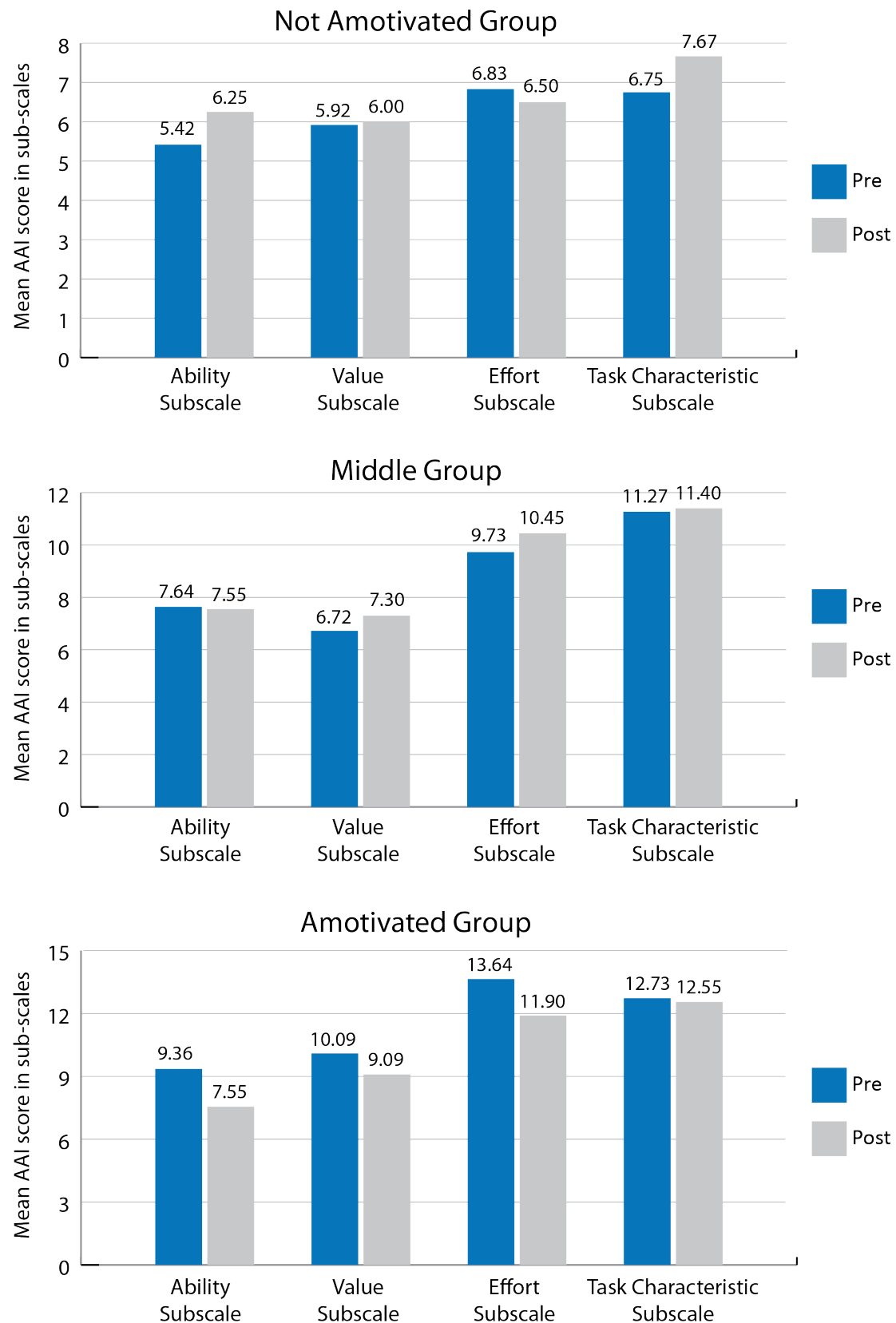


Fig. 5.5. Three Amotivation groups' AAI subscales Pre and Post mean scores.

5.5.4 Intervention impact on academic amotivation by nudge type.

In Experiment One the participants were randomly assigned to either the Ability nudge group or Value nudge group by sorting them according to their mobile phone numbers. This meant there was no reason to expect the nudge type would have a stronger effect on either group. However, there was the opportunity to explore if either the Value or Ability nudges had a more significant effect. The results are shown in Fig. 5.6 below.

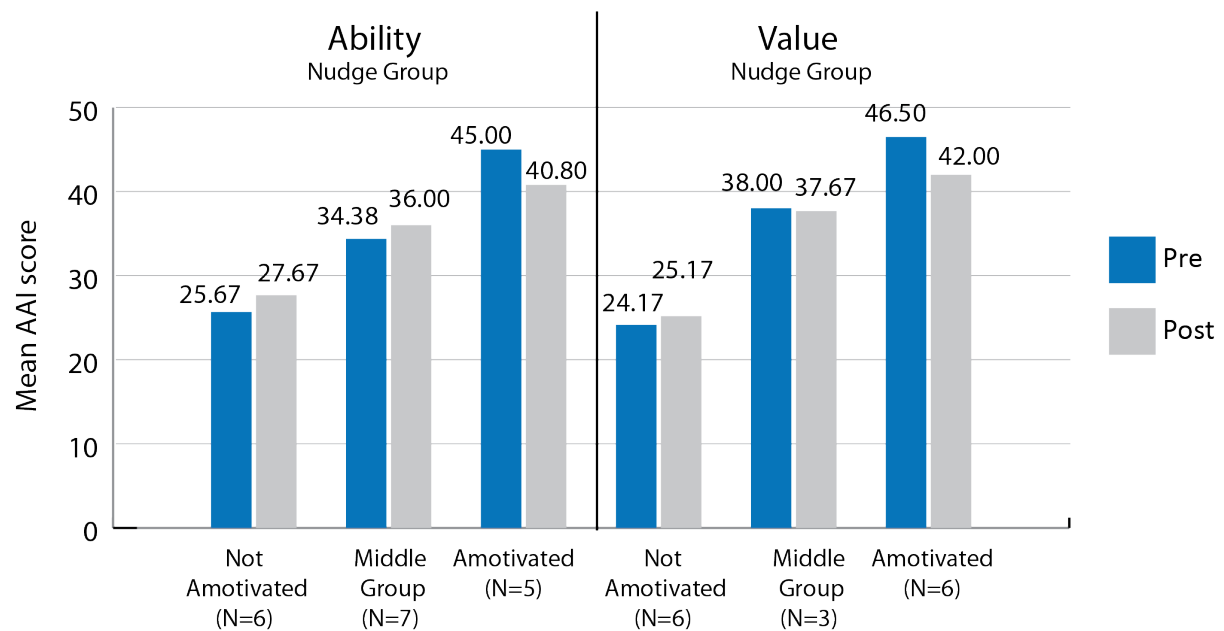


Fig. 5.6. Participants' AAI Pre and Post mean scores by nudge type and Amotivation level groups.

In exploring the mean differences in AAI scores Pre and Post, for the Amotivated group, the change was very similar across the two nudge categories. For the Amotivated group, the participants receiving Ability nudges showed a reduction in mean score of 4.2 (9.4%), while those receiving the Value nudges showed a reduction in mean score of 4.5 (9.7%). In testing for significance, no significant change was shown, which may be accounted for by the small numbers involved when splitting the groups to this level.

The Not Amotivated group showed a statistically insignificant increase in both nudge groups. The Middle Group showed an AAI decrease in the Value nudge group, Pre and Post and an increase in the Ability nudge group. In testing for significance, the increase was found to be statistically significant. a Wilcoxon signed-rank test showed that a 2-

week, 5 x 'boost nudge nudges intervention elicited a negative statistically significant change in the AAI for participants from the Middle group receiving Ability nudges ($Z = -2.032$, $p = 0.042$), median was 33.5 pre- and 35 post intervention, see Appendix I for full statistical detail.

It should be noted that with only 34 participants in Experiment One, breaking the data down to this level can mean small numbers per group which can skew analysis. However, visually as shown in fig. 5.6 the positive change was biggest for the two Amotivated groups.

5.5.5 Intervention impact on associated sub-scales of academic amotivation to nudge type.

As discussed in the previous section, there was no statistically significant impact shown in the AAI scores by nudge type received for the target 'Amotivated group'.

While the assignment of participants to nudge groups in Experiment One was randomised, the analysis in this section sought to investigate if the targeted nudges had more impact on the targeted subscale. For instance, for the Amotivated group receiving Ability nudges was there a larger impact on the Ability subscale than the Value subscale, and vice versa. Visually Fig. 5.7 below shows that there was support for this hypothesis within the Amotivated Group.

The Amotivated group receiving Ability nudges showed a reduction in mean score of 2.4 on the ability scale, while only showing a 0.4 reduction on the value scale. Conversely, the Amotivated group receiving the Value nudges showed a mean score reduction of 1.5 on the value scale, and a 0.7 reduction in the ability scale. In analysing these findings for significance, the reduction in the Ability subscale for the Amotivated Group receiving Ability nudges was a statistically significant result. A Wilcoxon signed-rank test showed that a 2-week, 5 x 'boost nudge intervention elicited a positive statistically significant change in the Ability subscale for the Amotivated group receiving Ability nudges ($Z = -2.032$, $p = 0.042$), median was 8 pre- and 7 post intervention.

The Middle Group receiving the Ability nudges showed increases in both the Ability and Value subscales. Conversely the Middle Group receiving Value nudges showed decreases on the same two scales, see Fig. 5.8. No significance was found in these results.

The Not Amotivated group as shown in Fig.5.9 scored higher or even in Pre to Post scores across all groups and scales. No significance was found in these results.

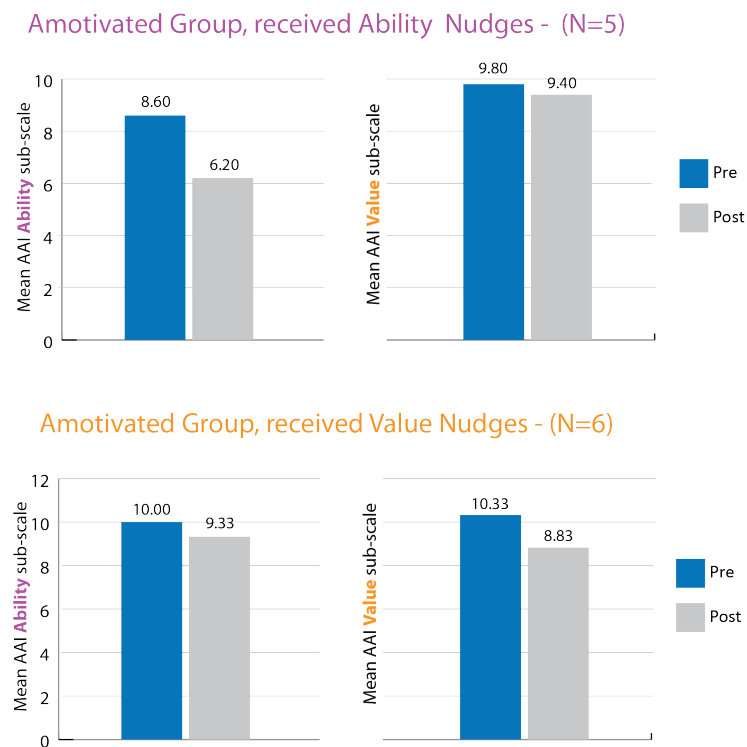


Fig. 5.7. Amotivated Group participants split by Nudge Group, Pre, and Post mean scores in; 'Ability,' and 'Value' subscales of AAI.

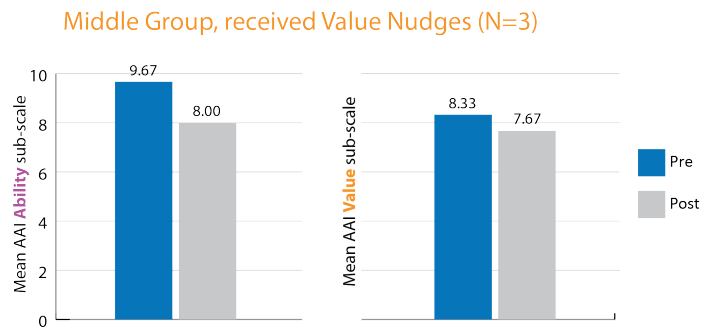
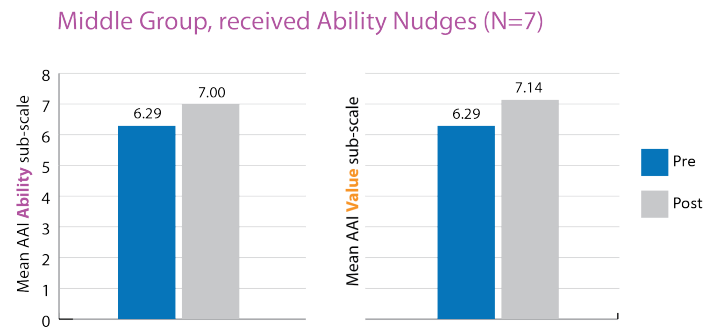


Fig. 5.8. **Middle Group** participants split by Nudge Group, Pre, and Post mean scores in; 'Ability,' and 'Value' subscales of AAI.

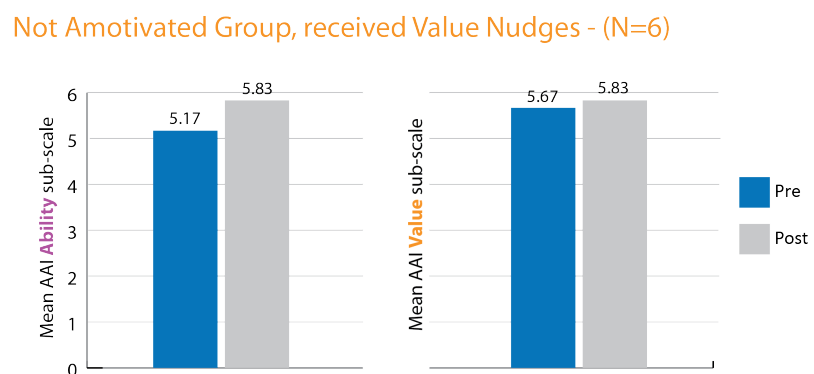
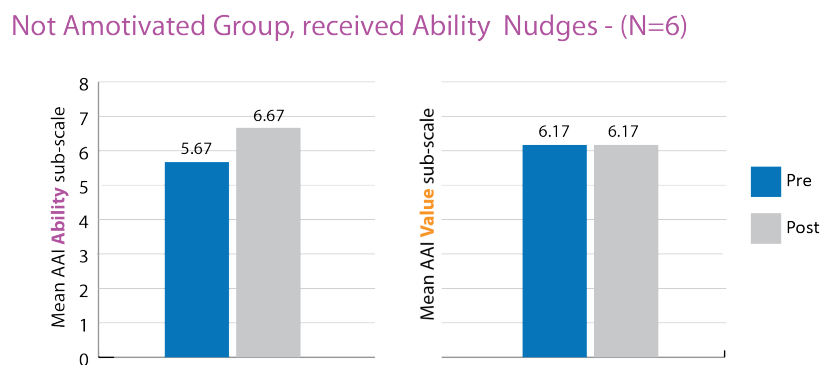


Fig. 5.9. **Not Amotivated Group** participants split by Nudge Group, Pre, and Post mean scores in; 'Ability,' and 'Value' subscales of AAI.

5.6 Data and Analysis – Self-report of behaviour intent

A component of this research sought to investigate the potential impact the targeted interventions had on negative academic behaviours. Specifically, as discussed in Chapter 4, performance measures and measures of maladaptive behaviours.

In Experiment One behaviour evidence was collected through pre and post self-reports leveraging Legault et.al.'s (2006) 13 item questionnaire. The questionnaire contains subscales related to the four areas of, Performance, Maladaptive behaviour, Self-esteem, and Intention to Drop-out (see appendix A).

5.6.1 Indicators related to performance.

In relation to indicators of Performance there were three self-report items. The first item asked participants “What has been your average grade this year?” the question should have been more precise. The responses that came through used different scales, for example, 2.1, B, 70%, 60-70, and ‘none yet’. There was no clear way to align these various formats in a meaningful way, therefore for Experiment One this item was omitted.

The other two self-reported items were seven-point Likert scales. In the original Legault format the participants were asked to ‘Please rate your own perceived proficiency in topic A’, and ‘Please rate your own perceived proficiency in topic B’. Given the multi course nature of the participants in this experiment this was amended to ‘Please rate your own perceived proficiency in a subject you enjoy’, and ‘Please rate your own perceived proficiency in a subject you enjoy least’. Investigating these items both individually and combined across all groups there was no significance shown in relation to pre and post measures, see Table 5.2 below and Appendix K for full detail.

5.6.2 Indicators related to maladaptive behaviours.

Self-report measures of Maladaptive Behaviour were served by three items. The first item asked participants to self-report the number of hours that they spent studying and doing homework every week. For the Amotivated and Middle groups there was no significance found. However, a Wilcoxon signed-rank test showed that a 2-week, 5 x ‘boost nudge nudges intervention elicited a positive statistically significant change in hours studied for

participants from the Not Amotivated group who received the Ability nudges, ($Z = -1.992$, $p = 0.046$), median was 16 pre- and 27.5 post intervention. In looking at the data there were some extreme changes among individual responses which may affect this result.

The second two items were seven-point Likert questions around how frequently participants reported being, late for class, and skipping class. Investigating these items individually and combined within the amotivated groups, no significant difference in relation to pre and post measures were found across all groups, see Table 5.2 and Appendix L for full detail.

5.6.3 Indicators related to self-esteem and intention to drop-out.

Performance and Maladaptive behaviours are the focus of this research; however, the tools being used provide ad-hoc opportunities to look for impact in relation to other behaviours. Four Likert questions relate to 'Self-esteem' and three relate to 'Intention to drop-out'. Each category's questions were grouped by adding the scores together and investigated to look for indicators of pre and post impact. No significant difference was found across all groups, see Table 5.2 and Appendix M for full detail.

Group	Message Type Received	Self Report Measure of Behaviour	N	Pre Score	PostScore	Difference Pre/Post	Wilcoxon Significance Test (Significant at 0.05)
Amotivated	Value	Performance 1. Rate your own perceived proficiency	6	8.8333	8.2000	-0.6333	0.680
		Maladaptive Behaviour 1. Hours, studying and assignments	6	13.1667	26.5000	13.3333	0.104
		Maladaptive Behaviour 2. 2 items	6	5.8333	5.1667	-0.6667	0.593
		Self Esteem. 4 items	6	18.1667	17.5000	-0.6667	0.916
		Intention to Drop Out. 3 items	5	8.5000	8.6000	0.1000	0.786
	Ability	Performance 1. Rate your own perceived proficiency	5	9.2000	9.4000	0.2000	0.785
		Maladaptive Behaviour 1. Hours, studying and assignments	5	20.8000	25.4000	4.6000	0.345
		Maladaptive Behaviour 2. 2 items	5	7.2000	8.2000	1.0000	0.465
		Self Esteem. 4 items	2	17.0000	16.5000	-0.5000	0.655
		Intention to Drop Out. 3 items	4	8.5000	9.2500	0.7500	1.000
Middle Group	Value	Performance 1. Rate your own perceived proficiency	3	8.6667	8.3333	-0.3333	0.655
		Maladaptive Behaviour 1. Hours, studying and assignments	3	17.0000	13.0000	-4.0000	0.102
		Maladaptive Behaviour 2. 2 items	3	8.3333	7.0000	-1.3333	0.157
		Self Esteem. 4 items	3	16.0000	15.3333	-0.6667	0.655
		Intention to Drop Out. 3 items	3	3.3333	4.0000	0.6667	0.655
	Ability	Performance 1. Rate your own perceived proficiency	7	9.6250	9.0000	-0.6250	0.739
		Maladaptive Behaviour 1. Hours, studying and assignments	7	12.2143	9.8750	-2.3393	0.400
		Maladaptive Behaviour 2. 2 items	8	4.6250	5.3750	0.7500	0.450
		Self Esteem. 4 items	6	15.3750	16.6667	1.2917	1.000
		Intention to Drop Out. 3 items	8	4.3750	5.0000	0.6250	0.498
Not Amotivated	Value	Performance 1. Rate your own perceived proficiency	4	9.1667	9.7500	0.5833	0.276
		Maladaptive Behaviour 1. Hours, studying and assignments	6	41.5000	38.8333	-2.6667	1.000
		Maladaptive Behaviour 2. 2 items	5	6.0000	5.2000	-0.8000	0.465
		Self Esteem. 4 items	3	18.4000	15.0000	-3.4000	0.180
		Intention to Drop Out. 3 items	4	5.2000	3.0000	-2.2000	0.180
	Ability	Performance 1. Rate your own perceived proficiency	6	11.0000	10.5000	-0.5000	0.854
		Maladaptive Behaviour 1. Hours, studying and assignments	6	15.8333	32.6667	16.8333	0.046
		Maladaptive Behaviour 2. 2 items	5	6.3333	5.4000	-0.9333	1.000
		Self Esteem. 4 items	4	16.0000	16.8333	0.8333	0.102
		Intention to Drop Out. 3 items	6	3.6667	5.1667	1.5000	0.066

Table 5.2. Self-report measures of behaviour by Group and Nudge type received.

5.7 Summary

The main purpose of the initial experiment was to investigate if student academic amotivation state could be impacted through an intervention leveraging a nudges approach. As shown in Fig. 5.4 and reported in section 5.5.2 a Wilcoxon signed-rank test showed that a 2-week, 5 x nudge nudges intervention elicited a positive, statistically significant, change in AAI in 'Amotivated' participants ($Z = -2.324$, $p = 0.02$). Median was 46 pre- and 42 post-nudges. The intervention had no significant impact on participants from the Middle Group or Not Amotivated Group which might be expected as the intervention took a problem first approach from the start. Therefore, participants who are not being affected by the problem of academic motivation might not be expected to improve as they are not amotivated to start with.

The participants in this experiment were allocated to either the 'ability' or 'value' nudge group through randomisation. However, in section 5.5.5 some initial support was shown that the targeted nudges did lead to larger decreases in the associated areas of amotivation. The reduction in Ability amotivation for the Amotivated group receiving Ability nudges showing statistical significance.

The other focus of the initial experiment was to trial the tools and methods adopted, designed in line with the implementation framework. While there was an issue highlighted in section 5.6.1 around self-report grades the intervention worked in line with expectations and appropriate for further interventions.

Chapter 6 – Experiment Two

6.1 Introduction

In Chapter 5 it was reported that a 2-week, 5 x nudge nudges intervention elicited a positive, statistically significant, change in self-report general amotivation for ‘Amotivated’ participants. In addition, the amotivated participants receiving Ability nudges yielded a statistically significant reduction in Ability amotivation based on the self-report AAI subscales.

The participants in Chapter 5 were allocated to their nudge groups by randomisation. The main focus of Experiment Two was to build on the Chapter 5 findings. In Experiment Two, prior to sending nudges, the participants were categorized in relation to the subcomponents of Ability and Value. Their current state was assessed based on scores from the Pre survey and they were assigned meaningfully to either the ‘Ability’ or ‘Value’ nudge group. The targeted nudges were then sent, and the final results investigated.

This Chapter discusses the set up for the experiment, the materials and procedures deployed in Experiment Two, the analysis undertaken in reviewing the data gathered and presents the findings in relation to self-report, amotivation and behaviors.

The participants for Experiment Two were students at Trinity College Dublin (TCD), a public university in Ireland, ranked number 1 in the country and among the top 100 worldwide in 2023². The population of interest for this research was first year undergraduate students. The participants in Experiment Two were first year engineering students studying a computer science module as part of their course.

6.2 Ethics

The necessary ethical permission was sought and received from TCD (see Appendix N). All participants were 18 or older. An information sheet explained to participants the background and purpose of the research and the intended use of any data collected.

² <https://www.topuniversities.com/universities/trinity-college-dublin-university-dublin>

Participants had access to a copy of the information sheet and the informed consent sheets on the college VLE. The information sheet and the informed consent sheet were explained to the students, and they were given the opportunity to ask questions. The first question in the survey asked them to agree to the following statement “SCSS, 2022: *I have read the information sheet and consent form for Peter Gillis' research project and agree to participate as per the information explained to me*”.

The submitted ethics was very similar to the version submitted to GCD in Experiment One. TCD sought the inclusion of a section on GDPR and an additional stage to the survey submission point to clarify the students’ understanding and allow for withdrawal. The submission statement read as follows “*Thank you for your valued input and time, please click the 'Proceed' option below to record your responses. If you decide to withdraw, click on 'Decline' and your responses will not be recorded. When you have made your choice please click the 'Submit'* (see Appendix F for full ethics submission to GCD). To comply with this request some additional programming was required to the Qualtrics survey platform.

6.3 Participants

The researcher works for TCD, and through connections to several professors approached them to seek interest in the research. A senior lecturer in the School of Computer Science and Statistics expressed interest in participating.

For Experiment Two the focus was tightened to include only first year undergraduates. The class size made available by the senior lecturer had close to 200 students. The module was computer science for first year engineering students.

Due to having Covid, the researcher briefed the students remotely, via Zoom. The information and consent forms were discussed and provided on the VLE. The students who consented, by agreeing to the first question, were given approximately eight minutes to complete the initial survey online, hosted on Qualtrics.

89 participants completed the initial survey, they received 6 nudges via text nudges over the following two weeks. Following the last nudge, the participants were asked to

complete the second survey. 54 participants from the same class completed the second survey, thus providing 54 valid cases for analysis.

6.4 Materials and methods

This research adopted a Design Based Research methodology, where each experiment builds on the findings and insights from the previous. Experiment Two leveraged and built on the materials from the initial experiment to align with the goals of Experiment Two. In this section the updated process and procedure from the initial experiment are described to demonstrate how the data was captured.

6.4.1 The survey

The same questions were used in both the pre and post surveys. The surveys were developed as online artefacts in Qualtrics and were based on the questions and format as described primarily for Experiment One in section 5.4.1. Additions included the amendments requested by TCD ethics committee as discussed in section 6.2.

In Experiment One there were issues reported around the formats submitted when gathering self-reported previous grades (see section 5.6.1). In addition, as the cohort for Experiment Two were first-year students, the participants had very few reference points for previous grades. Therefore, it was decided to omit this question for this experiment.

6.4.2 Defining the nudge groups.

For Experiment One, participants were randomly allocated to either the 'Ability' or the 'Value' nudge group. Experiment Two sought to allocate the participants meaningfully to either group based on their profile from the initial survey's results, and prior to deploying the nudges.

To measure overall academic amotivation, participants completed the 16 item self-report Academic Amotivation Index (AAI), which also contains four subscales. Of the sixteen statements in the AAI, four are dedicated to each of the subscales, Ability, Value, Effort and Task Characteristics. Each statement was answered using a seven-point Likert scale

where 1 = Does not correspond at all and 7 = Corresponds exactly. This gave each subscale a range from 4 to 28.

Initially each participant's reported scores for the two subscales of interest, 'Ability' and 'Value', were compared. The intention was to allocate participants to one of the two nudge groups based on each participant's recorded higher score. For example, if participant #67 reported 19 on the Ability subscale and 12 on the Value Subscale, he/she was allocated to the Ability nudge group. This process led to the identification of 35 participants for the Ability Group, 17 for the Value Group, and 2 participants who recorded identical scores for both. This group imbalance could have been left as it was, however, during this process it was noted that along with the two identical scores, nine participants recorded a difference of just 1 between the Ability and Value scores.

The following process was undertaken to investigate if broadening the score analysis to categories might help redress the number balance of participants in each group. Based on quartiles, a scale was devised for each subscale to categorise scores into four groups. Group 4 scoring 4 to 10 = motivated, Group 3 scoring 11 to 16 = not amotivated, Group 2 scoring 17 to 22 = amotivated, and Group 1 scoring 23 to 28 = very amotivated. The ability and value categories were then compared to identify each participant's group allocation.

In reviewing the 35 Ability group participants the process led to identifying 11 participants as belonging to the same Ability and Value quartile group. Of the 11, 7 participants aligned in the 'motivated' Group 4, and 4 participants aligned in the 'not amotivated' Group 3. Note these represent the more motivated groups, showing little amotivation. Along with the 2 participants who initially scored the same for both scales this gave 13 participants to be randomly assigned to either group. Seven were allocated to the Value Group while 6 remained with the Ability Group. The final numbers therefore were 30 in the Ability Group and 24 in the Value Group.

6.4.3 Defining amotivation level, groups.

The process described in section 4.4.2 was followed to allocate the participants to the Amotivated, Middle, or Not Amotivated groups. There were 18 allocated to each group based on their ranked scores on the AAI.

6.4.4 The Nudges

In Chapter 4, section 4.5, the design approach for the nudges was discussed, describing the approach to the development of two types of nudges to be deployed. Type A were nudges at the general or institution level, and Type B were at the module level to focus the relevance of the nudges. In Chapter 5, Experiment One could not leverage Type B nudges as there were three separate courses participating. In Experiment Two all participants were participating in the same module and so Type B nudges were possible and included.

The lecturer was briefed and provided with the 'Lecturer Toolkit', (see section 4.5.4) to support in the development of the Type B nudges. The lecturer provided two Type B nudges each for the Ability and Value groups, four nudges in total.

The researcher again performed research into both the Ability and Value aspects related to the Type A (more general) nudges, linked to the institution and the course being studied. Leveraging the 'Lecturer Toolkit', four Type A nudges were designed for both the Ability and Value groups, 8 nudges in total.

In total this led to six nudges in each group's nudge bank, the second and fourth nudge sent to each group were Type B, as shown in table 6.1 below.

Ability Nudges	Value Nudges
Hi, Peter Gillis from TCD here, thanks for agreeing to take part in my research. Here is the first nudge. Although cramming is better than not studying at all, are you better off spreading out your study? The answer is a resounding "yes."	Hi, Peter Gillis from TCD here, thanks for agreeing to take part in my research. Here is the first nudge. Your school ranks 1st in Ireland, and in top 25 in Europe. Graduates from your school are highly sought after and demand is continuing to grow.
(Type B) The end-of-semester assessment of this module includes a MCQ. The MCQ questions will be very similar to weekly mini-quiz questions, so study the feedback provided for those on Blackboard.	(Type B) CSU11XXX teaches you to solve problems using a computer programming language. Engineers of all kinds need to know how to use computing to solve engineering problems.

100 years of research and hundreds of experiments show that ‘practice testing’ enhances learning and retention. So, get some past papers and give it a go!	In a recession, college graduates are less vulnerable to layoffs. Statistically, people who suffer the most are employees with only second-level education.
Just sitting down to study can be the hardest step. Pick a day over the next week, set aside a few hours, and commit to it. You’ll be surprised how effective it is.	Is it worth it? The Irish Times reported in 2019 that within five years of leaving college ICT graduates were the highest earners (€815 a week), followed by engineering (€730)!
(Type B) The programming test will test your skill at using loops, functions, and arrays to address a programming task. You can do well in it with relatively simple application of each of those topics, all of which we will revise in upcoming lectures.	(Type B) CSU22XXX follows on from this module. You will find it easier and do better in that if you have grasped the concepts in this one.
There is power in numbers, peer study groups are a great support and way to get moving. Talk to even just two of your classmates and give it a try!	Every year your school hosts a computing careers event! Bringing in employers to meet students just like you!

Table 6.1. Amotivational support ability and value boost nudges sent in Experiment Two.

6.4.5 The Intervention

Two aspects were deemed important to the timing of interventions. Firstly, if the intervention took place too early in the academic year the students may not have had enough experience of academic life to know how they felt or may be feeling initially overwhelmed at the change. Secondly, if the intervention took place too close to exams students may be distracted with exam preparation. To ask them to participate at this time would not be appropriate. In discussion with the lecturer, it was agreed to run this experiment in the first two weeks of April. This timing aligned to mid-semester of the second term and was deemed appropriate in relation to both the previous points.

The groups were categorised as described in section 6.4.2 yielding 30 in the Ability Group and 24 in the Value Group. The nudges were sent at the same time to each group. A schedule was drawn up for the deployment of the six nudges on Monday, Wednesday,

and Friday in the first week, and Monday, Wednesday, Thursday in the second week. On the Friday of the second week a seventh nudge was sent as follows *“THANK YOU! That’s it! As the last step, it is really important to please complete the survey again at the link below, <https://tinyurl.com/XXXX>. Best Peter”*.

The nudges were sent using the web-text facility from the researcher’s own mobile phone provider. This method required manual input each time and a maximum of five recipients for each nudge. This manual process necessitated the development of a spreadsheet to track phone numbers to nudges and groups. The process meant each time a nudge was sent to both groups it took approximately 20 minutes to deploy. To avoid interfering with participants’ personal time the nudges were sent between the hours of 9.00am to 4.30pm.

The link in nudge seven above acted as a prompt and delivered some initial responses, a follow up reminder was sent the following week, and the lecturer prompted the students in class. These various activities resulted in capturing the final 54 participants that completed the pre and post surveys, a response rate of 61% of the original 89 signed up participants.

6.5 Data Preparation

The captured data existed in two separate Qualtrics surveys, one pre and one post. Each data set was exported from Qualtrics as an IBM SPSS Statistics file.

Prior to combining the survey datasets a few variables were computed in each set, note some variables like Amotivated Category were only required in the pre as they represented benchmark profiles for groups. All variables created are described in table 6.2 below. If a variable below is referenced as Pre/Post, it means two versions of that variable were created. All variable names and labels in the post data set were appended with the word ‘Post’.

For analysis it was necessary to combine the two datasets into one. The pre dataset was sorted by student e-mail, then a new variable ‘Participant ID’ was inserted. The new variable was sequentially numbered from 1 to 84.

Next, the post dataset was sorted by student e-mail, the two sets were then compared. The relevant participant ID was assigned, in a new variable, to the matching email in the post dataset, as defined by the pre dataset. Note in a small number of cases there was a slight discrepancy in the format the email was written pre and post. In these cases, the mobile number provided a secondary method of validation.

Pre/Post	Variable	Method	Purpose
Pre/Post	AAI Scale Score	Adding all 16 item response scores to the AAI index	Provide a profile of Academic Amotivation state.
Pre	Amotivated Category	Ranked scores on the AAI divided into 3 categories, Amotivated (highest third), Middle Group (middle Third) and Not Amotivated (lowest third)	Provides three categories Amotivation for comparison and investigation.
Pre/Post	Ability Scale Score	Adding the relevant 4 Ability item response scores to the AAI index	Provide a profile of Ability Academic Amotivation state. >14 equating to amotivated.
Pre/Post	Value Scale Score	Adding the relevant 4 Value item response scores to the AAI index	Provide a profile of Value Academic Amotivation state. >14 equating to amotivated.
Pre/Post	Effort Scale Score	Adding the relevant 4 Effort item response scores to the AAI index	Provide a profile of Effort Academic Amotivation state. >14 equating to amotivated.
Pre/Post	Task Value Scale Score	Adding the relevant 4 Task value item response scores to the AAI index	Provide a profile of Task value Academic Amotivation state. >14 equating to amotivated.
Pre	Ability Quarters	Recalculate Ability scale Score to quartiles as described in section 6.4.2	Provide classification of Ability levels of Amotivation
Pre	Value Quarters	Recalculate Value scale Score to quartiles as described in section 6.4.2	Provide classification of Value levels of Amotivation
Pre	Nudge Group	Based on calculations described in section 6.4.2, 1 = Value, 2 = Ability	Provide two categories 'Ability' and 'Value' for comparison.
Pre/Post	Self-Report maladaptive Behaviours	Adding the relevant 2 self-report items related to maladaptive behaviours	Profile in relation to maladaptive behaviours, related to Value.
Pre/Post	Self-Report self esteem	Adding the relevant 4 self-report items related to self-esteem	Profile in relation to self-esteem, related to Value.

Pre/Post	Self-Report on intention to drop out	Adding the relevant 3 self-report items related to intention to drop out	Profile in relation to self-esteem, related to intention to drop out
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Table 6.2. Variables computed from the data sets collected via the pre and post surveys.

The pre dataset was saved as a copy to provide the base for the final analysis set. The 54 participant IDs as defined by the post set were kept and all other cases were deleted.

The final analysis set, and the post set were then sorted by Participant ID. The post variables were copied and pasted into the final analysis set. The participant ID and emails provided a two-way means of checking the alignment of the combined sets. A full check, and then random checks were taken across the data set comparing each of these aspects for alignment. When the checks were completed to satisfaction, all college emails and mobile phone numbers were deleted from the data set along with some variables Qualtrics captures automatically like completion date, that were not relevant to the research. To view the full dataset, see Appendix O.

6.6 Data Analysis - Amotivation

Building on the findings from Experiment One, where there were statistically significant reductions in Amotivation, an initial analysis sought to investigate if evidence of impact on general amotivation could be found with an undergraduate cohort, the specific population of interest. Also, to investigate if the profiling of the participants prior to the intervention could influence the impact on the relevant subcomponent, Ability or Value, of amotivation via targeted nudges. In other words, does deploying ‘ability’ nudges to a participant who is showing more ‘ability’ amotivation than ‘value’ amotivation impact the predominant area of amotivation more than the other?

6.6.1 Descriptive Statistics

54 participants completed both the pre and post surveys representing the usable sample. All participants were completing the same computer science module as part of their engineering undergraduate course. The final sample students’ scores on the Pre-Academic Amotivation Index were reviewed for normal distribution as shown in Fig.6.1. The fit was good with no significant skewness or kurtosis shown.

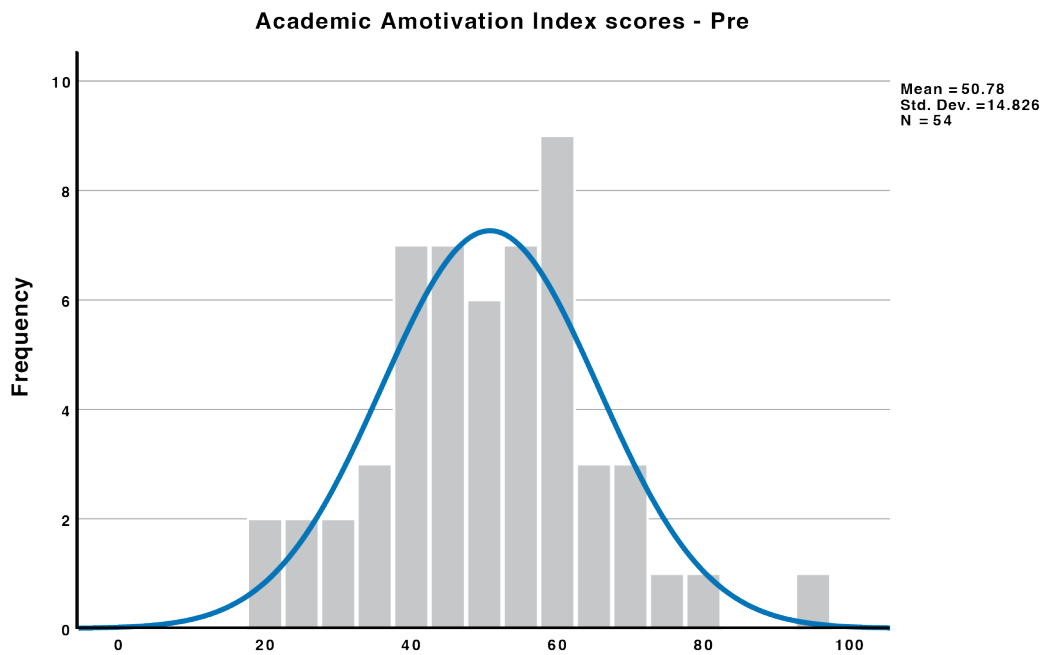


Fig. 6.1. Pre intervention, frequency distribution of answers to the 16 item Academic Amotivation Index, with normal distribution curve overlayed.

The researcher cannot control for which participants complete the Pre and Post surveys. However, Fig 6.2 shows a good balance was achieved with 30 students from the Ability nudge Group and 24 from the Value nudge Group completing both. Fig. 6.2 also shows The Amotivated and Not Amotivated groups had a reasonable distribution, while the 72.23% of the Middle Group received the Ability nudges.

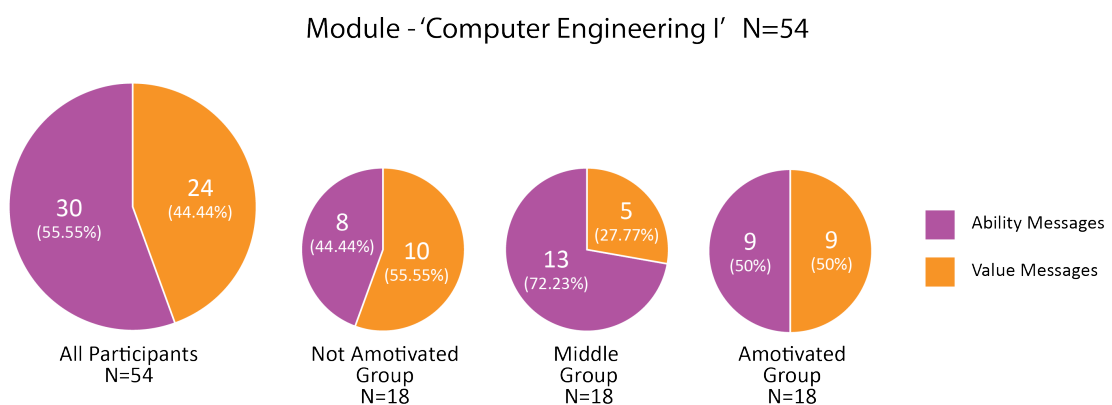


Fig. 6.2. Final participant groups completing both Pre and Post AAI split by Amotivation Category and nudge group.

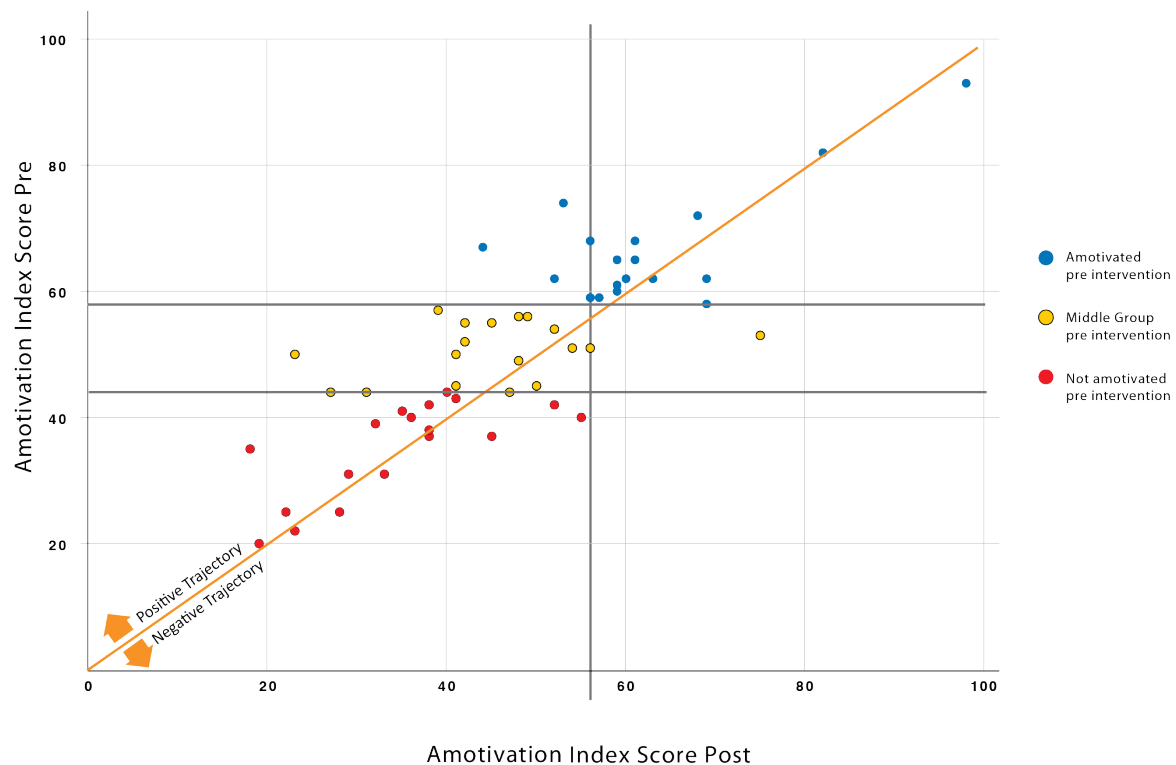


Fig. 6.3. Scatterplot showing the self-report pre and post measurements of overall academic amotivation.

In section 5.5.1.1 it was explained that dots to the left and above the orange diagonal line represent participants where Amotivation reduced from Pre to Post AAI tests. The blue dots in Fig 6.3 represent the participants who scored in the highest third on the AAI, (pre intervention, and categorised as the Amotivated group). As indicated in Fig. 6.3, 14 blue dots, move in a positive trajectory, and 4 blue dots move in a negative trajectory. This interprets as 78% of the amotivated students moving in a positive trajectory (i.e. becoming less amotivated).

The Yellow dots represent the participants who scored in the middle third on the AAI, (pre intervention, and categorised as the Middle Group). The middle group showed a similar pattern where 13 moved in a positive direction, while 5 moved in a negative direction pre and post. This interpreted as 72% of the Middle Group moving in a positive trajectory.

Fig.6.3 also shows the direction of travel for the participants who scored in the lowest third on the AAI (pre intervention and categorised as the Not Amotivated Group). This

group, represented by red dots, showed 11 (61%) moved in a positive trajectory while 7 moved in a negative direction pre and post.

6.6.1 Intervention impact on overall academic amotivation.

In Chapter 5, Experiment One showed a statistically significant reduction in amotivation for the Amotivated group. The first analysis involved checking if this finding held true in Experiment Two, involving first-year students all taking the same module. Fig. 6.4 shows the results for overall academic amotivation in Experiment Two. The Amotivated group showed a reduction of 4.8 (7.3%) in AAI mean scores Pre and Post. The Middle Group showed a reduction of 5.61 (11.1%), while the Not-Amotivated group showed a reduction of 0.55 (1.6%).

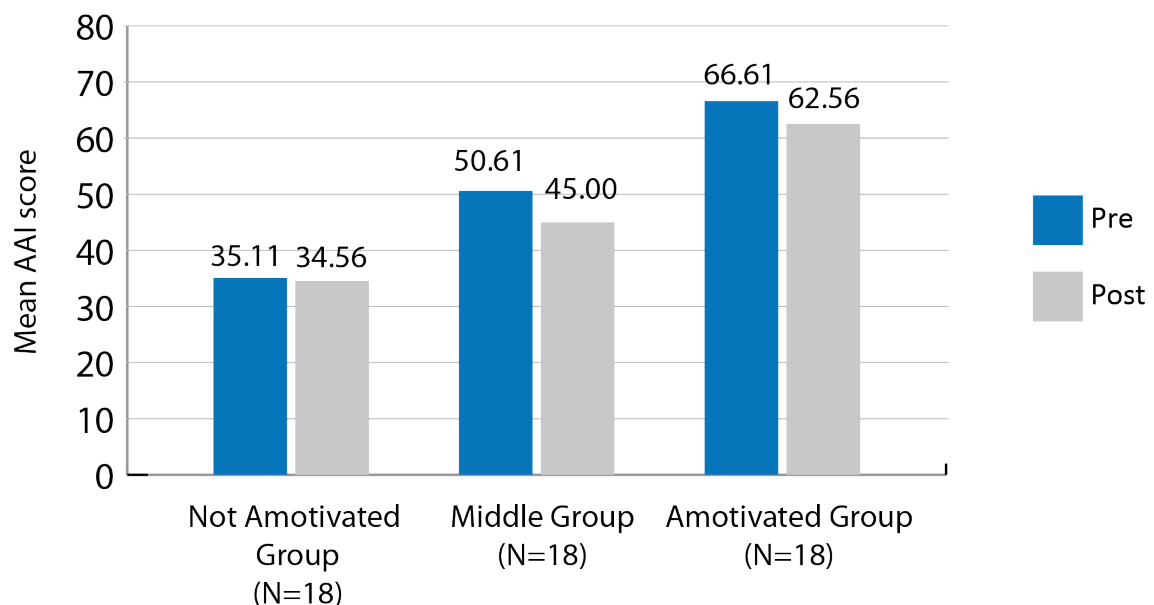


Fig. 6.4. AAI Pre and Post mean scores by group.

In testing for significance in the reduction of amotivation, a Wilcoxon signed-rank test showed that a 2-week, 6 x nudge nudges intervention elicited a positive, statistically significant, change in AAI in the 'Middle Group' participants ($Z = -2.113$, $p = 0.035$). Median was 51 pre- and 46 post-nudges. The intervention had no significant effect on the Not Amotivated group. The Amotivated Group saw the median drop from 63.5 to 59.5 in a near significant result at $p = .055$, (see Appendix P for full analysis).

6.6.2 Intervention impact on sub-scales of academic amotivation.

The subscales within the 16 item AAI measure the subcomponents within amotivation, each containing four specific items out of the 16. Adding each set of four scores together provides the score for each subscale.

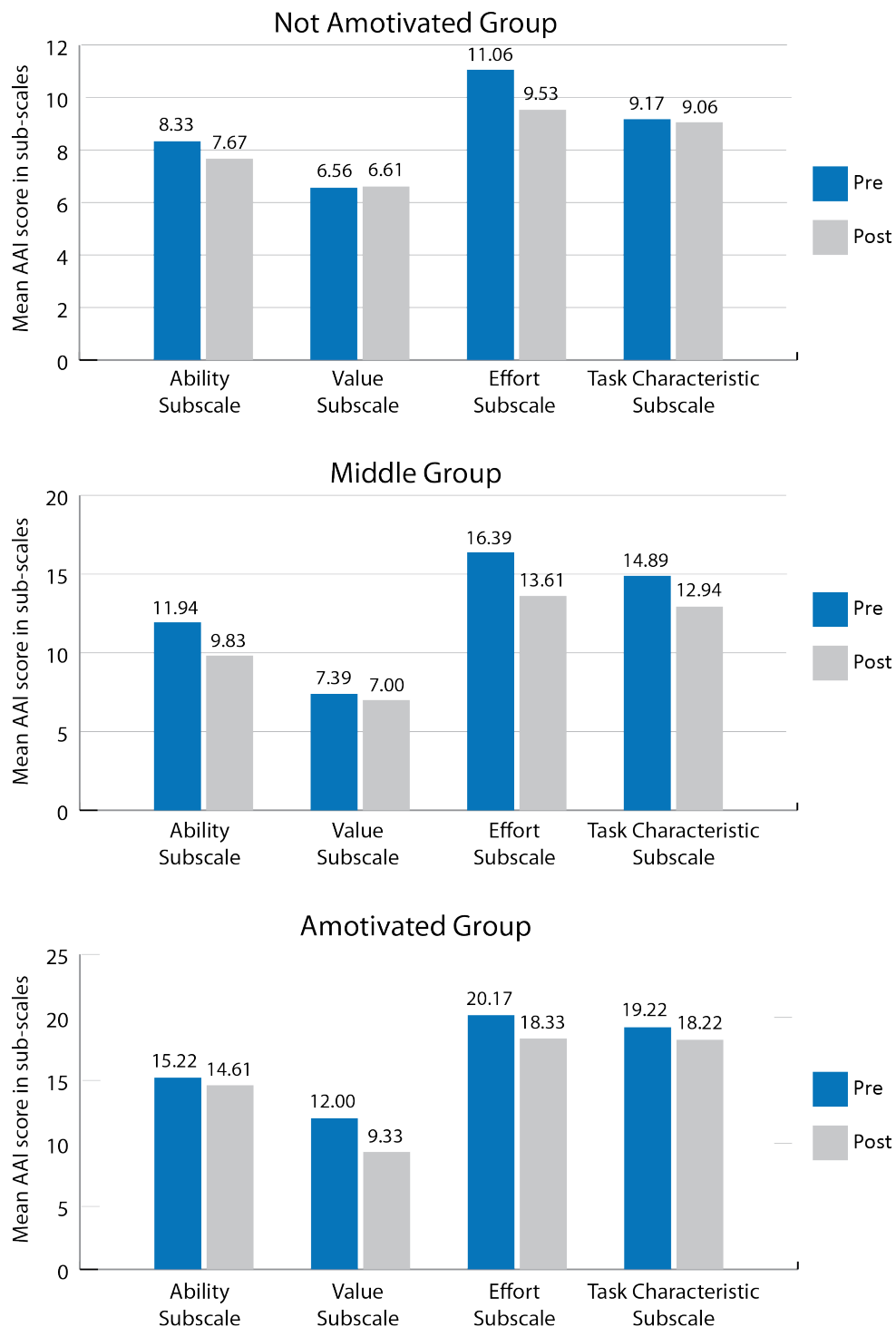


Fig. 6.5. Three Amotivation groups' AAI subscales Pre and Post mean scores.

For the Amotivated Group, all four subcomponents showed a reduction in Pre and Post (see Fig. 6.5). Investigating significance in the reductions a Wilcoxon signed-rank test showed that a 2-week, 6 x 'boost nudge nudges intervention elicited a statistically significant positive change in Value for participants from the amotivated group ($Z = -2.535$, $p = 0.011$), median was 12.5 pre- and 9 post intervention. A significant change in Effort was also found for the amotivated group ($Z = -2.001$, $p = 0.045$), median was 19.5 pre- and 18.5 post intervention. No significance was shown for the Ability and Task Characteristics subscales.

The Middle Group also showed a reduction across all four subcomponents. A Wilcoxon signed-rank test showed that a 2-week, 6 x 'boost nudge nudges intervention elicited a statistically significant positive change in three of the sub-scales as follows. Ability Subscale ($Z = -2.603$, $p = 0.009$), median was 12 pre- and 9.5 post intervention. Effort Subscale ($Z = -2.811$, $p = 0.005$), median was 16 pre- and 13.5 intervention. Task Subscale ($Z = -2.383$, $p = 0.017$), median was 14.5 pre- and 13 post intervention.

The Not Amotivated Group showed a reduction across three of the subcomponents with a very slight increase in the Value subscale. None of the changes in this group were statistically significant. See Appendix Q for analyses.

6.6.3 Impact on AAI and associated sub-scales scores of academic amotivation, by nudge type and across Amotivation Groups.

In Experiment One the participants were allocated randomly to the nudge groups. Leveraging a Design Based Research approach one of the main progressions in Experiment Two was to allocate the participants to the nudge groups by profiling insights from the Pre survey. The method as described in section 6.4.2 led to 30 participants in the Ability Group and 24 in the Value Group. Figures 6.6, 6.7, and 6.8 below report participants', Pre, and Post mean scores across the following three scales; the 16 item AAI, the Ability subscale, and the Value subscale. The results are reported by both Amotivation group, and Nudge type received.

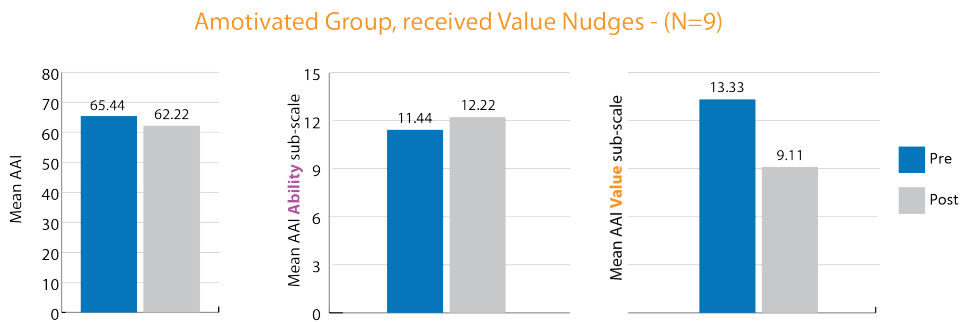
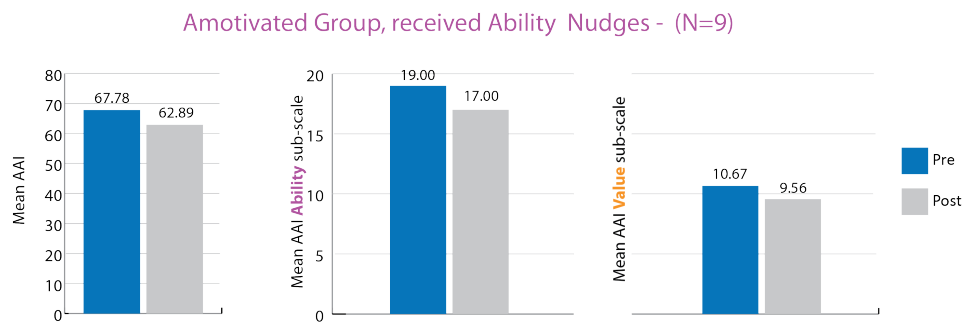


Fig. 6.6. Amotivated Group participants split by Nudge Group, Pre, and Post mean scores in; AAI, 'Ability,' and 'Value' subscales.

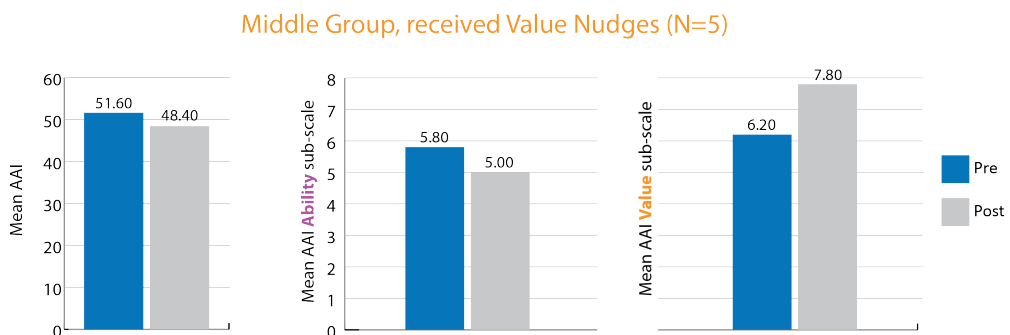
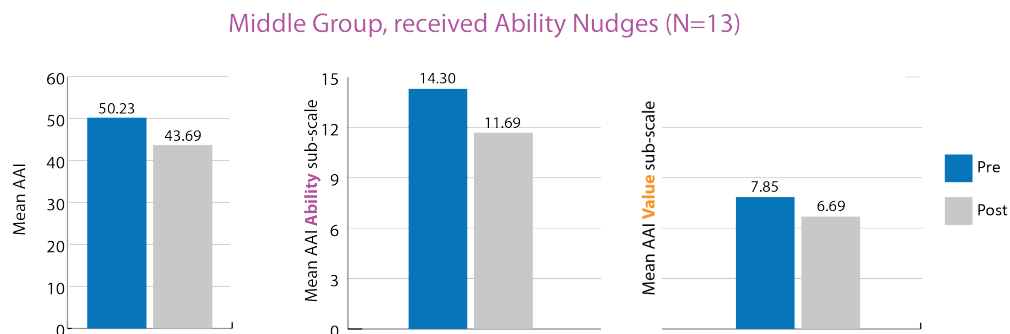


Fig. 6.7. Middle Group participants split by Nudge Group, Pre, and Post mean scores in; AAI, 'Ability,' and 'Value' subscales.

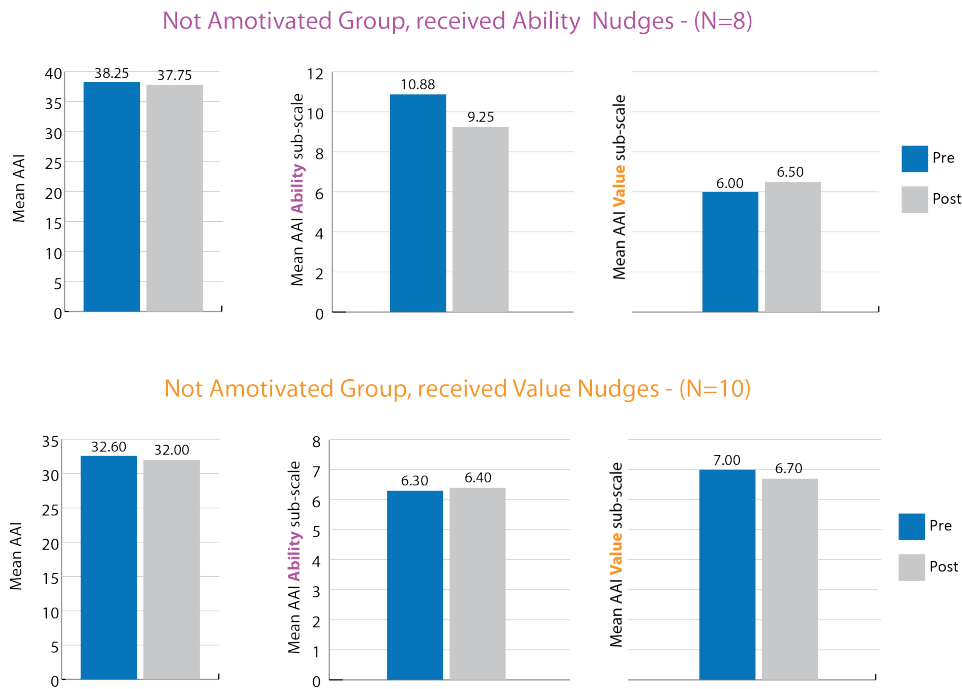


Fig. 6.8. Not Amotivated Group participants split by Nudge Group, Pre, and Post mean scores in; AAI, 'Ability,' and 'Value' subscales.

6.6.3.1 Discussing the results for each Group based on receiving Ability Nudges

The Amotivated Group receiving Ability nudges showed a reduction in mean scores across the AAI scale, the sub-scale Ability, and the sub-scale Value as shown in the top half of Fig. 6.6. In testing the findings no statistically significant results were returned.

The Middle Group receiving Ability nudges also showed a reduction across all three scales as shown in the top half of Fig. 6.7. In testing for significance, statistically significant results were returned for both general amotivation (AAI) and the sub-scale Ability. Wilcoxon signed-rank tests showed that a 2 week, 6 x 'boost nudge nudges intervention elicited a positive statistically significant change in; a) Overall AAI for participants from the Middle Group receiving Ability nudges ($Z = -2.063$, $p = 0.039$), median was 50 pre- and 47 post intervention, b) the Ability sub-scale for participants from Middle Group receiving Ability nudges ($Z = -2.586$, $p = 0.01$), median was 15 pre- and 12 post intervention.

The Not Amotivated Group receiving Ability nudges showed slight reductions in mean scores across the AAI scale and the sub-scale Ability. The sub-scale mean score for Value

increased slightly Pre and Post as shown in the top half of Fig. 6.8. In testing the findings no statistically significant results were returned.

6.6.3.2 Discussing the results for each Group based on receiving Value Nudges

The Amotivated Group receiving Value nudges showed reductions in mean scores across the AAI scale and the sub-scale Value. The sub-scale mean score for Ability increased Pre and Post as shown in the bottom half of Fig. 6.6. In testing for significance, a statistically significant result was returned for the sub-scale Value. A Wilcoxon signed-rank test showed that a 2-week, 6 x 'boost nudge intervention elicited a positive statistically significant change in the Value sub-scale for participants from the Amotivated Group receiving Value nudges ($Z = -2.383$, $p = 0.017$), median was 15.5 pre- and 11 post intervention,

The Middle Group receiving Value nudges showed reductions in mean scores across the AAI scale and the sub-scale Ability. The sub-scale mean score for Value increased Pre and Post as shown in the bottom half of Fig. 6.7. In testing the findings no statistically significant results were returned.

The Not Amotivated Group receiving Value nudges showed reductions in mean scores across the AAI scale and the sub-scale Value. The sub-scale Ability increased slightly Pre and Post as shown in the bottom half of Fig. 6.8. In testing the findings no statistically significant results were returned.

For full data analysis of both Ability and Value groups see Appendix R.

6.7 Data and Analysis – Self Report behaviour intent

As discussed in Chapters 4 and 5, along with reductions in amotivation state, the experiments are looking at impacts on negative academic behaviours associated with amotivation. Experiment Two leveraged the same self-report questionnaire used in Experiment One, apart from the self-report exam scores for reasons as discussed in section 6.4.1. The areas of interest were related to Performance and Maladaptive Behaviour, with the areas of Self-esteem and Intention to drop out also captured in the

process. The main results are shown in Table 6.3 and are discussed in the following sections. See Appendix S for full analysis.

Group	Message Type Received	Self Report Measure of Behaviour	N	Pre Score	PostScore	Difference Pre/Post	Wilcoxon Significance Test (Significant at 0.05)
Amotivated	Value	Performance 1. Rate your own perceived proficiency	8	4.7500	5.0000	0.2500	0.414
		Maladaptive Behaviour 1. Hours, studying and assignments	9	12.8889	18.2500	5.3611	0.176
		Maladaptive Behaviour 2. 2 items	8	5.0000	4.4444	-0.5556	0.461
		Self Esteem. 4 items	7	14.1250	13.1429	-0.9821	0.348
		Intention to Drop Out. 3 items	8	7.5000	7.2500	-0.2500	0.865
	Ability	Performance 1. Rate your own perceived proficiency	7	3.2222	3.7143	0.4921	0.102
		Maladaptive Behaviour 1. Hours, studying and assignments	9	17.5556	23.8889	6.3333	0.237
		Maladaptive Behaviour 2. 2 items	8	4.8889	4.2500	-0.6389	0.705
		Self Esteem. 4 items	7	19.0000	20.2500	1.2500	0.096
		Intention to Drop Out. 3 items	8	9.1111	8.8750	-0.2361	0.776
Middle Group	Value	Performance 1. Rate your own perceived proficiency	5	5.2000	6.0000	0.8000	0.180
		Maladaptive Behaviour 1. Hours, studying and assignments	5	7.4000	13.0000	5.6000	0.068
		Maladaptive Behaviour 2. 2 items	3	3.2500	4.6667	1.4167	0.180
		Self Esteem. 4 items	4	11.0000	8.2500	-2.7500	0.461
		Intention to Drop Out. 3 items	4	6.0000	4.8000	-1.2000	0.102
	Ability	Performance 1. Rate your own perceived proficiency	10	3.4000	4.8000	1.4000	0.017
		Maladaptive Behaviour 1. Hours, studying and assignments	12	16.9167	16.3333	-0.5833	0.735
		Maladaptive Behaviour 2. 2 items	12	4.3333	4.0000	-0.3333	0.719
		Self Esteem. 4 items	8	16.0000	13.8750	-2.1250	0.336
		Intention to Drop Out. 3 items	10	7.5000	6.7000	-0.8000	0.916
Not Amotivated	Value	Performance 1. Rate your own perceived proficiency	9	4.9000	5.2222	0.3222	0.461
		Maladaptive Behaviour 1. Hours, studying and assignments	10	21.8000	22.6000	0.8000	0.441
		Maladaptive Behaviour 2. 2 items	9	5.5556	5.1000	-0.4556	0.236
		Self Esteem. 4 items	8	10.8750	10.6667	-0.2083	0.528
		Intention to Drop Out. 3 items	10	4.3000	3.9000	-0.4000	0.593
	Ability	Performance 1. Rate your own perceived proficiency	7	4.1429	4.8750	0.7321	0.157
		Maladaptive Behaviour 1. Hours, studying and assignments	8	23.1429	22.7500	-0.3929	0.500
		Maladaptive Behaviour 2. 2 items	8	3.8750	5.1250	1.2500	0.223
		Self Esteem. 4 items	6	11.5000	10.5000	-1.0000	0.786
		Intention to Drop Out. 3 items	8	3.8750	5.1250	1.2500	0.461

Table 6.3. Self-report measures of behaviour by Group and Nudge type received.

6.7.1 Indicators related to performance.

Performance is a behaviour linked to Ability beliefs, one of the focus areas in this research. There were two Likert items in Experiment One related to participants' self-reported proficiency on both a module they liked, and one they didn't like. Self-reports on proficiency are linked to performance and therefore Ability beliefs. In Experiment Two the focus was on one module, to this end there was only one item in the performance category. The self-report question was phrased 'Please rate your own perceived proficiency in this module'. Investigating the data across the three groups of Amotivation, and Nudge types there was one significant result. A Wilcoxon signed-rank test showed that a 2-week, 6 x 'boost nudge nudges intervention elicited a positive statistically significant change in self-reported proficiency for the Middle Group participants receiving the Ability nudges ($Z = -2.392$, $p = 0.17$), median was 3.5 pre- and 5 post.

6.7.2 Indicators related to maladaptive behaviours.

Value is the other area of focus for this research which is linked to Maladaptive Behaviours. A measure related to Maladaptive behaviours was 'Self-reported hours studying'. In addition, there were two, seven-point Likert, questions around how frequently participants reported being late for class, and skipping class. These two items added together represented the score for the item 'Problem Behaviours'. There were no statistically significant results found related to these items across the three groups of Amotivation, and Nudge types.

6.7.1 Indicators related to self-esteem and intention to drop-out.

The other two ad hoc behaviour indicators captured relate to Self-esteem, and Intention to drop out. Self-esteem is calculated by adding the four relevant Likert scores together, however two of the questions are phrased positively and two negatively. To calculate self-esteem the results for the two positively phrased questions were recoded to reverse them. This meant a higher score represented less self-esteem. Three Likert scale items added provide the intention to drop out measure as per Experiment One. Neither result showed significance in testing. There were no significant results found related to these items across the three groups of Amotivation, and Nudge types.

Chapter 7 – Experiment Three

7.1 Introduction

This chapter discusses Experiment Three, the final experiment in this research. The experiments to this point investigated self-report measures of both amotivation, and negative academic behaviour. The previous results showed some support for the designed nudges having positive impact on the amotivated state of students while having a non-significant effect on those who were not amotivated.

In Experiment Three, the processes from Experiment Two were repeated, but importantly additional real-world behaviour measures were added and a larger cohort of 117 students were involved in the experiment. The goals of Experiment Three were,

- To test if the self-report scales would show support for impact of the approach at both the general amotivation and sub-component levels.
- Investigate if the intervention strategy and designed nudges had impact on the real-world measures of behaviour.
- Investigate if real-world measures like 'test results' could be used to predict amotivation presence, and profile.

The experimental setting for Experiment Three was once again Trinity College Dublin (TCD) and involved the participation of two first year undergraduate classes.

7.2 Ethics

The same ethics approval from TCD, previously discussed in section 6.2, remained in place for this experiment and covered all aspects of the experiment.

7.3 Participants

The focus of this experiment was on first year undergraduates, where there is evidence of academic amotivation as students transition from the scaffolded environment of secondary school (Gibney et al., 2011).

The same lecturer who participated in Experiment Two agreed to participate again. This provided access to first year undergraduate *engineering students* studying a computer science module. 102 students agreed to participate, completed the Pre survey, and received the nudges. 73 valid cases completed the Post survey representing the usable sample from this class, however on closer inspection two students had not provided all answers and were withdrawn leaving 71.

A second TCD senior lecturer expressed interest in the research and following a briefing from the researcher agreed to participate in Experiment Three. This provided access to first year undergraduate *computer science students* studying an introduction to computing module. The module looks at how programs execute on a microprocessor system, binary number systems and more. 83 students agreed to participate, completed the Pre survey, and received the nudges. 46 valid cases completed the Post survey representing the usable sample from this class. The two classes combined provided a valid sample of 117 students.

In a change to the previous process, and for both classes, the researcher was provided with a 15-minute slot, in-person, at in person lectures to brief the students, recruit participants and provide them with access to the Pre survey link. At the end of the intervention the researcher again attended in-person at the classes to debrief the participants and provide the link to the Post survey. The participants were given time to complete the survey in-class. This approach was taken to promote uptake on completing the process, it led to a small 3% increase in completion rate to 64%.

7.4 Materials and methods

In line with the DBR methodology, the materials and methods were progressed from the insights gained in the previous experiments. Any additional components included in the materials and methods are indicated below.

7.4.1 The survey

The online surveys, developed in Qualtrics, were in the same format as used in Experiment Two. In line with the implementation framework design, the survey comprised self-report

measures of academic amotivation, and self-report measures related to behaviours associated with the negative outcomes of academic amotivation.

7.4.2 Defining the nudge groups.

In Experiment Two, participants' reported scores for the two subscales of interest, 'Ability' and 'Value', were compared to define which subcomponent of amotivation was more prevalent. This process led to an imbalance in groups which was addressed using the process discussed in section 6.4.2. However, in Experiment Three, the initial process led to more balanced groups across both participant classes and so a further process was not required. For the *engineering students* 54 participants were in the Ability group and 48 were in the Value group. For the *computer science students*, 48 participants were in the Ability group and 35 in the Value group. This provided initial nudge groups of 102 Ability and 83 Value. As mentioned in Chapters 5 and 6, the implementation framework process had no control over the number of students from each group who would complete the Post survey, which represented the usable sample for analysis.

7.4.3 Defining amotivation level groups.

The process described in section 4.4.2 and 6.4.3 was followed again to allocate the participants to amotivation level groups as follows; Amotivated (N=38), Middle (N=38), or Not Amotivated (N=39), based on their ranked scores on the AAI.

7.4.4 The Nudges

The nudges, or boost nudges, sent to participants were designed using motivational theory and focused on the areas of Ability and Value. Within each group Type A nudges were focused on the general or institution level, and Type B were focused on the module level. Section 6.4.4 described the process in more detail.

Because Experiment Three was taking place in the same educational institute, the same Type A nudges from Experiment Two were used, as described previously in table 6.1.

The engineering students in Experiment Three were the following year's cohort³ to those in Experiment Two. Following a review by the lecturer, the same Type B nudges were identified as still valid, see table 6.1.

The lecturer for the computing students devised the Type B nudges for the purposes of Experiment Three leveraging the 'Lecturer Toolkit' (see section 4.5.4), resulting in the four type B nudges below in table 7.1.

Type B - Ability Nudges	Type B - Value Nudges
The final examination in CSUXXX will be similar to the weekly programming assignments. Spending time on the weekly assignments now will be a big help in preparation for the examination.	Writing ARM Assembly Language programs in CSUXXX will help you in the future to understand the behaviour, performance and efficiency of programs written in other languages and running on other processors.
The voluntary programming exercises that you are given each week will really help you to understand the core concepts presented in lectures and prepare you for upcoming assignments.	Concepts from CSUXXX will support your study of many other areas in computer science, including concurrency, parallel processing, networking, operating systems, and representation of many kinds of data in binary form.

Table 7.1. Type B nudges developed for the computer science undergraduates' class in Experiment Three.

7.4.5 The Intervention

The same timing approach as Experiment Two, and as described in Section 6.4.4, was again adopted for the intervention. Both classes were researched close to the middle of

³ As Experiment Three was executed one year after Experiment Two, both experiments were performed on the same course module but with different participants.

term. For the engineering students this was the second semester in March 2023. For the computer science students this was the first semester in November 2022.

The nudge deployment for each class followed the same format as Experiment Two, see section 6.4.5. The only difference, as described in section 7.3 was the researcher returning to the classes in-person to announce the end of the intervention, to debrief the students, take any questions, and ask them to complete the post survey.

7.5 Real-world data collection.

As referred to in section 7.1, the biggest design change in Experiment Three was the introduction of real-world behaviour measurements into the analysis. The self-report measures used in all experiments are reliable and validated tools. However, looking to the future usefulness of this research, the ability to profile students' amotivation state and nature from real-world behaviour indicators could bolster its potential utility and was of interest to this research.

In agreeing to participate in the experiment students provided consent for the researcher to access data from various college systems, e.g. LMS, around their grades and attendance. In section 4.4 it was shown that performance (grades) was negatively linked to Ability amotivation, and maladaptive behaviour (such as studying, associated with interacting with the VLE) was negatively linked to Value amotivation.

The method of accessing participants' data was discussed with the lecturers. As referred to in section 4.5.1, the lecturers agreed to retrieve the relevant data from the VLE, avoiding the need for the researcher to gain access permissions. Following the intervention, the researcher provided each lecturer with a list of the college e-mails for their students who had completed the Post survey.

In discussions with the lecturers on the data available it became apparent that due to the different structure of the two modules, data alignment, if possible, would be quite forced. Therefore, in analysing the real-world data it was deemed more appropriate to treat the two classes as separate cases.

The ranked Pre measures of each real-world behaviour provided the ability to categorise Value and Ability groups into High, Middle, or Low, as described in section 4.5.1. The following two sections will detail the different real-world data gathered. It is important to note in most cases the Pre and Post measures are related but not directly comparable. For instance, the mid-term exam could potentially have been more, or less difficult than the final exam.

This was deemed workable as the two 'Nudge type' categories provide a control group for each other within the same groups. For example, the test results discussed above are a performance measure, associated with Ability beliefs. Therefore, the group receiving Ability nudges would be the group where impact would be expected, the same level group receiving Value messages would not be expected to show impact.

In addition, the High, Middle, and Low, categories, described above, can act as control groups for each other. For example, if the Low Ability students show an average drop of 15% between midterm and final exam results this could be assessed by judging the percent drop against what was achieved by all other groups.

7.5.1 Real-world data for engineering students

For each of the engineering students, related to **ability**, the lecturer was able to supply the following pre and post intervention data:

- Averaged Weekly Multiple-Choice Question (MCQ) test results. As the intervention was mid-semester there were 5 MCQs pre and 4 MCQs post.
- Average weekly programming mark (out of 20), there was an equal number of tests pre and post.
- Students' mid-term and end of term results. The mid-term assessment was in week 6, just before the intervention.

For each of the engineering students, related to **value**, the lecturer was able to supply the following pre and post intervention data:

- VLE activity, the lecturer provided a report on daily VLE hits, defined as an instance of a student logging on to the VLE, for both the pre and post periods. This worked

out at a 49-day period Pre, and a 46-day period Post. This data was averaged to provide two variables, Pre, and Post VLE hit averages.

7.5.2 Real-world data for computer science students

For each of the computer science students, related to **ability**, the lecturer was able to supply the following pre and post intervention data:

- Average assignment mark normalised to 1.0 with all assignments equally weighted. There were 4 assignments Pre and 4 assignments Post intervention.

For each of the computer science students, related to **value**, the lecturer was able to supply the following pre and post intervention data:

- VLE activity, the lecturer provided a report on daily VLE hits for both the pre and post periods. Pre being start of term to the 10th of November and Post the 11th of November to 31st of December.
- Optional practice programming exercises, reporting the number of exercises attempted Pre and Post. This is under the 'value' category because the tests are optional and like other maladaptive behaviours are related to rate of participation rather than grade achieved.

7.5.3 Real-world data conclusion

Experiment Three highlighted the difficulty of data aligning real-world data across modules. However, in a situation where the opposing nudge groups, and the High, Middle, and Low groups act as controls for the target group it provides a flexible approach where the specifics of the data are not as crucial as the ability to compare related data across profiled student populations.

7.6 Data Preparation

Four separate Qualtrics surveys were required to capture the input from the two classes, a Pre and Post for each class. In addition, the real-world data from each lecturer was supplied to the researcher as two excel files. The same approach as described for Experiment Two in section 6.5 was undertaken to calculate variables before combining

the two data sets in SPSS However, the 'Ability Quarters' and 'Value Quarters' variables from Experiment Two were not required this time.

Some additional variables were required in Experiment Three related to the real-world data as discussed in section 7.5. These variables are detailed in Table 7.3. Note if the variable is Pre/Post it indicates there were two versions of that variable created. The real-world data variables calculated were specific to each class and were as follows:

Pre/Post	Variable	Method	Purpose
Pre/Post	Average MCQ (Engineering)	Adding MCQ scores and averaging by number of tests	Provide a real-world behaviour indicator related to Ability (performance).
Pre/Post	Average weekly programming test results (Engineering)	Adding weekly programming scores and averaging by number of tests	Provide a real-world behaviour indicator related to Ability (performance).
Pre	Midsemester test results (Engineering)	The mid-semester assessment grade in % just before the intervention	Provide a real-world behaviour indicator related to Ability (performance).
Post	End of term test results (Engineering)	The end of term assessment grade in % after the intervention	Provide a real-world behaviour indicator related to Ability (performance).
Pre/Post	VLE Activity (Engineering)	From daily activity VLE reports calculate the average daily 'hits'.	Provide a real-world behaviour indicator related to Value (maladaptive behaviours).
Pre/Post	Average assignment marks (Comp. Science)	Averages provided by lecturer, normalised to 1.0	Provide a real-world behaviour indicator related to Ability (performance).
Pre/Post	VLE Activity (Comp. Science)	From daily activity VLE reports calculate the average daily 'hits'.	Provide a real-world behaviour indicator related to Value (maladaptive behaviours).

Pre/Post	Optional exercises (Comp. Science)	Provided by lecturer, based on the number of optional tests attempted.	Provide a real-world behaviour indicator related to Value (maladaptive behaviours).
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Table 7.2. Additional variables computed in relation to real-world behaviour indicators.

The same approach to combining the data sets was adopted as described in section 6.5. This provided an anonymised data set that could not be linked back to any participant, with cases only identifiable by a participant ID, e.g. LH42. (See appendix T for full dataset)

7.7 Data Analysis - Amotivation

The interventions in Experiments One and Two showed some promising results in relation to impacting general academic motivation for amotivated students. In Experiment Three, with the largest cohort of participants, results from the AAI were analysed to seek further support for the approach's impact on general amotivation.

7.7.1 Descriptive Statistics

117 participants completed both the pre and post surveys representing the usable sample. All participants were first year undergraduate students at TCD. An analysis of the frequencies in relation to students' scores on the Pre- Academic Amotivation Index (AAI) showed good fit against the normal distribution curve with no significant skewness or kurtosis as shown in Fig. 7.1.

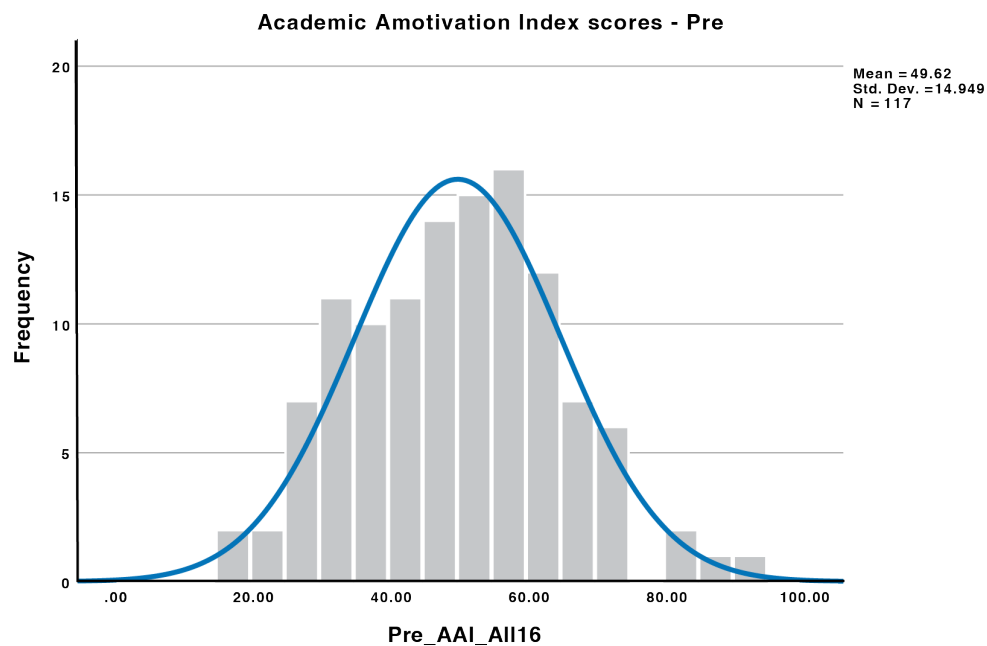


Fig. 7.1. Pre intervention, frequency distribution of answers to the 16 item Academic Amotivation Index, with normal distribution curve overlayed.

As mentioned in Chapter 6, the researcher could not control for which participants complete the Pre and Post surveys. However, Fig 7.2 shows that once again, as with Experiment Two, a good balance was achieved with 56 students from the Ability Nudge Group and 61 from the Value Nudge Group completing both. In the 'Not Amotivated' group 64.1% of students who completed the Pre and Post had received the Value Nudges. By contrast, In the 'Amotivated' group 33% of students who completed the Pre and Post had received the Value Nudges. In the Middle Group 59% received the Value Nudges.

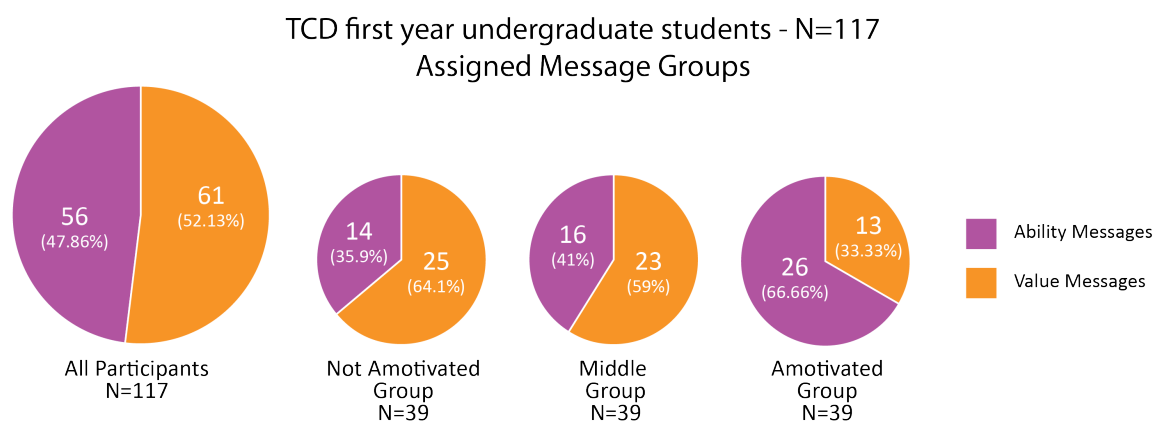


Fig. 7.2. Final participant groups completing both Pre and Post AAI split by nudge group.

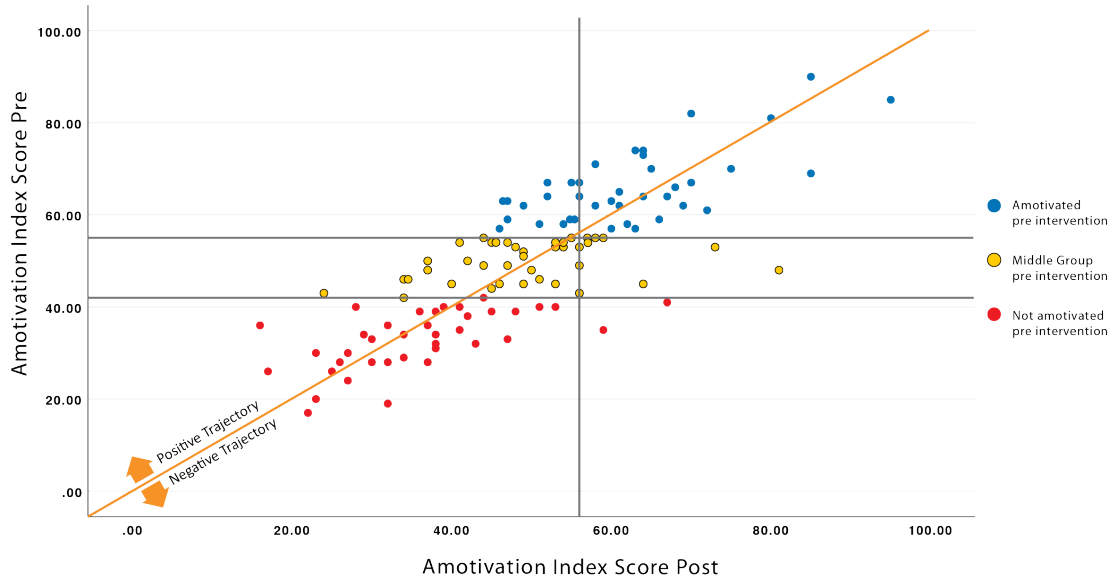


Fig. 7.3. Scatterplot showing the self-report Pre and Post measurements of overall academic amotivation.

Dots moving upwards from the orange diagonal axis are showing a positive trajectory, where amotivation has decreased following the intervention. Dots below the orange diagonal axis show a negative trajectory where amotivation has increased following the intervention. The blue dots in Fig 7.3 represent the Amotivated group, the participants who scored in the highest third on the AAI pre intervention. In this experiment 26 blue dots move in a positive trajectory; 1 blue dot is the same and 12 blue dots move in a negative trajectory. This interprets as 66% of the Amotivated group moving in a positive trajectory (i.e. becoming less amotivated).

The Yellow dots represent the participants who scored in the middle third on the AAI, pre intervention, and categorised as the Middle Group. The middle group showed quite an even balance between where 19 moved in a positive direction, while 17 moved in a negative direction, with three scoring the same pre and post.

Fig.7.3 also shows the direction of travel for the participants who scored in the lowest third, categorised as the Not-Amotivated Group. This group, represented by red dots, showed that 66% moved in a negative a trajectory. This result is the exact opposite of what happened for the amotivated group as described above.

7.7.1 Intervention impact on overall academic amotivation.

Experiment One showed a statistically significant reduction in general amotivation for the Amotivated group. Experiment Two showed a 6% drop for the Amotivated group, a near significant result ($p=.055$). Experiments One and Two both showed no statistically significant impact for the Not Amotivated group. The Middle group in Experiment Two showed a statistically significant reduction in general amotivation.

As shown in Fig. 7.4, in Experiment Three the Amotivated group showed a 3.74 (5.7%) reduction. In testing for significance in the reduction of amotivation within the amotivated group, a Wilcoxon signed-rank test showed that a 2-week, 6 x nudge nudges intervention elicited a positive, statistically significant, change in AAI for 'Amotivated Group' participants ($Z = -2.664$, $p = 0.008$). Median was 64 pre- and 61 post-nudges. In contrast to previous Experiments the intervention had a statistically significant negative effect on the not-amotivated group ($Z = -2.273$, $p = 0.0238$). Median was 34 pre- and 36 post-nudges. The Middle group showed no significant change (see Appendix U for full analysis).

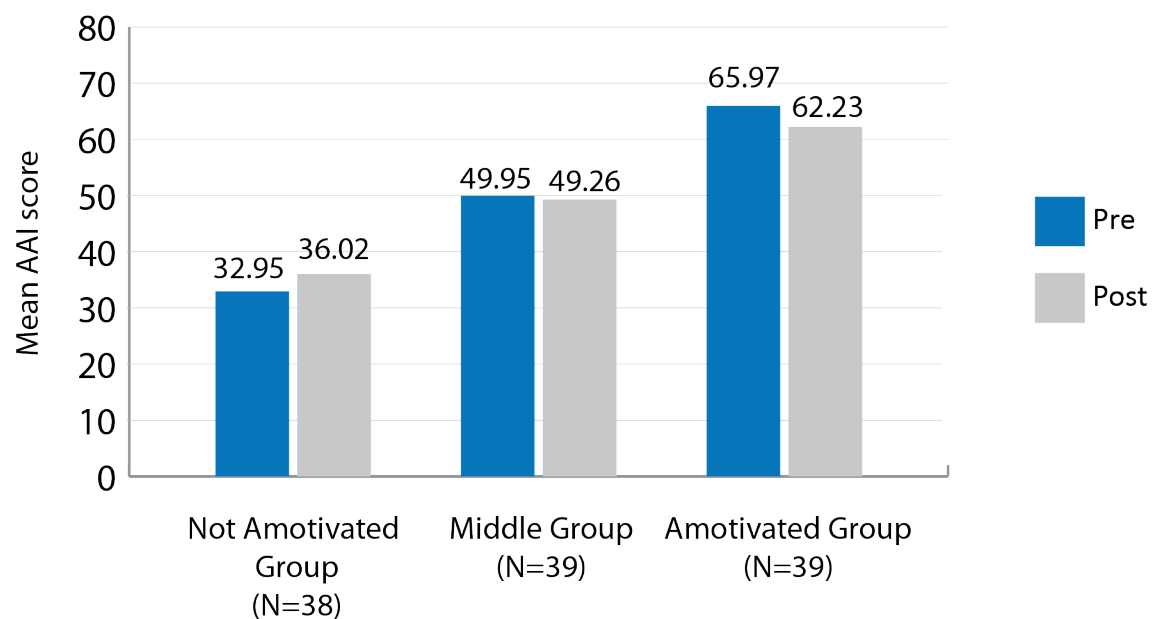


Fig. 7.4. AAI Pre and post mean scores by group.

7.7.2 Intervention impact on sub-scales of academic amotivation.

As in the other Experiments, the AAI's subscales related to Ability, Value, Self Esteem, and Intention to drop out, were calculated and analysed for differences Pre and Post intervention. Experiment Three's findings are shown in Fig. 7.5 below.

An investigation of the significance in the reductions in amotivation scores for the Amotivated Group was performed using a Wilcoxon signed-rank test. It showed that a 2-week, 6 x 'boost nudge' intervention elicited a statistically significant positive change in Ability for participants from the amotivated group ($Z = -2.320$, $p = 0.02$), median was 15 pre- and 13 post intervention, see Appendix V for analyses.

The same investigation was carried out for the other two groups. For the Middle Group a significant positive change in Effort was also found ($Z = -2.667$, $p = 0.008$), median was 17 pre- and 15 post intervention. For the Not Amotivated Group a significant negative change in Ability was found ($Z = -2.418$, $p = 0.016$), median was 6 pre- and 5 post intervention. The Not Amotivated Group also showed a significant negative change in Task Characteristics ($Z = -2.435$, $p = 0.015$), median was 9 pre- and 11 post intervention.

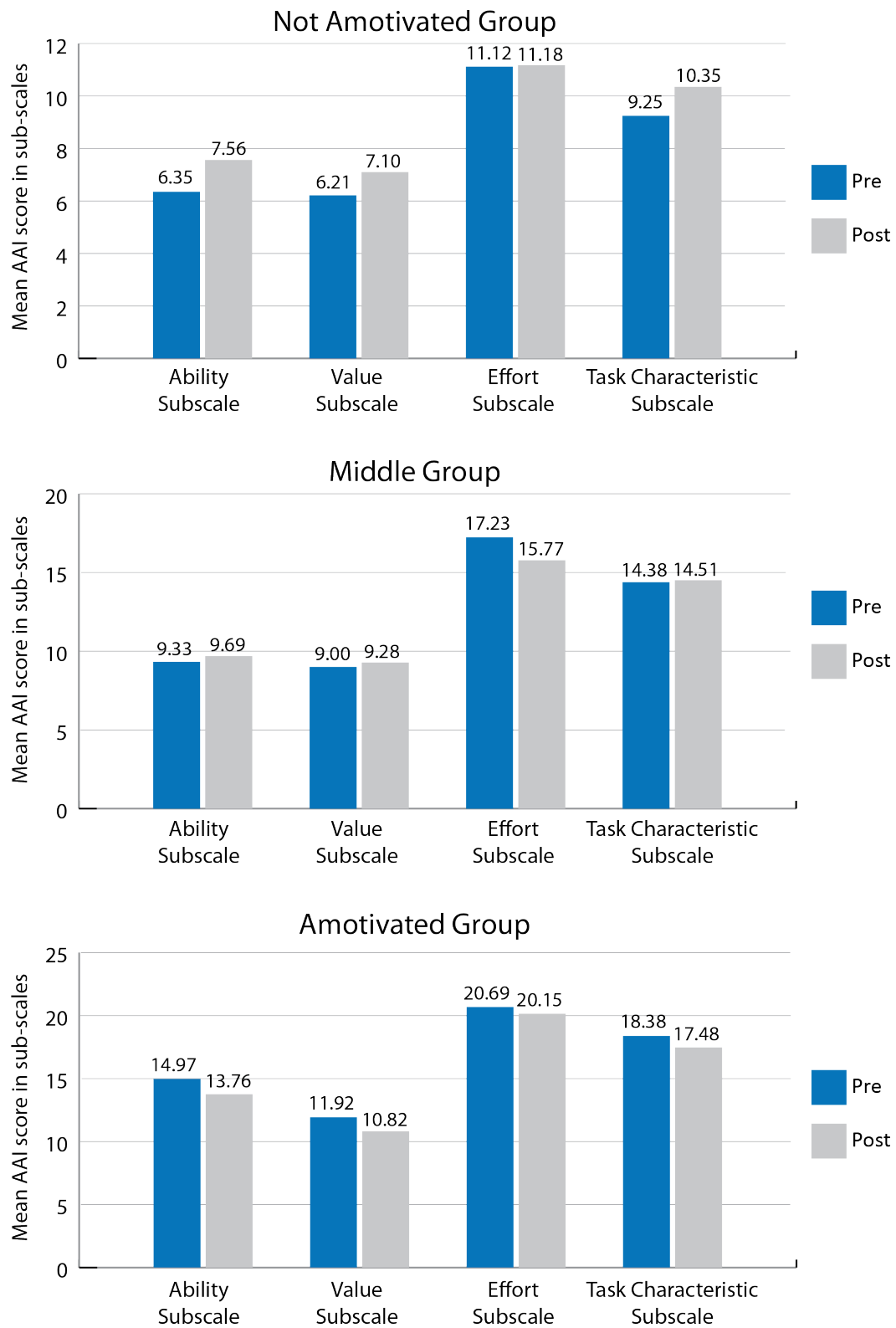


Fig. 7.5. 3 x Groups, AAI Pre and Post mean scores by subscales.

7.7.3 Impact on AAI and associated sub-scales scores of academic amotivation, by nudge type and across Amotivation Groups.

In Experiment Three, distilling the 117 valid participants produced 39 valid (amotivated) participants. 26 of these amotivated students were in the Ability group and 13 amotivated students were in the Value group.

In Experiment Two, participants in the Value group showed a statistically significant reduction in Value amotivation Pre and Post. In other words, Pre intervention this group measured a prevalence of amotivation in the subcomponent Value and therefore received the Value nudges. Post the nudges the targeted Value subscale reduced by a statistically significant measure (see section 6.6.3.2). The result was an early support for the ability to meaningfully target subcomponent aspects within the target audience.

The Figures 7.6, 7.7, and 7.8 show the results from Experiment Three where the same approach as Experiment Two (section 6.6.3) was adopted across each of the three Groups. See Appendix W for full analysis.

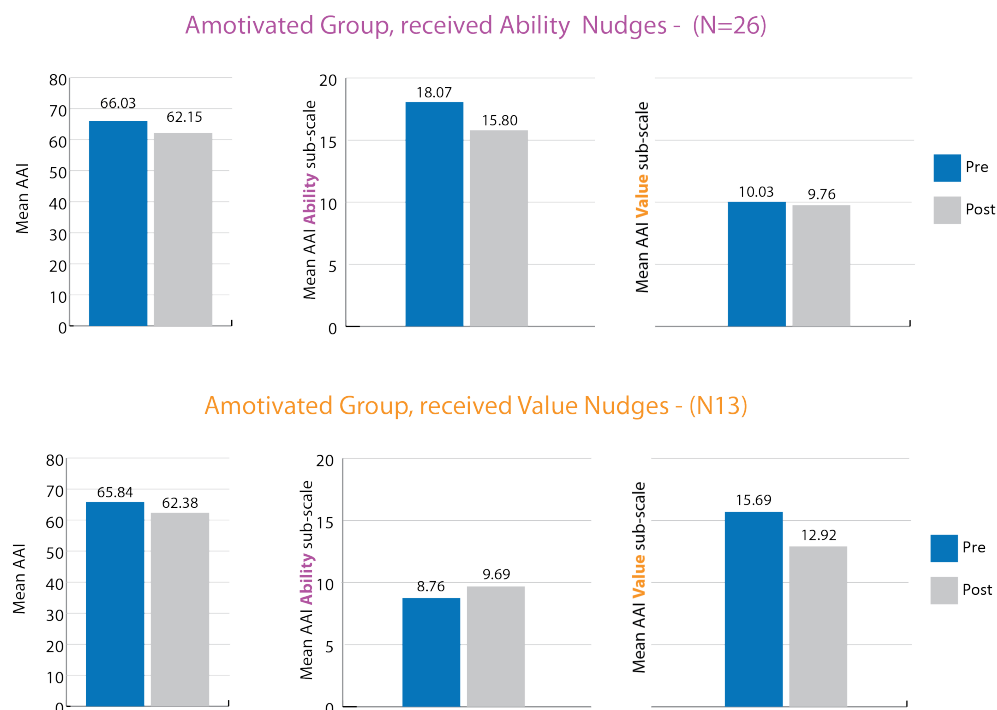


Fig. 7.6. Amotivated Group participants split by Nudge Group, Pre, and Post mean scores in; AAI, 'Ability,' and 'Value' subscales.

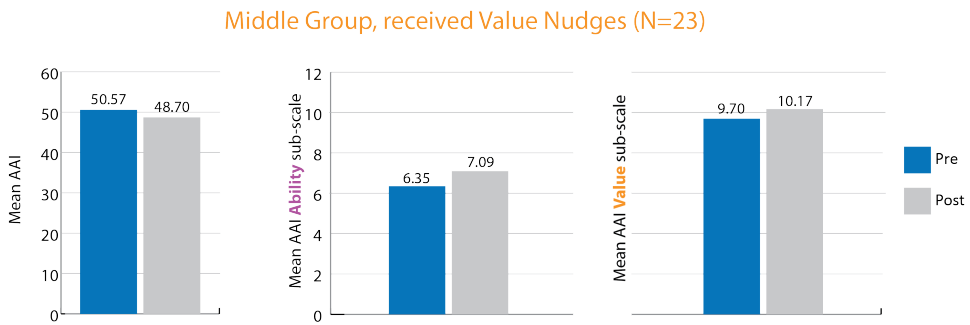
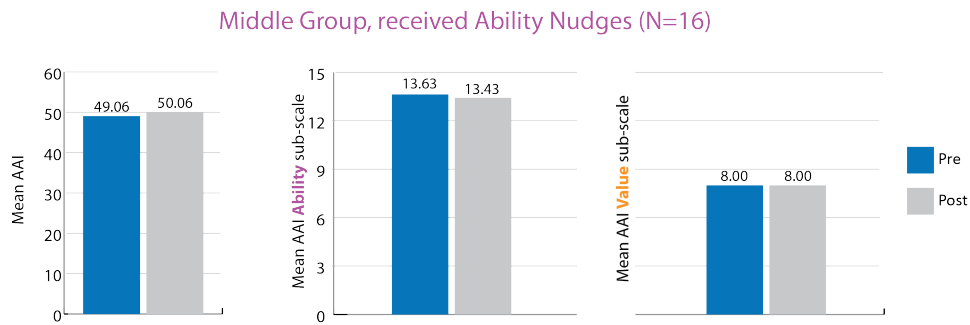


Fig. 7.7. Middle Group participants split by Nudge Group, Pre, and Post mean scores in; AAI, 'Ability,' and 'Value' subscales.

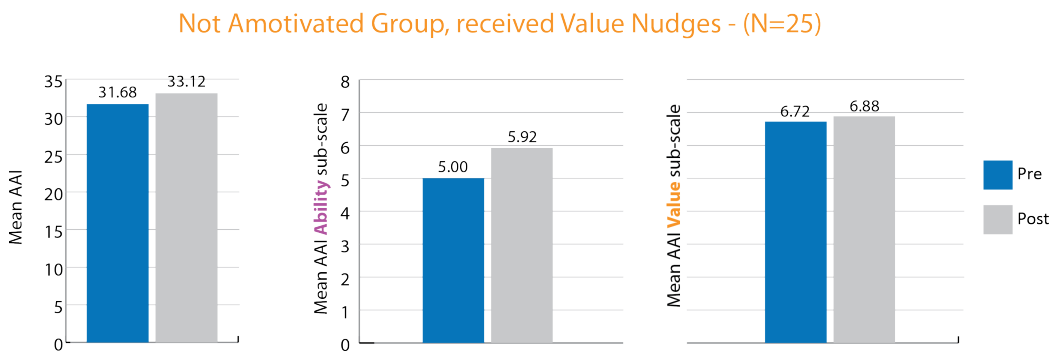
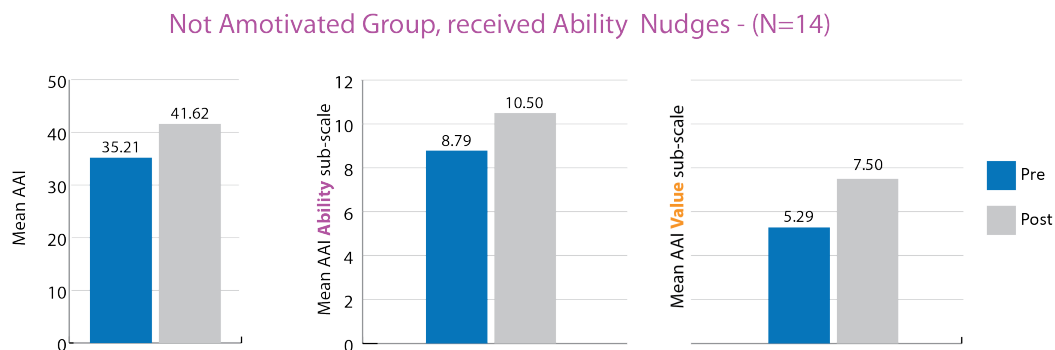


Fig. 7.8. Not Amotivated Group participants split by Nudge Group, Pre, and Post mean scores in; AAI, 'Ability,' and 'Value' subscales.

7.7.3.1 Discussing the results for each Group based on receiving Ability Nudges

The Amotivated Group receiving Ability nudges showed a reduction in mean scores across the AAI scale; the sub-scale Ability, and the sub scale Value as shown in the top half of Fig. 7.6. In testing for significance, statistically significant results were returned for both general amotivation (AAI) and the subcomponent Ability. A Wilcoxon signed-rank tests showed that a 2 week, 6 x 'boost nudge nudges intervention elicited a positive statistically significant change in; a) Overall AAI for participants from the amotivated Ability nudge group ($Z = -2.168$, $p = 0.03$), median was 64 pre- and 61.5 post intervention, b) Ability subscale for participants from the amotivated Ability nudge group ($Z = -2.917$, $p = 0.004$), median was 18 pre- and 16.5 post intervention. The reduction in the Value subscale was not significant.

The Middle Group receiving Ability nudges showed quite similar mean scores Pre- and Post across the AAI scale; the sub scale Ability and the sub scale Value as shown in the top half of Fig. 7.7. No statistically significant results were returned for any of the three scales.

The Not Amotivated Group receiving Ability nudges showed an increase in mean scores across the AAI scale, the sub scale Ability and the sub scale Value as shown in the top half of Fig. 7.8. In testing for significance, statistically significant results were returned for both general amotivation (AAI) and the subcomponent Ability. A Wilcoxon signed-rank tests showed that a 2 week, 6 x 'boost nudge nudges intervention elicited a negative statistically significant change in; a) Overall AAI for participants from the amotivated Ability nudge group ($Z = -1.993$, $p = 0.046$), median was 37 pre- and 41 post intervention, b) Ability subscale for participants from the amotivated Ability nudge group ($Z = -2.253$, $p = 0.024$), median was 8 pre- and 8 post intervention. The increase in the Value subscale was not significant.

7.7.3.2 Discussing the results for each Group based on receiving Value Nudges

The Amotivated Group receiving the Value nudges showed a reduction in the AAI scale, a slight increase in the sub scale Ability, and a reduction in the sub scale Value as shown in the lower half of Fig.7.6. In looking for significance, the sub scale Value was the only measure that showed as being statistically significant. A Wilcoxon signed-rank test

showed that a 2-week, 6 x 'boost nudge nudges intervention elicited a positive statistically significant change in Value subscale for participants from the Amotivated Value nudge group ($Z = -2.698$, $p = 0.007$), median was 16 pre- and 13 post intervention, see Appendix W for full data analysis.

The Middle Group receiving Value nudges showed a slight reduction Pre- and Post on the AAI scale of general amotivation. The same group showed slight increases in the sub scales Ability and Value as shown in the bottom half of Fig. 7.7. No statistically significant results were returned for any of the three scales.

The Not Amotivated Group receiving Value nudges showed slight increases in scores Pre- and Post across the AAI scale of general amotivation, the sub scale Ability and sub scale Value as shown in the bottom half of Fig. 7.8. No statistically significant results were returned for any of the three scales.

7.8 Data and Analysis on Self Report behaviour intent

A significant addition in Experiment Three (compared with Experiment Two) was the inclusion of real-world data related to behaviour which will be discussed in subsequent sections of this chapter. However, the self-report items concerning behaviour were included in the survey as per the other experiments. This section examines the findings from the three amotivation groups, related to Performance, Maladaptive Behaviour, Self-esteem, and Intention to drop out. Table 7.3 shows the pre- and post-mean scores from the groups and by nudge type received, (see Appendix X for full analysis).

7.8.1 Indicators related to performance.

Performance is a behaviour linked to one of the focus areas in this research, Ability beliefs. The survey item 'Please rate your own perceived proficiency in this module' is related to performance. Investigating the data across the three groups of Amotivation, and Nudge groups there was one significant result. A Wilcoxon signed-rank test showed that a 2-week, 6 x 'boost nudge nudges intervention elicited a positive statistically significant change in the Middle Group participants receiving the Ability nudges ($Z = -2.057$, $p = 0.04$), median was 3 pre- and 3 post.

Group	Message Type Received	Self Report Measure of Behaviour	N	Pre Score	PostScore	Difference Pre/Post	Wilcoxon Significance Test (Significant at 0.05)
Amotivated	Value	Performance 1. Rate your own perceived proficiency	13	4.9231	5.0000	0.0769	0.885
		Maladaptive Behaviour 1. Hours, studying and assignments	13	13.3846	12.3846	-1.0000	0.285
		Maladaptive Behaviour 2. 2 items	13	4.3846	5.3846	1.0000	0.098
		Self Esteem. 4 items	13	17.3846	16.7500	-0.6346	0.937
		Intention to Drop Out. 3 items	13	6.6154	5.8462	-0.7692	0.180
	Ability	Performance 1. Rate your own perceived proficiency	24	3.1667	3.5417	0.3750	0.444
		Maladaptive Behaviour 1. Hours, studying and assignments	25	12.8600	13.7600	0.9000	0.986
		Maladaptive Behaviour 2. 2 items	25	5.3600	5.1600	-0.2000	0.562
		Self Esteem. 4 items	24	17.9167	17.4091	-0.5076	0.195
		Intention to Drop Out. 3 items	25	9.1200	8.1818	-0.9382	0.048
Middle Group	Value	Performance 1. Rate your own perceived proficiency	22	5.4348	5.6818	0.2470	0.166
		Maladaptive Behaviour 1. Hours, studying and assignments	23	11.8913	10.9565	-0.9348	0.392
		Maladaptive Behaviour 2. 2 items	23	5.0000	5.7826	0.7826	0.220
		Self Esteem. 4 items	19	14.7368	15.1818	0.4450	0.463
		Intention to Drop Out. 3 items	22	5.0455	5.9545	0.9091	0.090
	Ability	Performance 1. Rate your own perceived proficiency	14	3.7143	4.4000	0.6857	0.040
		Maladaptive Behaviour 1. Hours, studying and assignments	16	13.5938	14.4063	0.8125	0.628
		Maladaptive Behaviour 2. 2 items	16	4.9375	4.4375	-0.5000	0.384
		Self Esteem. 4 items	11	18.6364	16.6250	-2.0114	0.279
		Intention to Drop Out. 3 items	15	6.9333	6.2143	-0.7190	0.876
Not Amotivated	Value	Performance 1. Rate your own perceived proficiency	25	5.5200	5.6957	0.1757	0.782
		Maladaptive Behaviour 1. Hours, studying and assignments	24	15.3958	16.7000	1.3042	0.421
		Maladaptive Behaviour 2. 2 items	25	3.9200	4.4583	0.5383	0.275
		Self Esteem. 4 items	22	15.8636	15.6364	-0.2273	0.580
		Intention to Drop Out. 3 items	25	5.1200	5.5200	0.4000	0.590
	Ability	Performance 1. Rate your own perceived proficiency	13	4.6923	4.6923	0.0000	0.623
		Maladaptive Behaviour 1. Hours, studying and assignments	14	15.9643	15.3571	-0.6071	0.513
		Maladaptive Behaviour 2. 2 items	13	4.6154	4.5000	-0.1154	0.470
		Self Esteem. 4 items	11	15.5455	17.0909	1.5455	0.084
		Intention to Drop Out. 3 items	14	3.5714	3.5714	0.0000	0.931

Table. 7.3. Self-report measures of behaviour by Group and Nudge type received.

7.8.2 Indicators related to maladaptive behaviours.

Value is the other area of focus for this research which is linked to Maladaptive Behaviours. ‘Self-reported hours studying’ is one measure associated with Maladaptive Behaviour. There were also two, seven-point Likert, questions around how frequently

participants reported being late for class and skipping class. These two items added together represented the score for the item 'Problem Behaviours'. There were no significant results found related to these items across all groups.

7.8.3 Indicators related to self-esteem and intention to drop-out.

There were two other ad hoc behaviour indicators captured in the survey.

The results for the Likert four-item scale of 'Self-esteem' showed no significant results across all groups Pre Vs Post.

The results for the Likert three-item scale of 'Intention to drop out' showed one significant result across all groups. A Wilcoxon signed-rank test showed that a 2-week, 6 x nudge nudges intervention elicited a positive, statistically significant, change in 'Amotivated' participants receiving Ability nudges ($Z = -1.975$, $p = 0.48$). Median was 9 pre- and 8 post-nudges.

7.9 Real-world Behaviour analysis

Motivation is a mindset, in relation to academic amotivation it links to negatively held beliefs. The research discussed to date has focused on changing this negative mindset through the intervention of nudges focused on general academic amotivation and the two subcomponents of Ability and Value. In this section the research takes a new turn to investigate if the intervention nudges had an impact on real-world behaviour.

Real-world behaviour measures associated with ability and value are considered. Ability beliefs are linked with performance, while value beliefs are linked to maladaptive behaviours, (see section 4.4). To investigate if the intervention had any impact on real-world behaviours it was hypothesized, in line with the implementation framework, to profile participants based on their pre intervention real-world measures. This process is described in detail in section 7.9.1.

In relation to performance, across the two classes there were several opportunities to gather accurate data through results on MCQs, interim tests, and summative tests. It was to be expected that some tests leveraged pre and post were more demanding than others.

However, the ability to compare Pre and Post between groups was seen as a way to allow for this, with other groups acting as control groups for the target group.

There were some limitations in relation to maladaptive behaviour measures. TCD does not formally track attendance which is seen as a key indicator of maladaptive behaviours. Studying, or lack thereof, is also related to maladaptive behaviours. Beyond self-report it is not possible to accurately track study hours. So to move to a real-world indicator aligned to study, participants' number of VLE access hits for the specific module was seen as an appropriate activity linked to study, which has been leveraged in previous studies (Blumenstein et al., 2018; Corrigan et al., 2015). VLE access is accurately captured and while there may be more, or less, activity at different times of the year the ability to compare between groups was again seen to allow for this. One class was also able to provide data on optional tests, in this case it was not the grade that was captured but how many of the tests were attempted. As the tests were optional but recommended, failure to attempt them aligned with the idea of maladaptive behaviours. In agreement with the lecturer of the class optional test attempts was seen as a valid measure related to maladaptive behaviour, linked to the amotivation subcomponent Value.

The nature of the different approaches for the two participating modules meant it was not possible to data align the real-world measures across classes. The rest of this section investigates four real-world measures from the engineering class and three from the computer science class as reported in table 7.2.

7.9.1 Defining the performance level groups for real-world data.

The students were divided into groups of thirds in the investigations of amotivation to date, as described in section 4.4.2. The process ranked participants' scores from the pre-intervention AAI scale and starting from the lowest score allocated a third of participants each to, Not Amotivated, Middle Group, and Amotivated. To look for impact based on real-world behaviours a similar approach was taken.

The scores on the real-world measures of 'Performance', which are linked to Ability beliefs, were ranked, and divided in thirds, although in this case the higher scores indicated better performance (see section 4.5.1). This resulted in three groups for

analysis, High Ability, Middle Ability, and Low Ability. The Low Ability group was regarded as the target for the interventions where it was hypothesized impact was most likely to occur. The same approach was taken for the 'Maladaptive Behaviour' measures linked to Value beliefs. This provided High Value, Middle Value, and Low Value groups where the Low Value group was seen as the target for interventions. New variables were calculated for each real-world measure where category values for High, Middle, and Low were assigned to facilitate data analysis by group.

The initial assigning of participants to Ability or Value nudge groups was not linked to real-world activity profiles. In section 7.4.2 the method for allocating students to the subcomponent Ability or Value nudge group was discussed. It was based on the self-report AAI results. When the real-world data was analysed, this fact could not be changed so there was a certain amount of unpredictability in the numbers that emerged in each group.

The following sections will investigate the impact of the interventions on the target groups as described above. For example, performance is associated with ability, therefore did those who were in the 'low ability' group (the target) who received the 'ability nudges' (the targeted intervention) show a performance impact pre and post. Was this impact greater or less than the 'low ability' group who received the 'value nudges' and the other groups, who acted as control groups. This approach provided an opportunity to compare six groups in each case. For this example, the target 'Low Ability' group's performance can be compared against the High and Middle Ability groups receiving Ability nudges, and the High, Middle, and Low Ability groups receiving the Value nudges.

This approach also allowed for a richer investigation of the real-world data and its impacts across all groups.

A final note on analysing data in this section is that standard significance tests comparing means hold no validity as the Pre and Post conditions are not identical.

The process described in this section is captured in Fig.7.10 and serves as a guide for the real-world measurement analysis that was followed in sections 7.9.2 to 7.9.9.

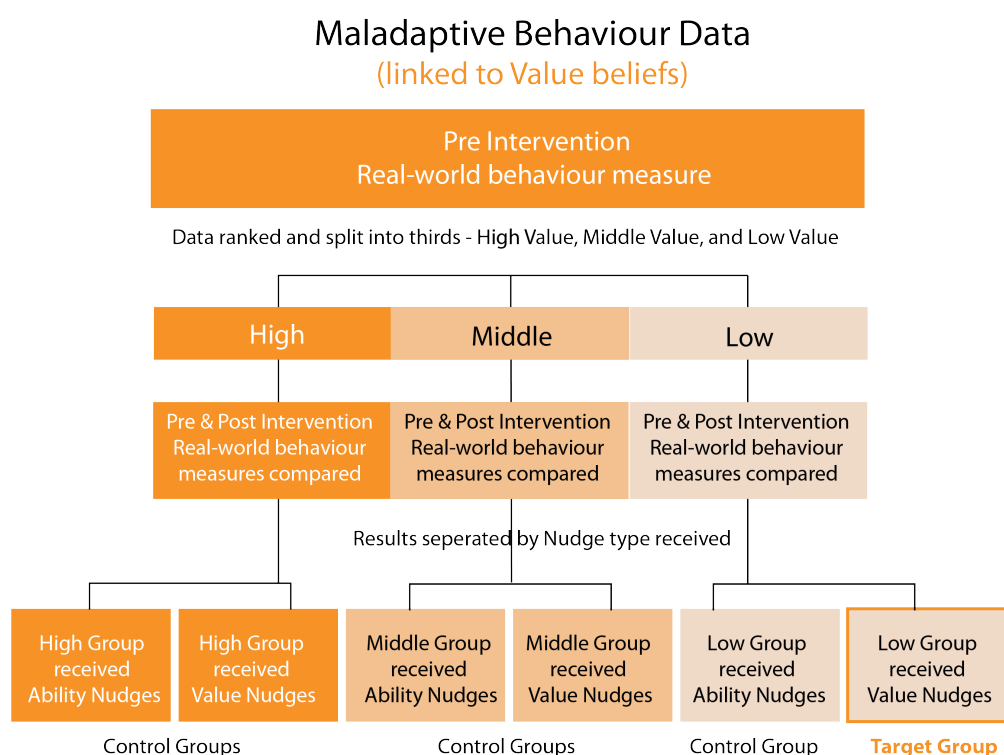
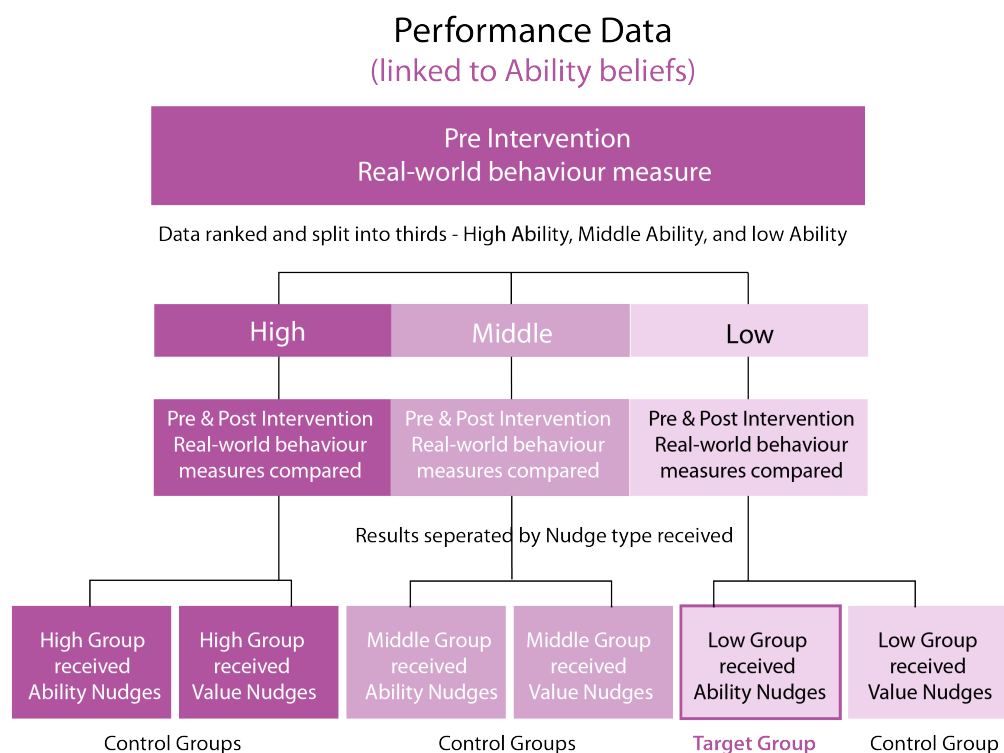


Fig. 7.10. Process followed to prepare and analyse real-world behaviour measures for Performance, and Maladaptive Behaviours.

7.9.2 Engineering Students - MCQ Performance - associated with Ability Amotivation.

Multiple Choice Question (MCQ) results are directly related to performance which is associated with the amotivation subcomponent ability.

For the engineering class the lecturer provided an average score per participant for the MCQs Pre and Post the intervention. The 'Low Ability' group receiving Ability nudges was the target. Following the process in section 7.9.1, 24 participants were identified in the 'Low Ability' category with an average Pre MCQ score range from 40 to 93.02, 24 participants in the 'Normal Ability' category with a range from 93.35 to 100. The 23 'High Ability' Group all had the top score of 100. As the short range in the Middle and High groups might imply, the overall scores showed a left skewness of -2.351 and leptokurtic kurtosis at 5.006, see Appendix Y.

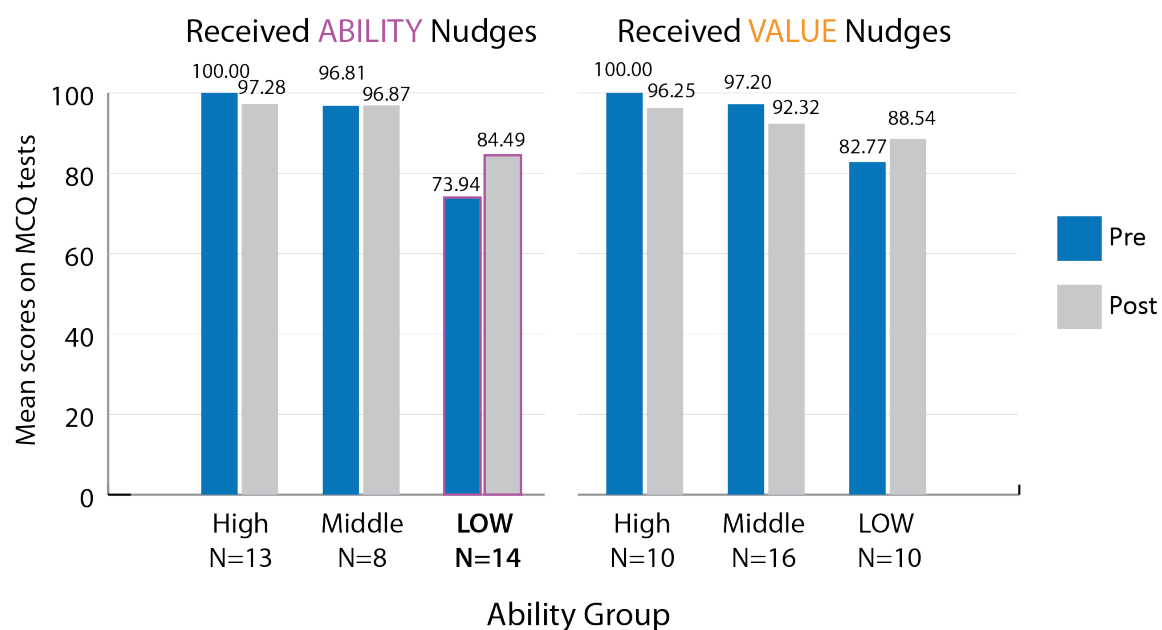


Fig. 7.11. Participants' Pre and Post mean scores in the MCQ for engineering students, identified by Ability related level, and separated by Nudge Group.

MCQ score is real-world behavior data associated with Ability beliefs. Therefore, the expected area of impact would be the 'Low Ability' participants, receiving the 'Ability nudges', identified in Fig 7.11 by a purple outline. For this group it is shown that the mean score increases by 15.56, (14.2%). As mentioned in section 7.9.1, due to differences in the Pre and Post MCQs, on its own this figure might not mean much as participants may naturally increase MCQ score in the second half of a semester, or the tests may have been

easier. However, the comparable Low Ability group that received value nudges showed a 5.77 (6.97%) increase.

Looking at the other groups, both High Ability groups show a slight decline, The Middle Ability group receiving Ability nudges stay pretty much the same, while the middle Ability group receiving the Value nudges show a drop of 4.88 (5%).

7.9.3 Engineering Students – Programming Test Scores - associated with Ability Amotivation.

Programming Test results are directly related to performance which is associated with ability. For the engineering class the lecturer provided an average score per participant for the Programming test scores Pre and Post the intervention. The 'Low Ability' group receiving Ability nudges was the target. An initial review of the overall scores showed a left skewness of -2.962 and significant leptokurtic kurtosis at 9.951, see Fig. 7.12.

This significant deviance from the normal curve, and narrow range of variance in scores meant the further analyses of this real-world behaviour would not yield meaningful results.

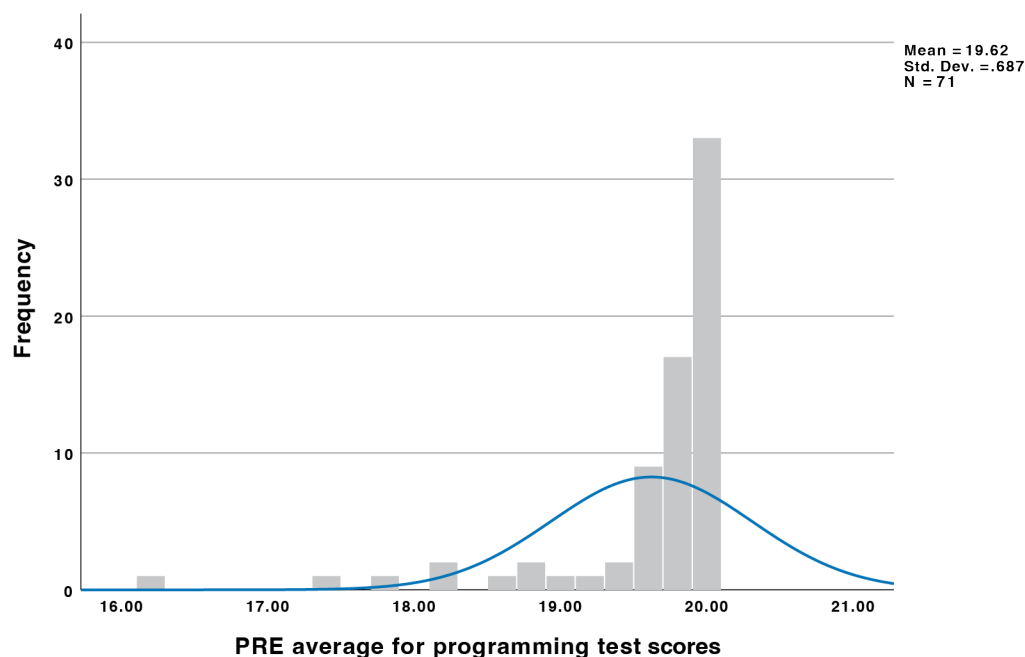


Fig. 7.12. Participants' Pre, Frequency distribution of Pre-Programming test scores for Engineering participants.

7.9.4 Engineering Students – Mid-term and end-term results - associated with Ability Amotivation.

Mid-term and end-of-term test results are directly related to performance which is associated with ability beliefs. For the engineering class the lecturer provided the participants' mid-term scores per participant, which took place pre intervention, and end of term test scores which took place post the intervention. The lecturer provided the assignment marks as percentage scores.

The process in section 7.9.1 identified 23 participants in the 'Low Ability' category with a score range 17.5 to 53.5. 24 participants in the 'Middle Ability' category with a score range of 54 to 84. 24 participants in the 'High Ability' category with a score range of 85 to 100. The overall scores were seen as a reasonable fit for the normal distribution curve with a slight left skewness of $-.413$, and platykurtic kurtosis at -1.14 , see appendix Z.

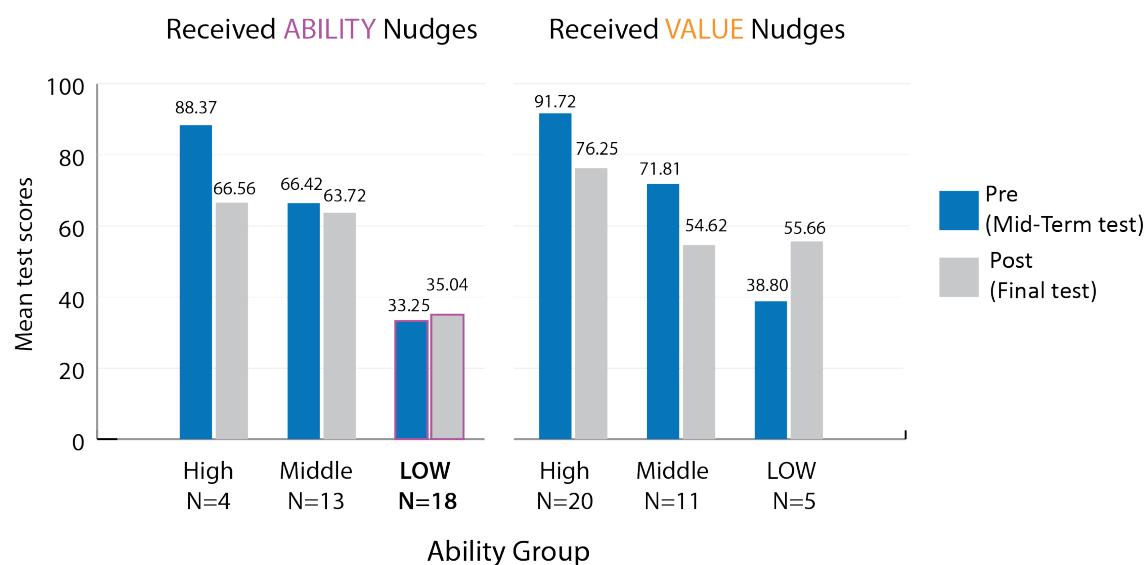


Fig. 7.13. Participants' Pre (midterm test) and Post (final test) mean scores for engineering students, identified by Ability related level, and separated by Nudge Group.

As test results are real-world data associated with Ability the expected area of impact would be the 'Low Ability' participants, receiving the 'Ability nudges', identified in Fig 7.13 by a purple outline. For this group it can be seen the target group's mean score increases slightly by 5%, from 33.25 to 35.04. The 'Low Ability' group participants that received the

Value nudges showed a large increase of 46%, however the group was a lot smaller, with N=5, possibly leaving it more susceptible to volatility.

The High Ability group receiving Ability nudges show a 25% reduction, however this was also a small group of 4 participants. The High Ability group receiving value nudges showed a 17% reduction. Of the two Middle Ability groups the group receiving ability nudges showed a small reduction of 4% while those receiving the Value nudges showed a 24% reduction in mean score from 71.81 pre to 54.62 post.

7.9.5 Computer Science Students – Practice Assignments Results - associated with Ability Amotivation.

Practice Assignment Test results are directly related to performance which is associated with ability beliefs. The computer science participants had four practice assignments pre the intervention, and four after. The lecturer averaged the assignment marks, normalised to 1.0, with all assignments equally weighted.

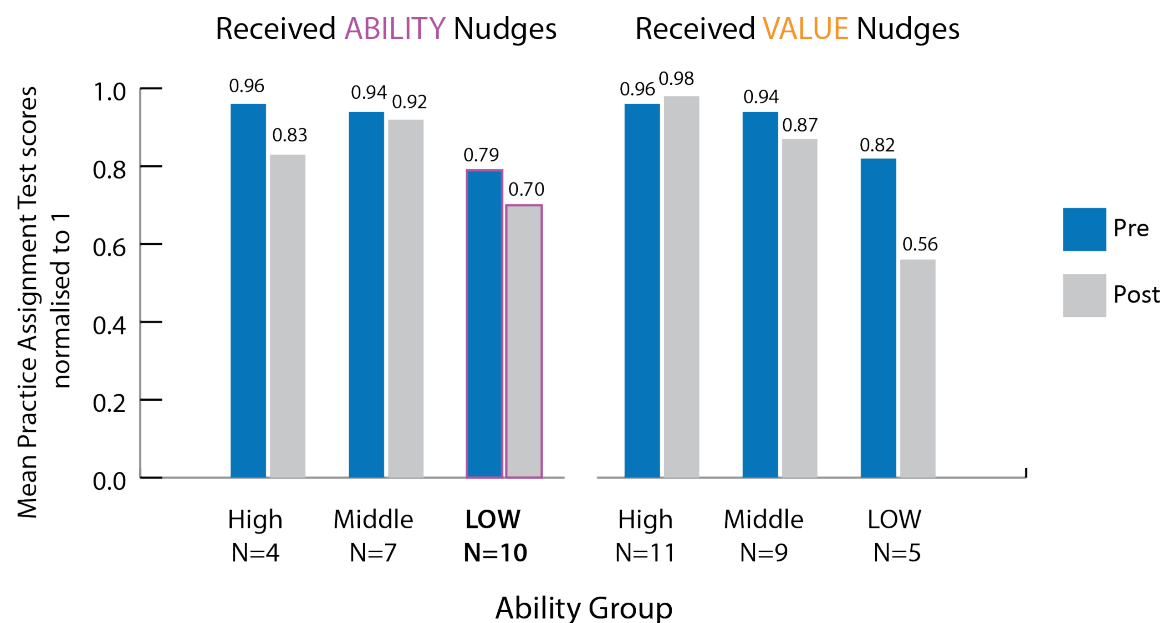


Fig. 7.14. Participants' Pre and Post mean scores in the Practice Assignment test for computer science students, identified by Ability related level, and separated by Nudge Group.

The process in section 7.9.1 identified 15 participants in the 'Low Ability' category with a range 0.63 to 0.9. 16 participants in the 'Middle Ability' category with a score range of

0.91 to 0.94. 15 participants in the 'High Ability' category had a consistent score of 0.96. The overall scores were seen as a reasonable fit for the normal distribution curve with a left skewness of -1.778, and leptokurtic kurtosis at 2.543, see Appendix AA.

Practice Assignment Test results are real-world data associated with Ability. Therefore, the expected area of impact would be the 'Low Ability' participants, receiving the 'Ability nudges', identified in Fig 7.14 by a purple outline. For this group the mean score decreases by 11.4%, from .079 to 0.7. The 'Low Ability' group participants that received the Value nudges showed the biggest drop of 30.5% between Pre 0.82, and Post 0.57, however as in section 7.9.4 the small size of this group (N=5) may be a factor. In looking across the other groups nearly all groups showed a decrease, implying possibly the post tests were more difficult. One group, the High Ability group receiving the Value nudges did show a very slight increase.

7.9.6 Engineering Students – VLE access measure - associated with Value Amotivation.

Accessing the VLE was deemed associated with maladaptive behaviours and therefore value.

The 'Low Value' group would be the target. To investigate the impact on the Low Value group the Pre VLE hits data was analysed in line with the process in the previous sections. This identified 24 participants in the 'Low Value' category with a range 48 to 92 hits. 24 participants in the 'Middle Value' category with a hit range of 92 to 134 hits. 23 participants in the 'High Value' category with a range of 135 to 272 hits. The overall scores were seen as a reasonable fit for the normal distribution curve with a right skewness of 1.132, and slight leptokurtic kurtosis at 1.007, see Appendix BB.

In Fig.7.15 the mean scores for each group are shown for hits on the VLE, a hit being an incidence of a participant logging on the VLE.

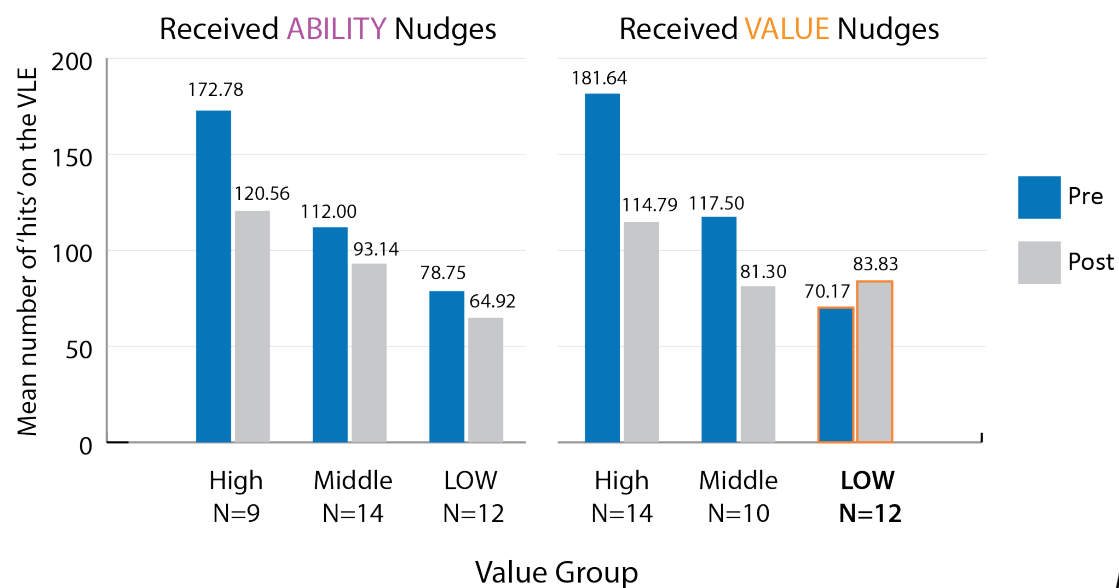


Fig.

7.15. Participants' Pre and Post mean number of hits on the VLE, identified by Value related level, and separated by Nudge Group.

VLE hits is real-world data associated with Value. Therefore, the expected area of impact would be the 'Low Value' participants, receiving the 'Value nudges' identified in Fig 7.15 by an orange outline. It can be seen the mean hits on the VLE increases by 13.67 from 70.17 to 83.83 a 19.5% increase. As mentioned in section 7.9.1, on its own this figure might not mean much as participants may naturally increase VLE usage in the second half of a semester. However, the Low Value group receiving the Ability nudges contained the same number of participants and showed a 17.6% decrease in hits. Looking across all other groups, the target group is the only one that shows an increase in hits.

7.9.7 Computer Science Students - VLE access measure - associated with Value Amotivation.

For computer science students and under the same premise as the previous section (7.9.6), 15 participants, were identified in the 'Low Value' category with a range 62 to 165 hits. 15 participants in the 'Middle Value' category with a score range of 170 to 220 hits. 16 participants in the 'High Value' category with a range of 224 to 405 hits. The overall scores with a skewness of .625, and kurtosis of .466 were within the tolerances of normal distribution, see appendix CC.

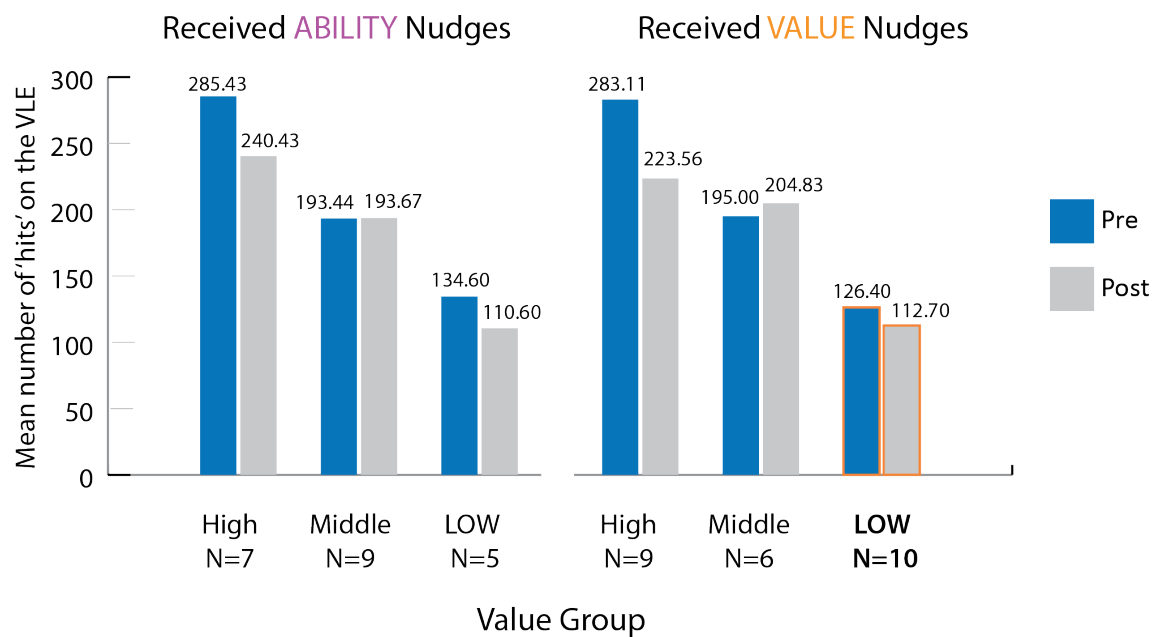


Fig. 7.16. Participants' Pre and Post mean number of hits on the VLE, identified by Value related level, and separated by Nudge Group.

The expected area of impact was 'Low Value' participants, receiving the 'Value nudges' identified in Fig 7.16 by an orange outline. It can be seen the mean hits on the VLE decreases by 13.7 from 126.4 to 112.7 a 10.9% decrease. As mentioned in section 7.9.1, the context of Pre to Post with other groups in this measurement is important. The other Low Value group receiving the Ability nudges showed a decrease of 17.9%, however there is a small number of participants in this group, where N=5.

Both High Value groups show sizeable decreases of 17.8% (Ability nudges) and 21% (Value nudges). The two Middle Value groups show minimal change in mean hits Pre and Post.

7.9.8 Computer Science Students - Optional test attempts - associated with Value Amotivation.

The number of optional tests attempted was deemed associated with maladaptive behaviours and therefore value beliefs. It was not the achieved score that was reported, rather the number of tests attempted, bearing in mind they were optional. The lecturer averaged the Pre and Post attempts and normalized them to 1.

The 'Low Value' group would be the target. In line with the process used in the previous two sections, 15 participants were identified in the 'Low Value' category with a range of 0 to 0.86. 15 participants in the 'Middle Value' category with a single score range of 0.93. 16 participants in the 'High Value' category with a range of 0.93 to 1.0. The overall scores were seen as a reasonable fit for the normal distribution curve with a left skewness of -1.254, and kurtosis in range at .037, see Appendix DD.

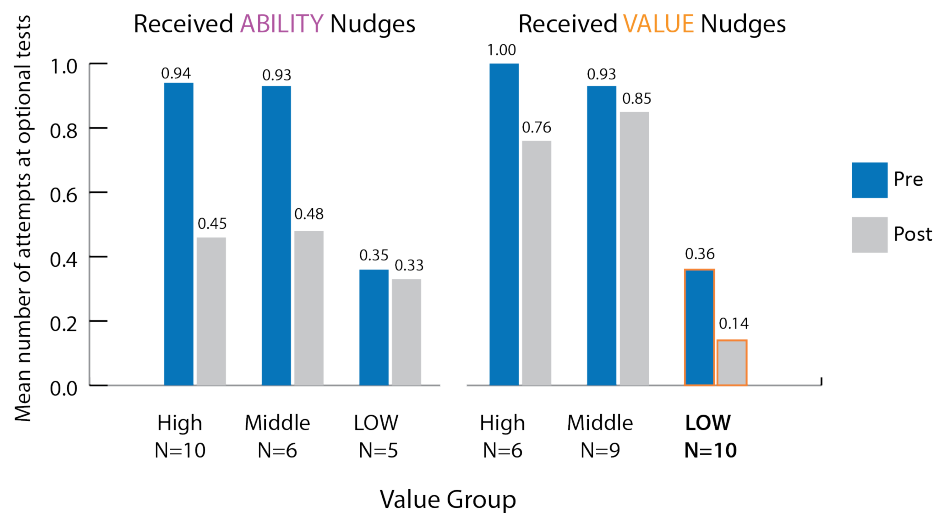


Fig. 7.17. Participants' Pre and Post mean attempts at optional attempts, irrespective of grade achieved, identified by Value related level, and separated by Nudge Group.

In Fig.7.17 the data shown followed the same process as described in sections 7.9.6 and 7.9.7. The expected area of impact was 'Low Value' participants, receiving the 'Value nudges' identified in Fig 7.17 by an orange outline. It can be seen the mean optional tests attempted by the group decreased by 36.4% to 0.14. As in previous sections it is important to review this change considering the other groups. All groups show a decline in the number of optional tests attempted. The Low Value group receiving the Ability nudges showing the least percent decrease at 8.4%, 0.35 to 0.33, however again this was a small group with N=5.

In looking at the other groups, both the High Value and Middle Value groups receiving the Ability nudges show large reductions of 52.2% and 48.4% respectively. These are in contrast to the results for the same two groups receiving the Value nudges, where The

High Value group show a reduction of 24% and the Middle Value Group show a reduction of 8.6%.

7.10 Correlations and Associations of Real-world data to Amotivation state

In this chapter, both self-report measures of amotivation and real-world measures of behaviour have been analysed. In this section the data is analysed to investigate correlations both between and within these two areas. The real-world data as reported in section 7.9 was looked at on a class-by-class basis where data was available. Therefore, there is no overarching measure of real-world behaviour as it relates to 'value' or 'ability'. To look for correlations it is necessary to take the amotivation self-report measures and look for correlations with each real-world measure reported.

7.10.1 Correlations and Associations Measures

The Academic Amotivation Index as discussed in Chapter 2 is a valid measure of academic amotivation state and has been deployed across many educational domains. The investigation of correlations was looking at potential links between academic amotivation state and the real-world behaviours reported in section 7.9. The following three approaches were used.

A Pearson correlation identifies the strength of a linear association between two variables (Gray, & Kinnear, 2012), as one rises does the other? Or, as one rises does the other fall? In this research the two realms of variables being the amotivation Pre- Ability, or Pre- Value, score as appropriate; and the Pre score from the relevant real-world measure.

As an example, the mid-term test scores for engineering are associated with Ability beliefs. In this case, the Pre-mid-term test scores were investigated against the participant scores from the AAI subscale 'Ability', to investigate if the Pre test scores were associated with the Ability subscale scores. In other words, does a lower mid-term test score predict a higher Ability amotivation score.

Secondly, a graph can often be a quick and intuitive way to look at data. For correlations a scatter-graph visually plots each case on an x/y axis, showing the relationship between the two variables.

Finally, a Lambda looks at the association between two nominal variables. In effect how likely is a person in 'category A' to be in unrelated 'category 3'. In this research, and as described in section 7.4.2, the participants were categorized into either the Value or Ability category, based on the higher score measured from the relevant subscales from the AAI. The participants in the lower third of each real-world category were classified as 'Low' ability or value as described in section 7.9.1. The Lambda looked at associations between these two nominal categories in each real-world measure.

7.10.2 Analysing the real-world incidences

There were seven real-world data variables identified in section 7.6 and analysed for pre-post results in sections 7.7.2 to 7.7.9. In section 7.9.3 the variable Programming Test Scores showed the distribution of the pre-data did not fit to normal distribution, therefore this variable was not analysed for correlations. This left six variables, four of the variables showed no significance across the measures described above. The two that showed statistical significances are reported below.

7.10.3 Engineering Students – Associations for 'Pre-Ability-Amotivation * Mid-term results'

The Mid-term test took place before the research intervention and was leveraged to provide a Pre-measure from real-world behaviour data. As discussed in section 7.9.4 test results are associated with 'Ability' beliefs. The AAI subscale of Ability amotivation provided a 0 to 28 scale measure of participants' pre amotivation state in relation to ability. An association between mid-term test scores and scores on the AAI Ability subscale was investigated.

A Pearson correlation coefficient was computed to determine the relationship between AAI subscale of Ability scores, and mid-term test scores. The results indicate a statistically significant negative relationship between Ability scores, and mid-term test scores, [$r(69) = -.482, p < .01$]. To sum up, the association lends support to the concept that as the mid-term test-score decreases, ability amotivation score increases. Therefore, null hypothesis can be rejected. The null hypothesis being that there is no relationship between mid-term

scores pre intervention and score on the AAI Ability subscale. The trajectory is also evident in the scatterplot in Fig. 7.15.

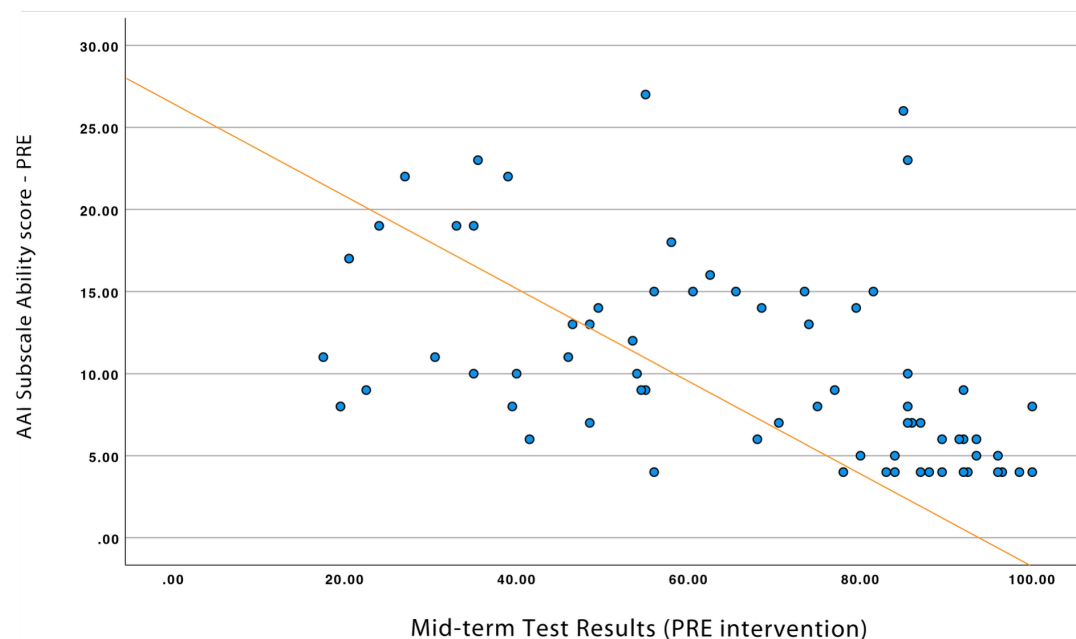


Fig. 7.18. Scatterplot showing the relationship between AAI Subscale, Ability scores Pre intervention and Mid-term test results, also Pre intervention.

A Lambda test for association identified a moderate symmetric association between the nominal categories 'ability/value nudge' and 'mid-term score High/Middle/Low ability' indicating an error reduction of 35.4%. Where the association is ability/value group dependent this rises to 42.9%. Where the association is mid-term score High/Middle/Low ability dependent the error reduction is 29.8%. See table 7.4.

Crosstabs

Case Processing Summary

	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Ability_ValueNudge * LH Pre MidTerm Score in Thirds Low Middle High	71	60.7%	46	39.3%	117	100.0%

Ability_ValueNudge * LH Pre MidTerm Score in Thirds Low Middle High Crosstabulation

		LH Pre MidTerm Score in Thirds Low Middle High			Total
		High Ability	Low Ability	Middle Ability	
Ability_ValueNudge	Value	20	5	11	36
	Ability	4	18	13	35
Total		24	23	24	71

Directional Measures

			Value	Asymptotic Standard Error ^a	Approximate T ^b	Approximate Significance
Nominal by Nominal	Lambda	Symmetric	0.354	0.100	3.005	0.003
		Ability_Value Nudge Dependent	0.429	0.148	2.266	0.023
		LH Pre MidTerm Score in Thirds Low Middle High Dependent	0.298	0.084	3.192	0.001

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on chi-square approximation

Table 7.4. Crosstabulation and Lambda test of association for the two nominal variables Ability/Value nudge Group and Mid-term score normal/low ability group.

7.10.4 Computer Science Students – Associations for ‘Pre-Ability-Amotivation * Practice Assignments Results

As discussed in section 7.9.5 the lecturer provided averaged assignment marks, equally weighted, and normalised to 1.0, for four practice assignments. Pre- and Post- scores were provided, the Pre scores were leveraged as a measure from real-world data for correlation. Test results are associated with ‘Ability’ beliefs. The AAI subscale of Ability amotivation provided a 0 to 28 scale measure of participants’ pre amotivation state in

relation to ability. An association between Pre-practice assignment scores and scores on the AAI Ability subscale was investigated.

A Pearson correlation coefficient was computed to determine the relationship between AAI subscale of Ability scores, and average practice test scores. The results indicate a significant negative relationship between Ability scores, and practice test scores, [$r(44) = -.449, p < .01$]. To sum up, the practice test-score decreases, the ability amotivation score increases. Therefore, null hypothesis can be rejected. The trajectory is also evident in the associated scatterplot shown in Fig.7.19, although the high number of students scoring near top scores does mean there are outliers evident.

A lambda showed no significant correlation at the nominal category level.



Fig. 7.19. Scatterplot showing the relationship between AAI Subscale, Ability scores Pre intervention and Average Practice Test results, also Pre intervention.

7.11. Summary

In line with the Design Based Research approach of this thesis, Experiment Three represented the final iteration. In this experiment the previous processes as deployed in Experiment Two were deployed with first year undergraduates, the focus population of this research. General Amotivation, and the two subcomponents of amotivation Ability

and Value all showed statistically significant reductions in line with the hypothesized outcomes of the targeted interventions.

Impact on real-world behaviour was not the primary focus of this thesis, however in Experiment Three the opportunity was taken to investigate the ability of the interventions to improve real-world behaviours. Some supporting results were uncovered and reported in this chapter.

In considering future directions for research in this area, the ability of real-world behaviour measures to detect and profile the presence of amotivation and the subcomponent levels would be valuable. To this end correlations were investigated between the pre measures of the subcomponent amotivation and the associated pre measures of real world behaviour. Two incidences of statistically significant correlations between the subcomponent Ability and associated real-world behaviours were reported.

Following the reporting of findings from the three experiments undertaken in this research over Chapters 5,6, and 7, the next chapter will discuss these findings. Chapter 8 will seek to interpret and discuss the implications of the results.

Chapter 8 – Discussion of results

8.1 Introduction

This thesis set out to investigate the potential impact of an intervention model and associated implementation framework for a personalised, ‘nudging’ approach to alleviate academic amotivation in undergraduate participants. A Design Based Research (DBR) approach was adopted, where iterated interventions were delivered through a series of three experiments.

In line with a DBR approach, Experiment Three represents the main experiment of interest, developed from insights gained in Experiments One and Two. In addition, based on the sampling design criteria discussed in section 3.5.2, Experiment Three represents the one where the criteria were met and exceeded. Therefore the initial discussion in each section of this chapter will look to Experiment Three’s results as the main findings. Experiments One and Two will also be discussed by way of providing additional indicators of support or dissent as the chapter progresses.

Academic amotivation is a mindset, a negatively held set of beliefs that impair academic performance (Barkoukis et al., 2008). Experiment Three in this thesis, showed reduced general academic amotivation at a statistically significant level, for the Amotivated group, Pre to Post intervention. Experiment One also showed a similar result while Experiment Two did not.

The result discussed in the previous paragraph was for General Amotivation, as measured by the AAI, and does not distinguish between the type of nudge sent. The targeted aspect to this research was interested in investigating if through profiling the type of Amotivation present could aligned nudges have an impact on the specific aspect of amotivation in question.

For this research the two types of amotivation were negative Ability beliefs, and Value beliefs. To investigate at the targeted level, participants’ levels of academic amotivation at the sub-component level were measured pre-intervention. Participants were assigned to receive either ability or value focussed boost nudges based on which sub-component

they had scored higher in. Experiment Three showed promising results where the Amotivated group with an Ability beliefs prevalence who received the Ability nudges showed a statistically significant reduction in the targeted Ability subscale Pre to Post. The same group did not show a significant reduction in the not targeted Value subscale. Additionally, Experiment Three also showed the Amotivated group with a Value beliefs prevalence who received the Value nudges showed a statistically significant reduction in the targeted Value subscale Pre to Post. The same group did not show a significant reduction in the not targeted Ability subscale.

Academic amotivation is the negative form of academic motivation. Motivation is “the process of instigating and sustaining goal-directed behaviour” (Schunk, 2013). This research comprised of one short, two-week, intervention with each class. Investigations into the data were carried out to see if there were any indicators of related behaviour change in the target areas.

As discussed in section 4.4, the sub-components of academic amotivation have been shown in previous research to be linked to specific negative academic outcomes. In the case of the two sub-components that were the focus of this research, Ability amotivation is linked to Performance and Value amotivation is linked to Maladaptive Behaviour.

Experiment Three investigated evidence of improvement in real-world behaviour among the Amotivated Group. While it should be acknowledged that there were several results that showed no impact, there were two instances of behaviour change identified that indicated positive outcomes from the targeted intervention. The first was linked to performance improvements for the group receiving the related Ability nudges. The other was linked to maladaptive behaviour improvements for the group receiving the related Value nudges. Both indicated change in behaviour compared to control groups, and linked to the targeted interventions.

The remainder of this chapter will seek to interpret the results, discuss the implications, and acknowledge the limitations.

8.2 Interpreting the Results

This research has gathered self-reported data on participants' general amotivation and all four sub-components of amotivation. In addition behaviour indicators both self-report and real-world were gathered. The Target group of interest was the Amotivated group. The two other groups were also investigated throughout the research. The Middle group and the Not Amotivated group, defined as set out in section 4.4.2, provided other results both as control groups and also as other groups of interest to explore.

Tables have been used in this chapter where appropriate to summarise the key data from relevant aspects of the findings across the three experiments. The data is compiled from data in other chapters of this thesis but is brought together in this chapter for the first time for ease of interpretation and analyses. To allow for different measures across the three experiments, mainly the use of a five point Likert in Experiment One and a seven point in Experiments Two and Three, the data are displayed as percentage change in mean scores, Pre to Post.

The rest of this section is set out as follows.

First, the personalised interventions set out to investigate impact on academic amotivation. The results with regard to impact on General amotivation are discussed.

Second, as an extension of the personalisation approach, the interventions in Experiments Two and Three sought to target the two sub components of amotivation, Ability and Value. The results in line with the impact shown are discussed.

Third, the impact of improving amotivation could be seen as improving various aspects of related behaviour, this section looks at the indicator measures that were captured in experiments two and three.

Finally, looking at both the amotivation and real-world behaviour data, the correlations between the two are discussed with interest in the ability of real-world indicators' to predict or detect academic amotivation.

8.2.1 Results related to impact on General amotivation.

Experiment Three, as the main experiment, provided an interesting view regarding impact on General Amotivation. The Amotivated Group showed a reduction, the Middle Group showed near identical scores Pre and Post, while the Not Amotivated Group showed an increase, (see Fig. 7.4). Section 7.7.1 showed the reduction in Amotivation for the Amotivated Group to be statistically significant. However, the same section also showed the increase in the Not Amotivated Group to also be statistically significant. This finding might support the idea that while the nudges were helpful for the Amotivated Group they may have been unhelpful for the Not Amotivated Group. Probing further on this aspect the future ambitions for this research would be the ability to profile students based on indicators of their real world behaviour and to deploy the nudges only when students indicate the presence of an aspect of amotivation. Therefore, the Not Amotivated should never receive the nudges, however these results may be an indicator that caution is required when deciding to deploy nudges in support of undergraduate academic amotivation.

Looking to Experiments One and Two related to impact on General Academic Amotivation The Amotivated Group again showed a significant decrease in Experiment One, see section 5.5.2, and a near significant reduction ($p=0.055$) in Experiment Two, see section 6.6.1. Across the three experiments there was an average reduction of 7.1%, based on the reported pre and post means from each experiment.

In Experiment Three, as reported above, there was virtually no change in scores for the Middle Group, Pre to Post. Experiment One showed a slight increase for the Middle Group while Experiment Two showed a statistically significant reduction for the Middle group. This provides some confusing results that may indicate that the Middle Group is volatile in terms of reaction. However, in Experiment Three the Middle Group was over double the size of the nearest other Middle Group, and may provide the best indicator where no change was evident. Further research would be required here.

For the Not Amotivated Group, Experiment Two showed virtually no change Pre to Post, while Experiment One showed a non-significant increase. Combining these outcomes with

the significant increase found in Experiment Three it would appear, from this research, that the nudges, at best have no positive effect on the Not Amotivated, as hypothesised. However, it also cannot be discounted that they may have a negative effect.

% Change on AAI Pre to Post			
	Experiment One	Experiment Two	Experiment Three
Amotivated Group	-9.5	-6.1	-5.7
Middle Group	3.2	-11.1	-1.4
Not Amotivated Group	6	-1.6	9.3

Note that negative numbers equal positive outcomes

Statistically Significant result



Table 8.1 Percentage change in AAI scores Pre to Post across Amotivation Groups and Experiments.

Experiment Three, supported by experiments One and Two, show support for the ability of nudges to alleviate Academic Amotivation. This is the only result that is consistent and was seen as statistically significant in two out of three experiments. The reduction in Experiment Three for the Amotivated Group was 5.7%. This may appear small in isolation but as reported in section 7.7.1 was statistically significant ($Z = -2.664$, $p = 0.008$), and the result of one, two-week intervention. In a developed solution, there would potentially be several interventions across an academic year, and also deployed for each module in the programme of study. The cumulative effect of such interventions could prove valuable, subject to further research. Of course as put forward by Brown et al. (2023) nudge overload would be a concern, moving from a support to a nag, where potentially the nudges might lose their efficacy. This is where a strategy of targeted interventions deployed only when required would be important. To do this would require further research, in line with the intervention model, where detection of amotivation, and its type, could potentially be achieved through monitoring real-world indicators of behaviour. The research results also imply the deployment of nudges to those outside the target Amotivated Group might not be beneficial.

Finally, in reviewing the results in their entirety what is interesting is the distinctness of the Groups from each other, see table 8.1. The Amotivated Group consistently benefited, the Not Amotivated Group did not benefit, and the Middle Group had mixed results. These outcomes do lend support to the Groups being distinct and providing control groups for each other.

8.2.1.1 Results related to impact on General amotivation by nudge type received.

The AAI is a measure of general academic amotivation comprising the four subscales of Ability, Value, Effort and Task Characteristics. The boost nudges sent to each participant were either Ability or Value focused. This section investigates if either nudge type had a more significant impact on the AAI.

In Experiment Three, and as reported in section 7.7.3, the Ability Nudges did produce a statistically significant reduction in the AAI for the Amotivated Group. The Value Nudges also showed a reduction in the AAI but not at a statistically significant level.

Similar to the results reported in 8.2.2, the nudge type made little difference to the results for the Middle Group showing minimal changes to AAI scores Pre to Post for both the Ability and Value nudge groups.

The Not Amotivated Value nudges group had an increase in AAI score that was not found to be significant. The Not Amotivated Ability nudges group showed a negative outcome with a statistically significant increase in AAI score Pre to Post. The percentage increase at 18.2% (See Table 8.2) is over three times the change of any other group in Experiment 3 which means there may have been some confounding aspect involved and would require further investigation.

Focussing on the results from experiment Three it would appear the Ability nudges had the stronger effect, both positively for the Amotivated Group, and negatively for the Not Amotivated Group. The Value nudges produced no significant change in AAI scores across the three groups. However, in interpreting this finding it is worth noting that the recipients of the nudges were profiled pre intervention to establish which sub component of amotivation was more prevalent for them. Therefore another interpretation could be

that those presenting with Ability led amotivation are more susceptible to change. In addition, Fig. 4.1 showed that negative Ability beliefs are related to three of the four negative academic outcomes defined by Legault et al. (2006), while Value is associated with two. This could show the Ability focus nudges have broader potential for impact, as students may be experiencing levels of all, or some, of the three negative outcomes around performance, self-esteem, and intention to drop out. In the absence of ability to profile students Ability nudges may be the preferential approach to take with nudges with amotivated first year undergraduates, subject to further research.

% Change on AAI Pre to Post						
	Experiment One		Experiment Two		Experiment Three	
	Ability Nudge	Value Nudge	Ability Nudge	Value Nudge	Ability Nudge	Value Nudge
Amotivated Group	-9.4	-9.7	-7.2	-4.9	-5.9	-5.3
Middle Group	4.7	-9.9	-13	-6.2	2	-4
Not Amotivated Group	7.8	4.1	-1.3	-1.8	18.2	4.5

Note that negative numbers equal positive outcomes

Statistically Significant result



Table 8.2 Percentage change in AAI scores Pre to Post across Amotivation Groups, Experiments, and Nudge type received.

Experiment Two showed reductions of a similar nature for both nudge groups and neither were significant.

Experiment One is interesting in relation to impact on the AAI by nudge group because the participants were assigned randomly to the nudge groups. However the numbers were small with group sizes ranging from 5 to 7 participants. In Experiment One there was one significant finding, in this case a statistically negative impact for the Middle group receiving the Ability nudges, see section 5.5.4.

Overall the findings from the research indicate that Ability nudges may be the more impactful of the two on General amotivation.

8.2.2 Results related to impact on Amotivation subscales.

The Academic Amotivation Index (AAI) contains subscales for the four sub components of Amotivation. The four sub components are negatively held academic beliefs around; Ability, Value, Effort and Task Characteristics. In this section, as with section 8.2.1, the results are looked at for the entire group irrespective of nudge type received.

In Experiment Three, as reported in section 7.7.2, the Amotivated Group showed positive statistically significant reductions for both the Ability and Effort subscales. The Middle Group also showed a significant reduction in the Effort subscale. The Not Amotivated Group showed statistically significant negative results for Ability, and Task Characteristics subscales Pre to Post.

Looking to Experiments One and Two. Experiment One showed positive reductions for the target Amotivated Group across both the Ability and Effort subscales. Experiment One also returned a statistically significant negative result for the Ability subscale with the Not Amotivated group. Experiment Two showed four statistically significant results, all positive. The Not Amotivated group in the Value and Effort subscales, and the Middle Group for the Ability and Effort subscales, see Table 8.3.

The nudges for this research were designed to support negative beliefs related to Ability or Value beliefs, therefore the frequency of significant results on the Effort subscale could be seen as surprising. The reported impact on Effort could be interpreted as implying it is a negative belief that is more susceptible to interventions. Conversely, potentially Effort fears naturally reduce as these first-year participants become more accustomed to academic life. Although Experiment One did show some negative results. Effort and Ability would be seen as distinct, but also quite closely aligned, both referring to beliefs linked to a participant's opinion of themselves. So, potentially the ability messaging also impacted on effort beliefs.

% Change on AAI 4 x Subscales Pre to Post												
	Experiment One				Experiment Two				Experiment Three			
	Ability Subscale	Value Subscale	Effort Subscale	Task Subscale	Ability Subscale	Value Subscale	Effort Subscale	Task Subscale	Ability Subscale	Value Subscale	Effort Subscale	Task Subscale
Amotivated Group	-19.3	-9.9	-12.8	-1.4	-4	-22.3	-9.1	-5.2	-8.1	-9.2	-2.6	-4.9
Middle Group	-1.2	8.6	7.4	1.2	-17.7	-5.3	-17	-13.1	3.9	3.1	-8.5	0.9
Not Amotivated Group	15.3	1.4	4.8	13.6	-7.9	0.8	-13.8	-1.2	19	14.3	-0.5	11.9

Note that negative numbers equal positive outcomes

Statistically Significant result ☐

Table 8.3 Percentage change in AAI subscale scores Pre to Post across Amotivation Groups, and Experiments.

In terms of the two subscales that were the focus of this thesis, Ability and Value. Ability showed statistically significant reduction in Experiment Three, as did Value in Experiment Two. It should be noted that this is looking across the group as a whole and not groups targeted with Ability or Value nudges as defined by their profile. These are discussed in section 8.2.3.

Interpreting the results overall, Table 8.3 tells a visual story on two levels. A quick review shows that as one scans from the top of the table, the Amotivated, to the bottom, the Not Amotivated two things happen. The amount of 'green' numbers reduces, green numbers representing positive change. In addition the amount of pale blue boxes reduces, indicating significant results. So, at this snapshot view it implies, significant, positive results are more likely with the Amotivated group.

The focus of this research was related to Ability and Value negative beliefs, in reviewing the data in Fig. 7.5, showing the Pre and Post scores across the subscales it appears that Effort and Task Characteristics were the two sub components more impacting on students. Across all Amotivation level groups the Effort subscale is scoring near double the Ability, and Value subscales, the Task Characteristics scores are higher too. This trend was also reflected to a lesser extent in Experiment Two. For future research it is interesting that Effort reduced significantly in four out of six cases across Experiments One and Two, while no significance was shown in any case for Task Characteristics. As mentioned above, potentially effort is linked to Ability, but Task Characteristics is distinct and was not approached in this research.

8.2.3 Results related to targeting the sub components of amotivation

The reporting in this chapter follows the flow of the three experiment chapters, which in turn follow a logical progression from general AAI to the targeted interventions, and outcomes. Therefore while this section is not the first reported in Chapter 8 it does report on the intervention most directly aligned to the objectives of this research, the development and analysis of personalised nudging interventions on academic amotivation.

Section 8.2.1 explained the personalisation approach to targeting general amotivation in this thesis. A second level of personalisation in Experiments Two and Three was added. This level sought to investigate if the nature of the amotivation present could be profiled, to identify which of the two sub components Ability or Value was more prevalent in the student, and could it be targeted through the intervention. In this thesis students were profiled based on their scores in the relevant AAI subscales and then assigned to either the Ability or Value group. It was necessary to take this approach for the research but of course it meant in this either/or scenario, students only received one set. A hypothesised outcome was there would be little effect on the sub component not targeted for each student, this provided a control group for the opposite subcomponent from within students at the same amotivation level. For example, a student profiled as Amotivated, Ability subcomponent prevalent, and receiving the Ability nudges, would be hypothesised to see less of a reduction in the Value subscale than the targeted Ability subscale.

In Experiments Two and Three the boost nudges consisted of a mix of researcher developed nudges, and those developed with the relevant lecturers focused on the module in question. Two sets for each module were designed, one targeting Ability beliefs and the other targeting Value beliefs. The intention was to seek support for objectives 3 and 4 where understanding a participant's profile would facilitate targeted nudges at the sub-component of amotivation level. The results across the three experiments are summarised in Table 8.4 showing the percentage change from Pre to Post.

% Change on AAI Ability and Value Subscales Pre to Post, by Experiment, Nudge type, and Amotivation Group												
	Experiment One				Experiment Two				Experiment Three			
	Ability Nudge		Value Nudge		Ability Nudge		Value Nudge		Ability Nudge		Value Nudge	
	Ability Subscale	Value Subscale	Ability Subscale	Value Subscale	Ability Subscale	Value Subscale	Ability Subscale	Value Subscale	Ability Subscale	Value Subscale	Ability Subscale	Value Subscale
Amotivated Group	-27.9	-4.1	-6.7	-14.5	-10.5	-10.4	6.8	-31.7	-12.6	-2.7	10.6	-17.7
Middle Group	11.3	13.5	-17.3	-7.9	-18.2	-14.8	-13.8	25.8	-1.5	0	11.7	4.8
Not Amotivated Group	17.6	0	12.8	2.8	-15	8.3	1.6	-4.3	19.5	41.8	18.4	2.4

Note that negative numbers equal positive outcomes

Statistically Significant result

Table 8.4 Percentage change in the Ability and Value AAI subscale scores Pre to Post across Amotivation Groups, Experiments and nudge type received.

Showing some support for these objectives, in Experiment Three, a statistically significant reduction in the two targeted sub components and not in the two untargeted sub components was shown for the Amotivated Group, the group of focus for this research.

The Amotivated Group in Experiment Three, who received the Ability nudges showed a statistically significant reduction in the targeted Ability amotivation. The Post- measures from the Ability subscale reduced by 12.6% against the Pre- measures. The same group showed a very slight, not significant, decrease in the not-targeted Value subscale. The Post measures from the Value subscale decreased by 0.27% against the Pre- measures.

The Amotivated group in Experiment Three, who received the Value nudges showed a statistically significant reduction in the targeted Value amotivation. The Post measure from the Value subscale reduced by 17.7% against the Pre- measure. The same group actually showed an increase of 10.6% in the not-targeted Ability subscale. This increase in Ability scale was in line with the effect on the Middle Group and Not Amotivated Group who received the Value nudges, see Table 8.4.

Investigating these results further, within the Amotivated Group, those receiving either the Ability or Value nudge can be seen as direct control groups for each other. The results showed that across the two nudge types sent the effect on the targeted subscale was positive and statistically significant, while the effect on the not-targeted aspect of amotivation was not statistically significant. Comparing within the Amotivated Group, in Experiment Three, the participants receiving the Ability nudges showed a larger reduction

in the Ability Subscale. Also, the participants receiving the Value nudges showed a larger reduction in the Value Subscale.

In section 8.2.2 and Table 8.3, the results from Experiment Three for the Amotivated Group as a whole showed a reduction in the Ability subscale of 8.1% compared to 12.6% when targeted was taken into account. Similarly the same group showed a reduction in the Value subscale of 2.6% compared to 17.7% when targeted. The numbers per group were smaller in the targeted interventions and may play a part in the differences reported. However, it supports the concept that a targeted intervention based on an amotivation profile could have more impact. If a reliable link between real-world behaviour indicators and sub components of amotivation were established it might be feasible to detect amotivation at the sub-component level and deploy the appropriate targeted response.

As discussed in Chapter 2 most of the research looking at amotivation tends to be of a correlational nature (Cannard et al., 2016; İlter, 2021, 2023; Jackson, 2016; Legault et al., 2006; Shen, 2015). Norvilitis et al. (2022) did find Amotivation to be a stronger predictor than intrinsic or extrinsic motivation for GPA, College Match, and First-Year Retention. İlter (2021) makes a call for more intervention studies related to academic amotivation.

The intervention studies that were found relating to amotivation focussed on the general form of Amotivation and showed some promising results, Cheon & Reeve (2015), Saravanan and Kingston (2014), and Terrier et al. (2018) showed positive results in significantly reducing general amotivation.

The results reported in this section progress the research to date. The research answers the call for more intervention studies and introduces the concept that it is possible to target interventions, beyond the general level, at the sub component levels of Ability and Effort amotivation with significant results.

For the Not Amotivated group one out of four impacts reported was statistically significant. The Not Amotivated Group who received the Ability Nudge showed a significant 19.5% increase on the Ability subscale. While this may be a cause for caution regarding the impact of nudges on the Not Amotivated Group it should be taken into account that the other three results, although negative, were not significant. The reasons

for this are unclear and are worthy of further investigation. Schunk (2013) refers to overjustification hypothesis where interested students can have their motivation reduced if the topic is overjustified in terms of its extrinsic value, while ability nudges would not be linked to this concept, is it possibly some variation of this theory? Haimovitz and Corpus (2011) found that first year college students may not find praise as genuine, their study did not stream participants. It could be this aspect also had some part to play, specifically with the Not Amotivated cohort. The not Amotivated act as a control in this research and would not be intended to receive nudges in a real world development of this research. In the meanwhile it would seem prudent to align such interventions to Amotivated students.

For the Middle Group in Experiment Three there were mixed results, in three of the four configurations there were small positive and negative moves and one that remained exactly the same. For the Middle Group students receiving the Value nudge there was an 11.7% negative increase in the Ability subscale, but as reported above in relation to the Amotivated Group, in Experiment Three across the three Amotivated levels this appears to be a constant.

Investigating the data from the Middle and Not Amotivated groups, based on the nudge type received where they act as a control for each other at the same level. Two results supported the hypotheses (Middle Group on the Ability subscale, Not Amotivated Group on the Value subscale) but two also did not, see Table 8.4. These are in contrast to the finding for the Amotivated Group reported above. This once again supports the concept that for the Amotivated Group there is evidence to support the approach but for other groups more investigation is required.

In looking to the other experiments carried out, the participants in Experiment One were allocated randomly to the Ability and Value nudge groups, therefore Experiment Two is the only one to investigate.

The results from Experiment Two do lend some further support where the Amotivated group receiving the Value nudges showed a statistically significant reduction of 31.7% in the targeted Value subscale, while showing an increase of 6.8% in the Ability subscale. In this case the students from the Amotivated Group receiving the Ability nudges showed

near identical reductions in the Ability and Value subscales at 10.4% and 10.5% respectively, see Table 8.4. Comparing results within the Amotivated Group, in Experiment Two, the participants receiving the Ability nudges showed the larger reduction in the Ability Subscale. Also, the participants receiving the Value nudges showed the larger reduction in the Value Subscale. The trends from Experiment two quite closely follow the findings from Experiment Three.

In relation to the negative finding from Experiment Three related to the Not Amotivated, Ability subscale increase, this was not found in Experiment Two where the same group showed a 15% improvement.

These findings are from only one piece of research, but are quite promising, it would be valuable for this researcher and others to leverage the implementation framework to see if further support can found for this approach.

8.2.4 Investigating the results related to academic behaviours.

As discussed in the previous sections of this chapter, the main motivation of this thesis was to investigate the potential to positively impact academic amotivation through a nudging intervention. Improved behaviour could be seen as the ultimate desired goal, the path to that behaviour change being facilitated through reducing an academic amotivation mindset.

8.2.4.1 Results related to impact on self-report behaviours.

The experiments in this thesis leveraged Legault, Green-Demers, and Pelletier's (2006) self-report behaviour questionnaire on the four negative academic outcomes; Performance, Self-esteem, Intention to drop-out, and Maladaptive behaviour, associated with one or more of the sub components of amotivation.

In Experiment Three across the 30 self-report measures reported in Table 7.3 there were two statistically significant results. For the Amotivated Group, who received the Ability nudges the self-report measure on 'Intention to drop-out' reduced statistically significantly. While accepting that the result only occurred in one experiment, the

potentially interesting observation here is that 'Intention to drop out' is the only negative academic outcome that is linked to both 'Ability' and 'Value' beliefs (see Fig. 4.1).

The other statistically significant result was for the Middle Group who received the Ability nudges and was related to an improvement in their perceived proficiency in the module of study. Investigating the data in Table 7.3 this group's Post Score for Proficiency is in line with the average for the other groups where the group reported a mean of 4.40 and the average was 4.84. However, the group's pre score of 3.71 is quite a bit below the average Pre score reported of 4.58. So the implication is that potentially this group were in a below average position on the Proficiency scale which is related to performance and therefore Ability, and while categorised in general for the Middle Group, in this particular aspect they were more aligned with an 'Amotivated' profile.

Interestingly, of the 30 self-report behaviour configurations reported in both Experiments Two and Three, the same proficiency item, for the same Middle Group was the only statistically significant finding in Experiment Two.

Looking to the data in Table 6.3, it also shows the Post Score for Proficiency is in line with the average for the other groups where the group reported a mean of 4.80 and the average was 4.94. However, again in line with Experiment Three the group's pre score of 3.4 is quite a bit below the average Pre score reported of 4.27.

One significant finding was reported in the Experiment One. The Not Amotivated group who received the Ability nudges reported an increase in Hours studying and doing assignments, from 15.83 hours per week to 32.66 hours a week, an increase of over 100%. Looking to the averages reported across the different groups in Table 5.2 the Not Amotivated group reported a Post figure of 32.67 well above the average of 24.38. In addition, the group reported a Pre figure of 15.83 well below the average of 20.09. While this measure has been leveraged in previous research (Legault et al., 2006) it is one that is open to interpretation between what is an assignment and what is study, it is also open to interpretation. If we take it on face value, it might not be seen as unusual that the Not Amotivated students are dramatically increasing their hours of study related activity, however it needs to be considered that the time difference between Pre and Post is just

two weeks. The students received the Ability nudge, however study is related to maladaptive behaviour and therefore the Value nudges (Legault et al., 2006), so the mechanisms at work are unclear for this result.

8.2.4.2 Results related to impact on real-world behaviours

In looking at real-world indicators of behaviour change Corrigan, Smeaton, Glynn, and Smyth (2015) profiled participants' VLE activity against historical records and on that basis, sent targeted support nudges through email. As discussed in Chapter 2, the results with first year undergraduates, showed statistically significant, performance improvements of nearly 3% for participants, over those who did not participate. Research like this lends support to the possibility to improve performance through targeted nudges, with first year undergraduates. However, as stated by the authors, the results may potentially have a confounding aspect where the motivation profile of participants who signed up to participate could be very different from those who chose not to. This is not as much a concern in this research as the control groups, as highlighted throughout this thesis, are drawn from within the participants. The groups provide several dimensions of control for each other across amotivation and sub component levels.

The boost nudge intervention in Experiment Three was one-off, and two-weeks in duration, even so, some real-world behaviour impact was identified. The experiments that showed some support for the hypotheses are discussed. This is not to discount the fact that several outcomes in Experiment Three, related to real-world measures, did not show support. A confounding factor, as mentioned previously, was that the experiments were not designed specifically for real-world measures and therefore in analysing the results some group sizes are small.

8.2.4.3 Results related to impact on real-world performance behaviours

Ability beliefs are linked to performance (Legault et al., 2006). Results in section 7.9.2 showed the target group of Low-Ability participants, who received the Ability nudges, improved their performance scores on MCQ tests by 14.2% post intervention. The most aligned control group to this group would be the students who were also in the Low-Ability group for this measure of MCQ test scores, but received the Value nudges. This

group did increase their scores by 6.9%, less than half the increase achieved by the target group.

Looking to the other Ability level groups, as shown in Fig. 7.11, The High Ability groups across the Ability, and Value nudge conditions showed a 2.72% and 3.75% reduction respectively. The Middle Group receiving the Ability nudge remained nearly the same Pre and Post, while the Middle Group receiving the Value nudges showed a near 5% reduction. nudge conditions showed a 3 to 4 Normal-Ability groups' scores actually returned a decrease in their MCQ test scores post- intervention.

In looking at these results in total, the first item that stands out is that in effect the two low Ability groups are the only groups to show strong indications of improvement. This could be seen as knowing they needed to improve more than the others. However, between the target Low-Ability group, receiving the Ability nudges and the Low-Ability group receiving the Value nudges the only difference was the nudge type. The performance improvement of the target group, 14.2%, was more than double the improvement for the control group. The number in each group were similar at 14 target and 10 control. This finding would lend some support to targeted nudges having real-world behaviour and performance impact where they should.

The Middle and High Ability groups in both nudge scenarios showed quite similar results within groups. However, what slight changes did occur, as reported above and shown in in Fig. 7.11, were more positive where the groups received the related, Ability nudge.

8.2.4.4 Results related to impact on real-world maladaptive behaviours

Value beliefs are related to maladaptive behaviour (Legault et al., 2006). Student hits on the module section of the VLE were used as a measure of real-world behaviour related to maladaptive behaviour. From the original research measures related to 'late for' and 'missing' class were put forward as strong indicators of maladaptive behaviour. As previously mentioned, this was not possible for this thesis as the institution where the research took place does not track either of these metrics. Study hours was another metric linked to maladaptive behaviour. As there was no way to independently measure

study hours, VLE hits was identified as not ideal, but a pragmatic substitute that was leveraged in previous research with first year undergraduates (Corrigan et al., 2015).

As reported in section 7.9.6 the target 'Low Value' group in the Engineering module, receiving Value nudges showed a 19.5% increase in VLE hits. All other groups showed a decrease. This included the closest related control group, the Low Value group receiving the Ability nudges who showed a 17.6% reduction in VLE hits. VLE hits have been used in previous studies (Blumenstein et al., 2018; Corrigan et al., 2015) and while it is understood there may be issues accepting VLE hits as a direct measure of maladaptive behaviour, it could be accepted that it is a measure 'related to' maladaptive behaviour. In which case it points to a small level of support to the targeted nudge having effect where it should, where the only difference between the two Low Value groups was the type of nudge they received.

The results across the Middle Value and High Value groups did all show negative outcomes with reductions in VLE hits. However, looking at 'within groups' scores, larger reductions were shown where they received the Value nudge, at odds with the hypotheses, see Fig. 7.15.

The equivalent VLE exercise with the computer science participants did not show a supporting result, but the low number of participants (N=5) in the 'low value' group receiving Ability nudges could be seen as a confounding factor here.

Once again to state this section would not be complete without acknowledging that the real-world behaviour indicators from sections 7.9.4, 7.9.5, 7.9.7 and 7.9.8 all did not return any significant results. Among them they contained a mix of Ability and Value real-world behaviour indicators where the target group did not show the expected significant impact. This is accepted and means there is further work to be done in this area. These results would require further investigation, possibly overjustification effects (Schunk, 2013) or as first years not finding the nudges genuine (Haimovitz and Corpus, 2011).

Real-world behaviour impacts related to amotivation or its sub components were not the primary target of this research. It would also be understandable to not expect too much behaviour change from such a short, two-week, one-off intervention. However, the

interesting result related to Ability discussed here gives some direction worth following. In addition, the need to explore better real-world behaviours related to Value and in turn, maladaptive behaviour is research that would be worthwhile in support of the intervention model.

8.2.5 Interpretation of correlations between amotivation indicators and behaviour indicators

As mentioned in the previous section, the main focus of this thesis was academic amotivation. However, the real-world behaviour indicator data gathered in Experiment Three provided an opportunity to look at correlations between Pre subcomponent amotivation measures and Pre real-world behaviour measures. The intention was to see if real-world behaviours could be relied on as indicators of the presence of amotivation at the sub component level. As reported in 7.10.2, four of the real-world data variables did not show statistically significant correlations between the reported pre- measures of a real-world behaviour and the associated amotivation pre- sub component scores.

There were two correlations that did register as statistically significant as reported in sections 7.10.3 and 7.10.4. They were both in relation to the correlation of the sub component ability amotivation measures to performance measures. In both cases the coefficient was above 0.4 (Engineering participants [$r(69) = -.482, p < .01$], Computer science participants [$r(44) = -.449, p < .01$]). A 0.4 to 0.6 correlation would indicate a moderate correlation. The correlation was negative, because a higher score in amotivation indicates a worse level of motivation. They were both related to test scores pre the intervention. These results would give some support to the idea that poorer test scores predict the presence of ability amotivation, which in turn could direct targeted interventions and are in line with İlter's (2021, 2023) findings with middle school students.

8.3 Implications of the Results

There is evidence of nudges being used successfully in many aspects of education (Damgaard & Nielsen, 2017). In looking at intervention studies, Blumenstein, Liu, Richards, Leichtweis, and Stephens (2018), focused on engagement but did not provide statistically significant results. Others studies took a social comparison approach,

informing students how they were doing compared to others, and did show statistically significant improvements in outcomes (Corrigan et al., 2015; O’Connell & Lang, 2018). No intervention studies were identified looking at nudges to alleviate academic amotivation directly with participants.

Amotivation in education has been identified as an area where there is a need to carry out further investigations, both from an intervention level and linked to behaviour (Legault et al., 2006; Leroy & Bressoux, 2016; R. M. Ryan & Deci, 2019). As reported in Chapter 2, few intervention studies were identified directly focused on amotivation. Some statistically significant results were found where Saravanan and Kingston (2014) included amotivation as part of a wider autonomy support approach, and as referred to already in this chapter, Terrier et al. (2018) leveraged ‘action identification’. The statistically significant results of the research projects referenced here, support the idea that amotivation, as a condition, can be influenced through intervention.

8.3.1 Implications related to amotivation

The primary motivation of this thesis was to investigate the potential of a model and associated implementation framework for a personalised, ‘nudging’ approach to alleviate academic amotivation in undergraduate participants. The approach taken in this thesis would appear to be unique.

The main results of interest to this research were those from Experiment Three. Section 8.2.3 discussed results directly linked to the main focus, profiling and targeting academic amotivation at the sub component level. Within the target Amotivated groups support was shown for the potential of the model and implementation framework developed and deployed in this thesis. In both nudge type variations statistically significant results were returned, and equally as interesting the non-targeted aspects were not impacted. Experiment Two also lent further support to these findings.

This research also took into account the other groups at different Amotivation levels. Across sections within section 8.2 there has been some evidence that the nudges may lead to negative amotivation shifts specifically for the Not Amotivated group. Or, does this represent the normal trend for students? This finding is interesting in itself and worthy of

further investigation. In future research it may be advisable to profile students pre and omit the Not Amotivated group, or further research should be undertaken to understand if there is another aspect at play. The Middle Group provided fluctuating results across the sections in section 8.2 but generally appeared to be less affected either positively or negatively by the interventions. Once again, this is an interesting finding that could lead the way for further research.

Taking the comments in the previous paragraphs, a finding that is emerging is that 'one size' does not fit all when it comes to supporting students through the use of messages such as nudges. This finding could have very near time implications for institutions that do send blanket messages to all groups.

The results across all sections in section 8.2 tend to indicate a slight bias towards Ability nudges in terms of efficacy over Value nudges. But as was shown in section 8.2.2 this particular group reported more amotivation related to Effort and Task Characteristics, again useful direction for future research.

Leveraging measures from the validated AAI self-report tool. The findings from this research lend support to the detection, profiling and targeting of academic amotivation at the general, Ability and Value dimensions. The other two dimensions Effort and Task Characteristic have still to be investigated in future research. In terms of what was investigated the implementation framework has provided a foundation for future research. The use of the AAI has been a valuable support for the implementation framework.

The challenge in moving from an implementation framework to developing the intervention model is how to detect and profile amotivation without the need for self-report tools. The recent developments in AI may be able to provide richer data on students via the VLE to support the identification of such issues in future work. The research has identified real-world behaviours linked to the sub components of amotivation. While real-world behaviour indicators were not the focus of this research some research was undertaken in the space, and the implications are discussed in the next section.

8.3.2 Implications related to behaviour

There was less evidence associated with behaviour change, but as stated already this was not the primary goal. It should also be taken into account that behaviour change takes time and the interventions in this thesis were one-off and only two weeks in duration. Even with all this taken into account there were some statistically significant behaviour changes found. These show some support for the potential to target sub components of amotivation leading to associated real-world behaviour change.

The two correlations between real-world behaviour and amotivation is an area to be further developed. If the link between real-world behaviours and amotivation and its sub components could be better understood it could provide early indicators of issues, without the need for self-report tools.

8.4 Limitations

There were some limitations in this research that will be acknowledged here, however they did not take away from the overall ability to conduct the research.

The intervention was a one-off two week process, this is a short period of time to hope to have an influence on participant amotivation, although the results indicate that in a lot of cases impact was shown, which may be a result of adopting a nudge approach. Even so, a semester, or academic year long intervention would bring further insights that could be valuable. In addition all participants received nudges, there was no group receiving no support, this would be a worthy inclusion for future research. The real world data could have been harvested from previous or subsequent years however there was no ethics for access to this data.

The research design captured data across the experiments on all four sub components of academic amotivation and the results were available for analyses. However the interventions targeted just two, Ability and Value. The reasons for this decision are given in Chapter 4. In addition subdividing the participant groups by four would have meant small numbers in each group, even with 117 participants, as per Experiment Three.

Further research might continue to capture all four as combined they give the General Amotivation score and possibly planning which subcomponents to test in each case.

The class cohorts were recruited through convenience sampling. In Experiment One this extended to recruiting some classes that were post-graduates. However as the main purpose of Experiment One was to test the general approach, at the general amotivation level this was not critical. Experiments Two and Three did recruit first year undergraduates but again through convenience sampling. They were attending the leading university in Ireland studying what could be considered quite career directed programmes of study where it might be expected amotivation would not be as prevalent. Access to different programmes of study may have provided stronger amotivation present.

Additional future research following the model and framework will provide a series of data captures that in themselves can provide the potential to interpret the data deeper to understand better why the interventions have and have not been effective and possibly identify correlates between real-world behaviours and amotivation.

There was an average 40% drop-off rate between Pre- and Post- where a lot of potentially valuable data was lost. These participants had received the nudges and were seven minutes (completing the Post- survey) from becoming valid participants. This reduced the amount of data to work with quite significantly

The measure of real-world behaviour chosen to indicate maladaptive behaviour ended up as hits on the VLE. This was a pragmatic decision to serve the purpose of the research and was understood as not being ideal. The preferred data would have been class attendance and late for class, but this data is not captured in Trinity College Dublin, the host institution for Experiments Two and Three.

8.5 Summary

While the intervention was short there were some very encouraging results related to the primary goals of the thesis and in support of the model and implementation framework. In the next chapter the potential for progression of this project will be discussed.

Chapter 9 - Conclusion

9.1 Introduction

The research question investigated in this thesis was “To what extent can a personalised boost nudge intervention reduce academic amotivation in first-year undergraduate students?”. The thesis aimed to investigate if a personalised, intervention model, and implementation framework, could help alleviate academic amotivation for undergraduate students at the general and sub component levels. The Design Based Research approach culminated in Experiment Three, with 117 first-year undergraduate students. Experiment Three did indicate support for the efficacy of the research approach at the general academic amotivation level. However, the area of most interest to this research was the potential to provide targeted amotivation reduction at the ‘Ability’ and ‘Value’ sub-component levels. The results from Experiment Three showed statistically significant support for the model and implementation framework at these levels with Amotivated students.

Ultimately, the ambition of reducing academic amotivation is to hopefully improve goal-directed behaviour outcomes for the students. In Experiment Three, even after a one-off short intervention, there were some indicators of the intervention model and implementation framework having a targeted positive effect on behaviour.

9.2 Findings

Motivation and goal-directed behaviour are related concepts, the focus of this research was to investigate the potential to reduce academic amotivation, the negative form of academic motivation. Lack of motivation for academic studies has been identified as a significant challenge for students, institutions, and society (Sarraf et al., 2019; Sosu & Pheunpha, 2019; Ulriksen et al., 2010). This thesis investigated the challenge through the lens of academic amotivation because, in the researcher’s view, that is the problem space, where students have negatively held beliefs related to their academic journey.

This research set out four clear objectives, aligned to the research question, the following sections of this chapter review the findings in relation to each objective.

9.2.1 Findings for Objective 1

Objective 1: *Investigate the current state of the art in educational amotivation research, carry out a literature review to examine the use of nudging technologies in education, and intervention studies in both areas.*

Objective 1 was completed and identified a lack of research to date in relation to academic amotivation. In fact calls for more research in the area were found. Most research found looks to the areas of extrinsic and intrinsic motivation. While these areas are related to amotivation they are distinct from it. The work that was found in relation to academic amotivation identified it as a multi-component construct comprising elements related to negatively held beliefs around the students' ability, values, effort and task characteristics. Academic studies of amotivation leveraging direct intervention with students were not much in evidence. One research project, in the hospitality education setting, did show support for the concept that amotivation is capable of being impacted through intervention and, was linked to positive performance outcomes.

Nudges were identified early in the research as a potential means of deploying any intervention. Researching nudges in education revealed a wealth of use cases and nudge types. Of those researched, 'boost nudges' focused on general skills, like grit and motivation, appeared the most appropriate. Nudges have been used extensively in education with the wider community including parents and teachers as well as students. There was no research found looking at nudges directly sent to students and linked to academic amotivation, or motivation. Some intervention studies, directly with students, on engagement and performance, had showed mixed results.

The findings indicated the intended direction of this research to be unique, and supportive to the call for more research into intervention studies focused on academic amotivation.

9.2.3 Findings for Objective 2

Objective 2: *Investigate the potential of amotivation focused boost nudges targeting amotivation levels, via a pilot experiment*

In Chapter 3 different approaches to an appropriate methodology for this research were considered. Design Based Research emerged as an approach that aligned well to investigating the problem space in an iterative fashion. The first iteration, in line with Objective 2, was to investigate if motivation support nudges, designed in line with motivation theory, and focussed on the researched dimensions of amotivation, might have an impact on student amotivation. Experiment One was designed to answer this aspect, and showed encouraging results in terms of Objective 2. Experiment One was also useful in understanding the design requirements for Objective 3.

9.2.4 Findings for Objective 3

Objective 3: *Research and develop a model of personalised amotivation-focused boost nudges and investigate their potential to impact on specific aspects of a learner's amotivation and subsequent behaviours.*

From the results of Experiment One it was possible to progress the initial model design to a more concrete intervention model, and in doing so, address Objective 3. The research in Chapter 2 had shown academic amotivation as a multi-dimensional concept. This provided an opportunity to look at developing a personalised intervention model that included; general academic amotivation, and also focused in on the specific sub components (Ability or Value) at play for each student. The personalised nature of the intervention model not only focused on the sub-components but was also able to target amotivation at the module level.

The research had shown that lecturers are time poor when it comes to activities such as designing nudges. Previous research projects had provided nudge banks for lecturers to draw from. This research designed a lecturer-toolkit to support lecturers in crafting module-level nudges, targeting the two focus areas of, 'Ability' and 'Value'.

One lecturer participated in both Experiments Two and Three. In that case it was found, on review, that the same module focussed nudges were valid for both. This implies that following a small amount of effort from lecturers in creating the first batch of nudges, they might only require monitoring and updating in subsequent years.

The model for the research combined validated self-report tools and identified real world indicators of behaviour. The behaviour indicators aligned with the two amotivation sub-components of interest.

In line with previous successful research interventions with educational nudges, the model identified a two week intervention as being appropriate. The model was received well by the lecturers involved.

The model includes Type A nudges focussed at the institution level to provide general support and Type B focussed at the module level. Having a clear design model facilitated the development, deployment and analysis of the implementation framework and subsequent results in line with Objective 4.

9.2.5 Findings for Objective 4

Objective 4: *Research and develop an implementation framework to support an intervention process. Artefacts and instruments to allow further development and analysis of personalised nudging interventions on amotivation. Deploy the implementation framework and perform evaluation exercises to analyse the effects of the framework with regards to the effects on academic amotivation.*

As defined by the intervention model, there was a need to profile students in relation to both amotivation levels and self-reports of behaviour. Two established and validated scales of measure that had been deployed in other research were leveraged. This approach brought validity to the scales. A Qualtrics survey combined both question sets into one survey that took on average seven minutes to complete. There was a need to obtain this information pre intervention and again post intervention, a duplicate of the survey served this purpose. The efficiency, for students, of completing the survey either on laptop or phone, and the short time required, both served the research well.

In Experiments Two and Three the relevant nudge nudges were sent to students, according to their amotivation profile, via text. Previous research had indicated text nudges as an efficient method of delivery (Castleman & Page, 2015) as people tend to look at text nudges whereas they may ignore emails. A commercial bulk-text service was

used in experiments 3 to manage the text nudge delivery. This made the process very efficient where nudges could be sent to groups in batches, and pre-timed.

In Experiment Three the real-world data on academic behaviour was kindly collected by the lecturers and sent to the researcher to avoid the need to provide access to the VLE. Experiments Three was specifically focused at the module level, so this approach may be seen as appropriate as it does not require providing access to anyone who does not have permission already. The different nature of the data sent by each lecturer in Experiment Three meant the two groups needed to be analysed individually. This can be seen as a positive finding, demonstrating the flexibility of the implementation framework to deal with different assessments and VLE data. All in all the implementation framework served the research purpose well in being efficient, valid, and reliable. The components of the framework are also, by the evidence, repeatable in different contexts.

The implementation framework allowed for strong analysis across the three areas of amotivation, self-report behaviours and real-world behaviours. As discussed in sections 8.2.1 and 8.2.3, the encouraging results from Experiment Three showed statistically significant positive results in three out of three of the intended instances for amotivation and targeted sub-components. There was some support also shown from Experiments One and Two.

It was also shown in Experiment Three that those considered 'Not Amotivated' showed some statistically significant negative outcomes across the same scales. This is an area that requires more research, and could have implications for the concept of blanket messaging students. However, it also lends support to this research thesis' concept of profiling students prior to any intervention.

The multiple data captured allowed for an investigation into effects on real-world behaviour and some effect was seen in relation to ability-amotivation decrease leading to improved performance relative to all other groups. There were also instances of no effect but it is encouraging for further investigation.

9.3 Suggestions for Future Research

9.3.1 Developments of the current research

An important component of this research was the potential to target amotivation at the module level irrespective of the module content. The necessary convenience sampling approach required for this thesis provided students studying Computer Science modules at Ireland's leading university. It would be beneficial to run a similar study incorporating a wider sample of courses and potentially levels. For example, in Ireland there are Post Leaving Certificate (PLC) courses offered to students who may not have been awarded a college place after second level education and provide an alternative route (Citizens Information, 2024). In addition third level courses from Science, technology, engineering, and mathematics (STEM), Arts and Humanities and others could all provide rich insights into the presence and profile of amotivation across domains.

The time permitted to undertake the research in this thesis was bounded by several factors including the need to progress the thesis in a timely fashion, the availability of the students and their lecturers, and the academic calendar. Outside these barriers it would be beneficial undertake research over a longer period, possibly an academic year, where there would be affordances to conduct a deeper investigation into the area and include qualitative aspects from both student and lecturer perspectives to build a better understanding of the area.

In the current study, at the subcomponent level, within the amotivated group, the Ability group acted as a control group for the Value group and vice versa. In carrying out further investigations it could be interesting to include control and experimental groups at the same amotivation grouping and level where the control group receive no intervention.

9.3.2 New research inspired by the current research

Based on the statistically significant outcomes in relation to reducing overall amotivation and the two targeted sub-components of 'Ability' and 'Value' it would be valuable to adopt a similar approach across the full four sub-components. The sub component 'Effort' was seen to be statistically significantly positively impacted across the three experiments

and possibly is linked to ability. Task Characteristics remained unaffected, probably as no surprise given its discrete nature and could make for an interesting addition.

The duration of the intervention would appear to have been effective. This research was one off across one module. It would be interesting to look at a multi-module approach. In this instance, to avoid nudge overload, only students who measured as amotivated pre-intervention would receive the nudges.

In addition research on the effect on the post AAI scores of (i) longer time duration over which the nudges are delivered, (ii) greater number of nudges (i.e. greater number of nudges overall) (iii) greater intensity nudges e.g. greater number of nudges per week effects, could all be interesting, and are to date unexplored.

9.3.3 Real world behaviour research

The investigation of real-world behaviours in this research was seen as opportunistic and was not the main focus. However, the ability to a) detect the presence of amotivation and b) impact associated real-world behaviours is an intriguing combination that could yield powerful real-world interventions. Profiling students through activities like test scores and VLE activity could potentially make the process semi-automatic with nudges despatched from a nudge bank based on profile. This approach could support the development of a future real-world solution to be deployed supporting undergraduates and potentially triggered by data in the VLE environment. There were mixed results to this aspect within the scope of this study, however there were some indicators as reported in sections 7.10.3 and 7.10.4. These could be developed and progressed in future research.

9.4 Implications for practice and policy

The research in this thesis has shown support for the positive effect of an intervention leveraging boost nudges for Amotivated students. In addition the potential at the targeted subcomponent level. It is worth noting that the nudges delivered were crafted by designing a structure and framework for the messages using Keller's (2010) ARCS theory. This approach meant the intervention was aligned to the profile of the issue. Understanding why a student may be struggling with performance or behaviour does not

need a system to intervene. Lecturers could learn from the principles of this research and undertake their own interventions.

The second area for consideration is that it was shown that at best the intervention had no effect on those who were not amotivated, and potentially may have had a detrimental effect on their amotivation. The implications here would be that when dealing with students' amotivation 'one size would appear to not fit all'. Therefore assuming positive messages will always have a positive effect is not necessarily true. Indeed to draw from one of the earliest findings of SDT, extrinsic motivators like rewards have been shown to have potential to decrease intrinsic motivation (Deci & Ryan, 1985).

9.5 Contributions to the field

As discussed in this chapter, research into the application of the model and implementation framework to reduce academic amotivation has shown indicators of having utility and value in the main Experiment Three with some support from the others. The implementation framework is flexible yet robust not requiring an onerous input from any of the stakeholders involved. It is addressing an intervention in academic amotivation approach, that is unique, and can contribute to insights in the area. The model and implementation framework could be developed into a potential real-world solution helping to alleviate what is identified as a painful problem for students, institutions and society.

The primary focus of this research was reducing academic amotivation, ultimately it would be hypothesised that the mindset change would improve performance and behaviour for students. In looking to the data captured and analysed there were some indicators of impact in behaviour related to ability, indicated by performance improvements. This in and of itself is an interesting contribution and leads the way for further investigation to understand what aspects might be improved to increase the link to the nudging intervention approach to achieve repeatable results in this field.

As discussed in Chapter 1 the research has received interest and some validation from the international education and technology community with presentations at three

international conferences and a paper being submitted to a peer reviewed journal in March 2024.

Did this thesis answer the research question 'To what extent can a personalised boost nudge intervention reduce academic amotivation in first-year undergraduate students?' maybe not definitively, but in line with a post-positivist approach, there is room for doubt when dealing with humans (Creswell & Creswell, 2018). Strong support was shown for there being value in this research approach. The inclusion of the two other amotivation levels, Middle Group and Not Amotivated provides a rich vein for further investigation by the researcher and others. This is academic research, it is carried out to contribute toward improving outcomes for first year undergraduate students, and all told has achieved this goal.

References

- Alghamdi, A. H. (2013). Adapting design-based research as a research methodology in educational settings. *International Journal of Education and Research*, 1(10), 1–12.
- Anderson, T., & Shattuck, J. (2012). Design-based research: A decade of progress in education research? *Educational Researcher*, 41(1), 16–25.
<https://doi.org/10.3102/0013189X11428813>
- Antonenko, P. D. (2015). The instrumental value of conceptual frameworks in educational technology research. *Educational Technology Research and Development*, 63(1), 53–71. <https://doi.org/10.1007/s11423-014-9363-4>
- Baik, C., Naylor, R., & Arkoudis, S. (2015). The First Year Experience in Australian Universities: Findings from Two Decades, 1994-2015. In *Centre for the Study of Higher Education University of Melbourne*. Retrieved from http://www.cshe.unimelb.edu.au/research/experience/docs/FYE_Report_1994_to_2009.pdf
- Barkoukis, V., Tsorbatzoudis, H., Grouios, G., & Sideridis, G. (2008). The assessment of intrinsic and extrinsic motivation and amotivation: Validity and reliability of the Greek version of the Academic Motivation Scale. *Assessment in Education: Principles, Policy & Practice*, 15(1), 39–55.
<https://doi.org/10.1080/09695940701876128>
- Belland, B. R., Kim, C. M., & Hannafin, M. J. (2013). A Framework for Designing Scaffolds That Improve Motivation and Cognition. *Educational Psychologist*, 48(4), 243–270.
<https://doi.org/10.1080/00461520.2013.838920>
- Blumenstein, M., Liu, D. Y. T., Richards, D., Leichtweis, S., & Stephens, J. M. (2018). Data-informed nudges for student engagement and success. In *Learning Analytics in the Classroom* (1st ed., pp. 185–207). <https://doi.org/10.4324/9781351113038-12>
- Brown, A. L. (1992). Design Experiments: Theoretical and Methodological Challenges in Creating Complex Interventions in Classroom Settings. *Journal of the Learning*

Sciences, 2(2), 141–178. https://doi.org/10.1207/s15327809jls0202_2

Brown, A., Lawrence, J., Basson, M., Axelsen, M., Redmond, P., Turner, J., ... Galligan, L. (2023). *The creation of a nudging protocol to support online student engagement in higher education*. <https://doi.org/10.1177/14697874211039077>

Burden, P. (2015). motivation ? An Action Research project investigating antecedent attitudes to English among Japanese university students. *Journal of OKAYAMA SHOKA UNIVERSITY*, 51(1), 36.

Cannard, C., Lannegrand-Willems, L., Safont-Mottay, C., & Zimmermann, G. (2016). Brief report: Academic amotivation in light of the dark side of identity formation. *Journal of Adolescence*, 47, 179–184. <https://doi.org/10.1016/j.adolescence.2015.10.002>

Castleman, B. L., & Page, L. C. (2015). Summer nudging: Can personalized text messages and peer mentor outreach increase college going among low-income high school graduates? *Journal of Economic Behavior and Organization*, 115, 144–160. <https://doi.org/10.1016/j.jebo.2014.12.008>

Centre for Self-Determination Theory. (2023). Retrieved August 26, 2023, from <https://selfdeterminationtheory.org/>

Chemolli, E., & Gagné, M. (2014). Evidence against the continuum structure underlying motivation measures derived from self-determination theory. *Psychological Assessment*, 26(2), 575–585. <https://doi.org/10.1037/a0036212>

Cheon, S. H., & Reeve, J. (2015). A classroom-based intervention to help teachers decrease students' amotivation. *Contemporary Educational Psychology*, 40, 99–111. <https://doi.org/10.1016/j.cedpsych.2014.06.004>

Cheon, S. H., Reeve, J., & Moon, I. S. (2012). Experimentally based, longitudinally designed, teacher-focused intervention to help physical education teachers be more autonomy supportive toward their students. *Journal of Sport & Exercise Psychology*, 34(3), 365–396. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/22691399>

- Cheon, S. H., Reeve, J., & Song, Y.-G. (2016). A Teacher-Focused Intervention to Decrease PE Students' Amotivation by Increasing Need Satisfaction and Decreasing Need Frustration. *Journal of Sport and Exercise Psychology*, 38(3), 217–235.
<https://doi.org/10.1123/jsep.2015-0236>
- Citizens Information. (2024). Post Leaving Certificate (PLC) courses. Retrieved March 18, 2025, from Citizens Information website:
<https://www.citizensinformation.ie/en/education/further-education-and-training/post-leaving-certificate-courses/#d2bd89>
- Collins, A., Joseph, D., & Bielaczyc, K. (2004). Design Research: Theoretical and Methodological Issues. *Journal of the Learning Sciences*, 13(1), 15–42.
https://doi.org/10.1207/s15327809jls1301_2
- Corrigan, O., Smeaton, A. F., Glynn, M., & Smyth, S. (2015). *Using Educational Analytics to Improve Test Performance*. https://doi.org/10.1007/978-3-319-24258-3_4
- Creswell, W. J., & Creswell, J. D. (2018). Research Design: Qualitative, Quantitative and Mixed Methods Approaches. In *Journal of Chemical Information and Modeling* (Vol. 53).
- D'Lima, G. M., Winsler, A., & Kitsantas, A. (2014). Ethnic and gender differences in first-year college students' goal orientation, Self-Efficacy, and extrinsic and intrinsic motivation. *Journal of Educational Research*, 107(5), 341–356.
<https://doi.org/10.1080/00220671.2013.823366>
- Damgaard, M. T., & Nielsen, H. S. (2017). *The use of nudges and other behavioural approaches in education*. <https://doi.org/10.2766/147222>
- Damgaard, M. T., & Nielsen, H. S. (2018). Nudging in education. *Economics of Education Review*, 64(October 2017), 313–342.
<https://doi.org/10.1016/j.econedurev.2018.03.008>
- Dar, R., & Katz, H. (2005). Action identification in obsessive-compulsive washers. *Cognitive Therapy and Research*, 29(3), 333–341. <https://doi.org/10.1007/s10608->

- Deci, E. L., & Ryan, R. M. (1985). The general causality orientations scale: Self-determination in personality. *Journal of Research in Personality, 19*(2), 109–134. [https://doi.org/10.1016/0092-6566\(85\)90023-6](https://doi.org/10.1016/0092-6566(85)90023-6)
- Deci, E. L., & Ryan, R. M. (2008). Self-determination theory: A macrotheory of human motivation, development, and health. *Canadian Psychology, 49*(3), 182–185. <https://doi.org/10.1037/a0012801>
- Deci, E. L., Vallerand, R. J., Pelletier, L. G., & Ryan, R. M. (1991). Motivation and Education: The Self-Determination Perspective. *Educational Psychologist, 26*(3–4), 325–346. <https://doi.org/10.1080/00461520.1991.9653137>
- Edmunds, J., Ntoumanis, N., & Duda, J. L. (2006). Testing a self-determination theory based teaching style in the exercise domain. *J Applied Social Psychology, 36*(9), 2240–2265.
- Fryer, L. K., Ginns, P., & Walker, R. (2014). Between students' instrumental goals and how they learn: Goal content is the gap to mind. *British Journal of Educational Psychology, 84*(4), 612–630. <https://doi.org/10.1111/bjep.12052>
- Fryer, L. K., Nicholas Bovee, H., & Nakao, K. (2014). E-learning: Reasons students in language learning courses don't want to. *Computers and Education, 74*, 26–36. <https://doi.org/10.1016/j.compedu.2014.01.008>
- Gagné, M., & Deci, E. L. (2005). Self-determination theory and work motivation. *Journal of Organizational Behavior, 26*(4), 331–362. <https://doi.org/10.1002/job.322>
- Gibney, A., Moore, N., Murphy, F., & O'Sullivan, S. (2011). The first semester of university life; "will I be able to manage it at all?" *Higher Education, 62*(3), 351–366. <https://doi.org/10.1007/S10734-010-9392-9/FIGURES/3>
- Gillis, P. (2013). *EBSCOhost | 97179643 | An Experiment Investigating The Effects Of Motivation On Cognitive Multimedia Learning Theory*. Retrieved from <https://web.p.ebscohost.com/abstract?direct=true&profile=ehost&scope=site&aut>

htype=crawler&jrnl=20093160&AN=97179643&h=t65OrTGlqHjIqpOJ6YII7pW9bdI%
2FpsAsX3nURqoXpEK12uxlhPxf8PPOHa6mw1pJRbu8pErFd7LZJqhs8A34xg%3D%3D
&crl=c&resultNs=AdminWebAuth&resultLocal=E

Gray, Colin, D., & Kinnear, Paul, R. (2012). *IBM SPSS Statistics 19 Made Simple*. East Sussex, UK: Psychology Press.

Green-Demers, I., Legault, L., Pelletier, D., & Pelletier, L. G. (2008). Factorial invariance of the Academic Amotivation Inventory (AAI) across gender and grade in a sample of canadian high school students. *Educational and Psychological Measurement*, 68(5), 862–880. <https://doi.org/10.1177/0013164407313368>

Green, S. B. (1991). How Many Subjects Does It Take To Do A Regression Analysis. *Multivariate Behavioral Research*, 26(3), 499–510.
https://doi.org/10.1207/s15327906mbr2603_7

Guba, E. G., & Lincoln, Y. S. (1994). Competing Paradigms in Qualitative Research. In K. Denzin, Norman & S. Lincoln, Yvonna (Eds.), *Handbook of Qualitative Research* (pp. 273–285). Sage Publications.

Gustavsson, P., Jirwe, M., Aurell, J., Miller, E., & Rudman, A. (2016). Autonomy-supportive interventions in schools: A review. *Estocolmo Karolinska ...*, (July). Retrieved from <https://www.researchgate.net/publication/304999207>

Haimovitz, K., & Corpus, J. H. (2011). *Effects of person versus process praise on student motivation : stability and change in emerging adulthood*. 3410(May).
<https://doi.org/10.1080/01443410.2011.585950>

Hausman, D. M., & Welch, B. (2010). Debate: To nudge or not to nudge. *Journal of Political Philosophy*, 18(1), 123–136. <https://doi.org/10.1111/j.1467-9760.2009.00351.x>

Heale, R., & Twycross, A. (2015). Validity and reliability in quantitative studies. *Evidence-Based Nursing*, 18(3), 66–67. <https://doi.org/10.1136/eb-2015-102129>

- Hoadley, C., Baumgartner, E., Bell, P., Hsi, S., Joseph, D., Orrill, C., ... Tabak, I. (2002). Design-Based Research: An Emerging Paradigm for Educational Inquiry. *Educational Researcher*, 32(1), 5–8.
- Hoadley, C. M. (2004). Methodological alignment in design-based research. *Educational Psychologist*, 39(4), 203–212. https://doi.org/10.1207/s15326985ep3904_2
- Huett, J. B., Kalinowski, K. E., Moller, L., & Huett, K. C. (2008). Improving the motivation and retention of online students through the use of arcs-based e-mails. *International Journal of Phytoremediation*, 21(1), 159–176. <https://doi.org/10.1080/08923640802224451>
- İlter, İ. (2021). *The Relationship between Academic Amotivation and Academic Achievement: A Study on Middle School Students Akademik Motivasyonsuzluk ile Akademik Başarı Arasındaki İlişki: Ortaokul Öğrencileri Üzerine Bir Çalışma*. 14(July), 389–410. <https://doi.org/http://doi.org/10.30831/akukeg.847145>
- İlter, İ. (2023). *Which Types of Amotivation Affect School Absenteeism and Academic Performance of Middle School Students ? A Structural Equation Modeling Analysis*. <https://doi.org/10.1080/19404476.2022.2161785>
- Irvine, J. (2018). A framework for comparing theories related to motivation in education. *Research in Higher Education Journal*, 35, 1–30.
- Jackson-Kersey, R., & Spray, C. (2016). The effect of perceived psychological need support on amotivation in physical education. *European Physical Education Review*, 22(1), 99–112. <https://doi.org/10.1177/1356336X15591341>
- Jackson, R. (2016). *Understanding amotivation in Physical Education c*.
- Keller, J. M. (2010). Motivational design for learning and performance: The ARCS model approach. *Motivational Design for Learning and Performance: The ARCS Model Approach*, 1–353. <https://doi.org/10.1007/978-1-4419-1250-3>
- Keller, J., & Suzuki, K. (2004). Learner motivation and E-learning design: A multinationally validated process. *Journal of Educational Media*, 29(3), 229–239.

<https://doi.org/10.1080/1358165042000283084>

- Kim, C., & Keller, J. M. (2008). Effects of motivational and volitional email messages (MVEM) with personal messages on undergraduate students' motivation, study habits and achievement. *British Journal of Educational Technology*, 39(1), 36–51. <https://doi.org/10.1111/j.1467-8535.2007.00701.x>
- Kim, C. M., & Keller, J. M. (2011). Towards technology integration: The impact of motivational and volitional email messages. *Educational Technology Research and Development*, 59(1), 91–111. <https://doi.org/10.1007/s11423-010-9174-1>
- Kouml, Y., & Seoğlu. (2013). Academic motivation of the first-year university students and the self- determination theory. *Educational Research and Reviews*, 8(8), 418–424. <https://doi.org/10.5897/ERR12.124>
- Laforce, M., Noble, E., & Blackwell, C. (2017). Problem-based learning (PBL) and student interest in STEM careers: The roles of motivation and ability beliefs. *Education Sciences*, 7(4). <https://doi.org/10.3390/educsci7040092>
- Lazowski, R. A., & Hulleman, C. S. (2016). Motivation Interventions in Education: A Meta-Analytic Review. *Review of Educational Research*, 86(2), 602–640. <https://doi.org/10.3102/0034654315617832>
- Legault, L., Green-Demers, I., & Pelletier, L. (2006). Why do high school students lack motivation in the classroom? Toward an understanding of academic amotivation and the role of social support. *Journal of Educational Psychology*, 98(3), 567–582. <https://doi.org/10.1037/0022-0663.98.3.567>
- Leonard, T. C. (2008). Richard H. Thaler, Cass R. Sunstein, Nudge: Improving decisions about health, wealth, and happiness. *Constitutional Political Economy*, 19(4), 356–360. <https://doi.org/10.1007/s10602-008-9056-2>
- Leroy, N., & Bressoux, P. (2016). Does amotivation matter more than motivation in predicting mathematics learning gains? A longitudinal study of sixth-grade students in France. *Contemporary Educational Psychology*, 44–45, 41–53.

<https://doi.org/10.1016/j.cedpsych.2016.02.001>

Litalien, D., Morin, A. J. S., Gagné, M., Vallerand, R. J., Losier, G. F., & Ryan, R. M. (2017). Evidence of a continuum structure of academic self-determination: A two-study test using a bifactor-ESEM representation of academic motivation. *Contemporary Educational Psychology*, 51, 67–82.

<https://doi.org/10.1016/j.cedpsych.2017.06.010>

Lucas, R. I. G., Bernardo, A. B. I., & Rojo-Laurilla, M. A. (2016). Amotivation in filipino ESL learners: Exploring some correlates . *Porta Linguarum*, 2016(26), 109–119.

Retrieved from <https://www.scopus.com/inward/record.uri?eid=2-s2.0-84994438778&partnerID=40&md5=7479f5c7c45fbefeb749912edb927e71>

Luyckx, K., Schwartz, S. J., Berzonsky, M. D., Soenens, B., Vansteenkiste, M., Smits, I., & Goossens, L. (2008). Capturing ruminative exploration: Extending the four-dimensional model of identity formation in late adolescence. *Journal of Research in Personality*, 42(1), 58–82. <https://doi.org/10.1016/j.jrp.2007.04.004>

Marchiori, D. R., Adriaanse, M. A., & De Ridder, D. T. D. (2017). Unresolved questions in nudging research: Putting the psychology back in nudging. *Social and Personality Psychology Compass*, 11(1), 1–13. <https://doi.org/10.1111/spc3.12297>

Mertens, S., Herberz, M., Hahnel, U. J. J., & Brosch, T. (2022). The effectiveness of nudging: A meta-analysis of choice architecture interventions across behavioral domains. *Proceedings of the National Academy of Sciences of the United States of America*, 119(1), 1–10. <https://doi.org/10.1073/pnas.2107346118>

Miller, G. F., Gupta, S., Kropp, J. D., Grogan, K. A., & Mathews, A. (2016). The effects of pre-ordering and behavioral nudges on National School Lunch Program participants' food item selection. *Journal of Economic Psychology*, 55, 4–16. <https://doi.org/10.1016/j.joep.2016.02.010>

Mohammadi, M. (2014). The Pathology of Demotivation and Amotivation in English Language Learning Context: A Case Study. *Social Research Quarterly*, 6(4), 21–34.

- Mora-Villalobos, C. R., Oreopoulos, P., & Petronijevic, U. (2017). Nber Working Paper Series Goal Setting, Academic Reminders, and College Success: a Large-Scale Field Experiment. *Uniagraria, Volumen 5*. Retrieved from https://www.nber.org/system/files/working_papers/w23738/w23738.pdf
- Moreno Murcia, J. A., Parra Rojas, N., & Gonzalez-Cutre Coll, D. (2008). [Influence of autonomy support, social goals and relatedness on amotivation in physical education classes]. *Psicothema, 20*(4), 636–641.
- Norvilitis, J. M., Reid, H. M., & States, U. (2022). *Amotivation : A Key Predictor of College GPA , College Match , and First- Year Retention. 11*(3), 314–338. <https://doi.org/10.17583/ijep.2022.7309>
- O’Connell, S. D., & Lang, G. (2018). Can Personalized Nudges Improve Learning in Hybrid Classes? Experimental Evidence From an Introductory Undergraduate Course. *Journal of Research on Technology in Education, 50*(2), 105–119. <https://doi.org/10.1080/15391523.2017.1408438>
- O’Shea, M. (2021). Higher Education – Key Facts and Figures 2020/2021. Retrieved September 10, 2022, from <https://hea.ie/2021/10/11/higher-education-key-facts-and-figures-2020-2021/>
- Olson, J. A., Sandra, D. A., Chmoulevitch, D., Raz, A., & Veissière, S. P. L. (2022). A Nudge-Based Intervention to Reduce Problematic Smartphone Use: Randomised Controlled Trial. *International Journal of Mental Health and Addiction, (0123456789)*. <https://doi.org/10.1007/s11469-022-00826-w>
- Panhwar, A. H., Ansari, S., & Shah Asif Ali. (2017). Post-positivism: an effective paradigm for social and educational research | Panhwar | International Research Journal of Arts & Humanities (IRJAH). *International Research Journal of Arts & Humanities , 45*(45), 253–260. Retrieved from <https://sujo-old.usindh.edu.pk/index.php/IRJAH/article/view/3371>
- Parnell, H., Fernandes, R., Walker, E., Suchard, G., & Wilson, V. (2014). *Turning research into public education: “Don’t trust your tired self.”* (2009), 9p. Retrieved from

<http://acrs.org.au/publications/conference-papers/database/%0Ahttps://trid.trb.org/view/1354141>

Perlman, D., & Caputi, P. (2017). Examining the influence of Sport Education on the precursors of amotivation. *European Physical Education Review*, 23(2), 212–222. <https://doi.org/10.1177/1356336X16643921>

Perlman, D. J. (2015). Help motivate the amotivated by being a supportive teacher. *Physical Education and Sport Pedagogy*, 20(2), 204–214. <https://doi.org/10.1080/17408989.2013.868876>

Phillips, D. C., & Burbules, N. C. (2000). *Postpositivism and Educational Research*. Lanham, M.D.: Rowman & Littlefield Publishers.

Pool, J., & Laubscher, D. (2016). Design-based research: is this a suitable methodology for short-term projects? *Educational Media International*, 53(1), 42–52. <https://doi.org/10.1080/09523987.2016.1189246>

Purohit, A. K., Barev, T. J., Schöbel, S., Janson, A., & Holzer, A. (2023). *Designing for Digital Wellbeing on a Smartphone : Co-creation of Digital Nudges to Mitigate Instagram Overuse*. Retrieved from https://www.researchgate.net/publication/364341104_Designing_for_Digital_Wellbeing_on_a_Smartphone_Co-creation_of_Digital_Nudges_to_Mitigate_Instagram_Overuse

Reeve, J. (2002). No Title. In *Handbook of self-determination research* (pp. 183–204). University of Rochester Press.

Ryan, A. B. (2006). Post-positivist approaches to research. *Researching and Writing Your Thesis: A Guide for Postgraduate Students*, 12–28.

Ryan, R. M., Bradshaw, E., & Deci, E. L. (2019). A History of Human Motivation Theories. In *The Cambridge handbook of the intellectual history of psychology* (pp. 391–411).

Ryan, R. M., & Deci, E. L. (2000). Intrinsic and Extrinsic Motivations : Classic Definitions

- and New Directions. *Contemporary Educational Psychology*, 25, 54–67.
<https://doi.org/10.1006/ceps.1999.1020>
- Ryan, R. M., & Deci, E. L. (2017). *Self-Determination Theory : Basic Psychological Needs in Motivation, Development, and Wellness*. Guilford Publications.
- Ryan, R. M., & Deci, E. L. (2019). Brick by brick: The origins, development, and future of self-determination theory. In *Advances in motivation science* (Vol. 6, pp. 111–156). Elsevier.
- Saravanan, C., & Kingston, R. (2014). A randomized control study of psychological intervention to reduce anxiety, amotivation and psychological distress among medical students. *Journal of Research in Medical Sciences*, 19(5), 391–397.
 Retrieved from
<http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L373383430>
- Sarra, A., Fontanella, L., & Di Zio, S. (2019). Identifying Students at Risk of Academic Failure Within the Educational Data Mining Framework. *Social Indicators Research*, 146(1–2), 41–60. <https://doi.org/10.1007/s11205-018-1901-8>
- Savery, J. . (2006). Overview of problem-based learning: Devinition and distinction interdisciplinary. *Journal Problem-Based Learning*, 1(1), 9–20. Retrieved from <https://doi.org/10.7771/1541-5015.1002>
- Schippers, M. C., Scheepers, A. W. A., & Peterson, J. B. (2015). A scalable goal-setting intervention closes both the gender and ethnic minority achievement gap. *Palgrave Communications*, 1(May). <https://doi.org/10.1057/palcomms.2015.14>
- Schmidt, A. T., & Engelen, B. (2020). The ethics of nudging: An overview. *Philosophy Compass*, 15(4), 1–13. <https://doi.org/10.1111/phc3.12658>
- Schunk, D. (2013). *Learning Theories An Educational Perspective* (6th ed.). Boston: Pearson.
- Shen, B. (2015). Gender Differences in the Relationship Between Teacher Autonomy

- Support and Amotivation in Physical Education. *Sex Roles*, 72(3–4), 163–172.
<https://doi.org/10.1007/s11199-015-0448-2>
- Shen, B., Wingert, R. K., Li, W., Sun, H., & Rukavina, P. B. (2010). An amotivation model in physical education. *Journal of Teaching in Physical Education*, 29(1), 72–84.
<https://doi.org/10.1123/jtpe.29.1.72>
- Sosu, E. M., & Pheunpha, P. (2019). Trajectory of University Dropout: Investigating the Cumulative Effect of Academic Vulnerability and Proximity to Family Support. *Frontiers in Education*, 4(February), 1–10.
<https://doi.org/10.3389/educ.2019.00006>
- Su, Y. L., & Reeve, J. (2011). A Meta-analysis of the Effectiveness of Intervention Programs Designed to Support Autonomy. *Educational Psychology Review*, 23(1), 159–188. <https://doi.org/10.1007/s10648-010-9142-7>
- Sunstein, C. R. (2015). Nudges, Agency, and Abstraction: A Reply to Critics. *Review of Philosophy and Psychology*, 6(3), 511–529. <https://doi.org/10.1007/s13164-015-0266-z>
- Terrier, L., Rech, A., Marfaing, B., & Fernandez, S. (2018). How to Deal with Amotivated Students? Using Commitment to Reduce Amotivation as Applied to Hospitality Training. *Journal of Hospitality and Tourism Education*, 30(1), 11–18.
<https://doi.org/10.1080/10963758.2017.1413379>
- Thaler, R. H., Sunstein, C. R., & Balz, J. P. (2014). Choice Architecture. *Ssrn*, (December).
<https://doi.org/10.2139/ssrn.2536504>
- Ulriksen, L., Madsen, L. M., & Holmegaard, H. T. (2010). What do we know about explanations for drop out/opt out among young people from STM higher education programmes? *Studies in Science Education*, 46(2), 209–244.
<https://doi.org/10.1080/03057267.2010.504549>
- van der Meij, H., van der Meij, J., & Harmsen, R. (2015). Animated pedagogical agents effects on enhancing student motivation and learning in a science inquiry learning

- environment. *Educational Technology Research and Development*, 63(3), 381–403.
<https://doi.org/10.1007/s11423-015-9378-5>
- Visser, J., & Keller, J. M. (1990). The clinical use of motivational messages: an inquiry into the validity of the ARCS model of motivational design. *Instructional Science*, 19(6), 467–500. <https://doi.org/10.1007/BF00119391>
- Visser, L., Plomp, T., Amirault, R. J. ., & Kuiper, W. (2002). Motivating students at a distance: The case of an international audience Author (s): Lya Visser , Tjeerd Plomp , Ray J . Amirault and Wilmad Kuiper Source : Educational Technology Research and Development , Vol . 50 , No . 2 (2002) , pp . 94-110 Publi. *Educational Technology Research and Development*, 50(2), 94–110.
- Weijers, R. J., de Koning, B. B., & Paas, F. (2021). Nudging in education: from theory towards guidelines for successful implementation. *European Journal of Psychology of Education*, 36(3), 883–902. <https://doi.org/10.1007/s10212-020-00495-0>
- Weiner, B. (1990). *History of Motivational Research in Education*. 82(4), 616–622.
- Weiser, M., & Garibaldi, G. (2015). Quantifying motivational deficits and apathy: A review of the literature. *European Neuropsychopharmacology*, 25(8), 1060–1081.
<https://doi.org/10.1016/j.euroneuro.2014.08.018>
- Wigfield, A., & Eccles, J. S. (2000). Expectancy-value theory of achievement motivation. *Contemporary Educational Psychology*, 25(1), 68–81.
<https://doi.org/10.1006/ceps.1999.1015>
- Wilson Van Voorhis, C. R., & Morgan, B. L. (2007). Understanding Power and Rules of Thumb for Determining Sample Sizes. *Tutorials in Quantitative Methods for Psychology*, 3(2), 43–50. <https://doi.org/10.20982/tqmp.03.2.p043>

Appendix

Appendix A - Research Instrument 1 - Self-Report Questionnaire on Academic Behaviours.

Q1. What has been your grade-point average (%) on all your tests to date? _____

(measure for performance subscale)

Q2. Please report the average number of hours spent studying and doing assignments each week _____

(measure for maladaptive behaviour subscale)

Please rate, each statement (S.1 to S.11) from 1 to 7 by ticking the box that most aligns to your view. **Note the rankings are not all the same so read the ranking statements carefully before ticking your box.**

S1. Please rate your own perceived proficiency in topic 'A' (measure for performance subscale)

Weak			Average			Outstanding
1	2	3	4	5	6	7

S2. Please rate your own perceived proficiency in topic 'B' (measure for performance subscale)

Weak			Average			Outstanding
1	2	3	4	5	6	7

S3. This term, how frequently were you late for class? (measure for maladaptive behaviour subscale)

Never			Sometimes			Frequently
1	2	3	4	5	6	7

S4. This term, how frequently did you skip class? (measure for maladaptive behaviour subscale)

Never			Sometimes			Frequently
1	2	3	4	5	6	7

S5. I am able to do this course as well as most other people (measure for self-esteem subscale)

Strongly agree			Neither agree or disagree			Strongly disagree
1	2	3	4	5	6	7

S6. At times I think I am no good at this course at all. (measure for self-esteem subscale)

Strongly agree			Neither agree or disagree			Strongly disagree
1	2	3	4	5	6	7

S7. I feel I do not have much to be proud of on this course (measure for self-esteem subscale)

Strongly agree			Neither agree or disagree			Strongly disagree
1	2	3	4	5	6	7

S8. I have high self-esteem (measure for self-esteem subscale)

Not very true of me						Very true of me
1	2	3	4	5	6	7

S9. I sometimes consider dropping out of school. (measure for intention to drop out subscale)

Not very true of me						Very true of me
1	2	3	4	5	6	7

S10. I intend to drop out of school. (measure for intention to drop out subscale)

Not very true of me						Very true of me
1	2	3	4	5	6	7

S11. I sometimes feel unsure about continuing my studies year after year. (measure for intention to drop out subscale)

Not very true of me						Very true of me
1	2	3	4	5	6	7

Appendix B - Research Instrument 2 – Academic Amotivation Inventory.

Please rate, from 1 to 7, the degree to which each of the 16 statements below correspond to your wanting to/or not, study or do college work (1 = does not correspond at all, 4 = corresponds moderately, 7 = corresponds exactly). Please tick beside the number that represents how you feel for each question below.

Value Subscale Questions

1. Because, for me, school holds no interest.
2. Because studying is not valuable to me.
3. Because I have no good reason to study.
4. Because studying is not important to me.

Ability Subscale Questions

5. Because I don't have what it takes to do well in school.
6. Because I don't have the knowledge required to succeed in school.
7. Because I'm not good at school.
8. Because the tasks demanded of me surpass my abilities.

Task Characteristics Subscale Questions

9. Because I find that studying is boring.
10. I don't like studying.
11. Because I have the impression that it's always the same thing every day.
12. Because my school work is not stimulating.

Effort Subscale Questions

13. Because I'm a bit lazy.
14. Because I'm not energetic enough.
15. Because I can't seem to invest the effort that is required.
16. Because I don't have the energy to study.

Appendix C - Research Instrument 2 – Lisa Legault support for this thesis' research and leveraging the 13 item self-report behaviour questionnaire.

Peter Gillis <peter.gillis@learnovatecentre.org>

5 Sept 2018, 09:52

to LeGault

Dear Lisa,

My name is Peter Gillis, I am a researcher at the Learnovate Centre, hosted at Trinity College Dublin, Ireland (www.learnovatecentre.org). My current study for a PhD at Trinity College Dublin is researching the potential of 'nudging' as a way to approach amotivation in undergraduate students. I am very interested in the work you and your colleagues, Luc Pelletier and Isabelle Green-Demers carried out in 2006. Specifically, the four-dimension aspect of the Academic Amotivation Inventory.

In my research I would like to leverage some of your approaches and was wondering if you might share with me the specifics around the tools used for the "self-reported behavioural and psychological measures".

I am sure you are very busy, so I am keeping this short, but happy to share further detail with you if required.

Hoping you can help.

Best

Peter

Lisa Legault <llegault@clarkson.edu>

10 Sept 2018, 19:33

to me

Dear Peter,

Thanks for your interest. Your project sounds very interesting! I no longer have record of the exact items you're asking for, but most of what you need should be searchable. We assessed academic performance and time spent studying by just asking students their GPA and how many hours per week they spent studying on a Likert scale. If you search for measures of academic self-esteem (I'm sorry I don't have any on hand, otherwise I would send them to you), I believe some have been published since this paper. Alternately, you might adapt the Rosenberg scale. I wish I had a compendium of the measures you're asking for, but I do not. Do you have the academic amotivation measure - that one I can dig out!

Best of luck in your research!

Lisa

Appendix D. Lecturer Toolkit.

Thank you for agreeing to support this research. As part of the intervention 'Nudges' will be sent to the students over the two weeks.

Nudges are short nudges where experts, like you, guide individuals to make better choices, instead of mandating choices. The benefit claims are that people are still free to make their own choices, but when the desired approach is framed in a helpful way, that they will decide to make that choice.

There will be two groups defined prior to the intervention. For one group the nudges will be targeting students' Ability beliefs. Belief in their ability to participate in, and successfully complete the module. For the other group the nudges will be targeting the students' perceived value of the outcome to be achieved in completing the module.

I would ask you to develop 2 nudges for each category, Ability and Value, focused on your specific module. The nudges in this case will be sent as text nudges to the students' phones.

In line with all the above the nudge nudges should be kept short and focus on positives directly related to your module.

The Ability Nudges.

In developing the two ability nudges it might be helpful to focus on historically challenging areas of the module and what specific strategies you might recommend that would support the students' beliefs that they can accomplish the result.

An example might look like this.

ABILITY - This a support nudge around the students' ability to complete the module:

For Business students studying the economics module (students and the module) the assessment is an online quiz and final open book exam, (description of assessment). You need to study the manual and as you do, think about how this relates to your own understanding of the economy and try to relate it to the turmoil the world is currently experiencing (Study tip)

The Value Nudges.

In relation to then Value nudges, please structure the nudges, if possible, on the near-term value of successfully completing your module. What will success in the module deliver to the student that is meaningful to them in the next stages of their study?

An example might look like this.

VALUE - This nudge is around the practical value of the module in the future:

For Business students studying the economics module (students and the module) the assessment is a presentation, (description of assessment, however this could also be a learning outcome or ancillary learning outcome) employers often comment that it is skills like presentations that graduates often lack when starting their career. So try and use this opportunity to practice and improve. (the practical future value of achieving the assessment)

Appendix E - Griffith College Dublin Ethics Approval.



GRIFFITH COLLEGE

Research Ethics Committee

South Circular Road, Dublin 8.

Griffith College

Tel: +353 1 415 0400 Website: www.griffith.ie

Friday 29 March 2019

Re: Application for Ethics Approval

Dear Peter,

Your request to conduct research involving learners of the college was formally considered at a meeting of the college's research ethics committee on Wednesday 27th March 2019.

The committee welcomes the revisions made to your earlier research instruments.

The committee approved your application to conduct the research.

You may now engage directly with the participating faculties and undertake the research as outlined.

Any change to the research methodology or research instrument from those outlined by you in your application, must be notified in advance to the research committee.

Wishing you success with your research and related findings.

Yours sincerely,

Dr. Tomás Mac Eochagáin

Chair of Research Committee

Appendix F - Griffith College Dublin Ethics Application.

Request to Griffith College for assistance in undertaking research as part of Peter Gillis' PhD studies.

An investigation of the potential of personalised nudging techniques on; amotivation state, associated negative beliefs and subsequent outcomes of amotivation in first-year undergraduate students.

Research project information for Griffith College management and Ethics	1
Experiment One plan	4
Griffith College Ethical Approval Form	5
Research Instrument 1. Academic Amotivation Inventory.	7
Research Instrument 2. Self-Report Antecedents.	7
Participant Information Sheet	9
Participant Consent Form	11

Research project information for Griffith College management and Ethics

My name is Peter Gillis, I hold a first-class honours degree in Psychology and a MSc in Technology enhanced Learning. I am currently starting the third year of my part-time PhD with Trinity College Dublin (TCD). I work full-time at the TCD hosted research centre, Learnovate. I have been an Associate Lecturer on the Psychology of Teaching and Learning at Griffith for four years on the MATE programme and I am starting my third-year lecturing on the HDDE/HDME course. In 2018 I have taken on the lead role on the MATE Dissertation module.

Below is a brief outline of my motivation to undertake this research. On Page 3 I have put in detail around where I am hoping Griffith College can help me with my research. In total, and in part, I believe my research objectives can benefit Griffith College, providing insight into the motivational drivers of first year undergraduates and identifying potential areas for improvement across; student ability beliefs, effort beliefs, value beliefs and quality of teaching materials. In addition, the ability to compare these beliefs across disciplines. This is a report I would be happy to prepare for Griffith College in addition to my research.

Research Motivation

“there is a great need to look into academic amotivation..... the link between amotivation and performance is still underexplored” (Leroy & Bressoux, 2016, p.43).

“One of the most prominent academic problems plaguing today’s teenage youth is a lack of motivation toward academic activities”, (Legault, Green-Demers and Pelletier, 2006, p.567).

“amotivation appears to be an active negative form of motivation rather than a lack of it, and possibly a more sensitive guide of engagement level, yet to date there appears to be little research into it as an independent motivation paradigm” (Gillis, 2013).

This research will look at an experimental intervention approach to investigate the potential of technological ‘nudging techniques’ focused on amotivation in relation to performance and academic motivation.

A report relating to first year students in the Australian university sector sees motivation as “critical for persistence and achievement” (Baik, Naylor & Arkoudis, 2014). For new undergraduates, motivation to study has shown to be an issue, Baik et.al reporting over a third expressing difficulty in the area (2014). An Irish study in University College Dublin (UCD) reported similar numbers with 29% reporting academic motivational concerns in the first semester.

In discussing motivation for undergraduates, most of the research tends to focus on intrinsic and extrinsic aspects of motivation (Baik, Naylor & Arkoudis, 2014; Gibney, Moore, Murphy, & O'Sullivan, 2011; D'Lima & Winsler 2014). These two concepts are cornerstones of Deci & Ryan's well established and robust Self Determination Theory of Motivation (1985). The theory contains a third dimension which tends to be overlooked in the aforementioned research. The concept of amotivation, which Deci & Ryan hold refers to “a lack of intention and motivation” (1985). In relation to academic endeavour Barkoukis et.al. expand on this definition stating that amotivation is beyond a lack; amotivation also involves a belief the outcome is not desirable and that even with great effort successful completion is not possible (2008). On this basis it would appear intrinsic and extrinsic approaches are providing solutions where as an amotivation approach is

tackling the problem. It is through an amotivation lens this research seeks to investigate the potential of interventions to remove barriers to motivation.

The research will also seek to adopt a unique approach through the use of Educational nudges; soft interventions such as information provision and reminders intended to induce better decision making (Damgaard, M.T. & Skyt Nielsen, H. 2017). Nudging has received attention as a means to improve educational outcomes including a recent European Commission report on the topic, (Damgaard, M.T. & Skyt Nielsen, H. 2017). Of particular interest in this research is a subset of nudges referred to as boost nudges. Boost nudges seek to assist in the general area of skills required by students to succeed and how to deal with barriers they may encounter. Unlike specific informational nudges, boost seeks to address issues such as self-control (Damgaard and Nielsen 2018). No research found has sought to use boost nudges aligned to amotivation of individuals. Ultimately the research will seek to design and investigate the potential of an adaptive model of nudge interventions based on student profile, delivered via technology directly to the student. In this first experiment the concept is to investigate the potential of nudges to impact on amotivation and performance.

Research Question

An investigation of the potential of personalised nudging techniques on; amotivation state, associated negative beliefs and subsequent outcomes of amotivation in first year undergraduate students.

Objectives:

While I would hope to work with Griffith on all three objectives, the current request for assistance and access is in relation to Objective 1 below.

Objective 1

Through initial experiment investigate the potential of amotivation focused boost nudges targeting amotivation levels and subsequent outcomes.

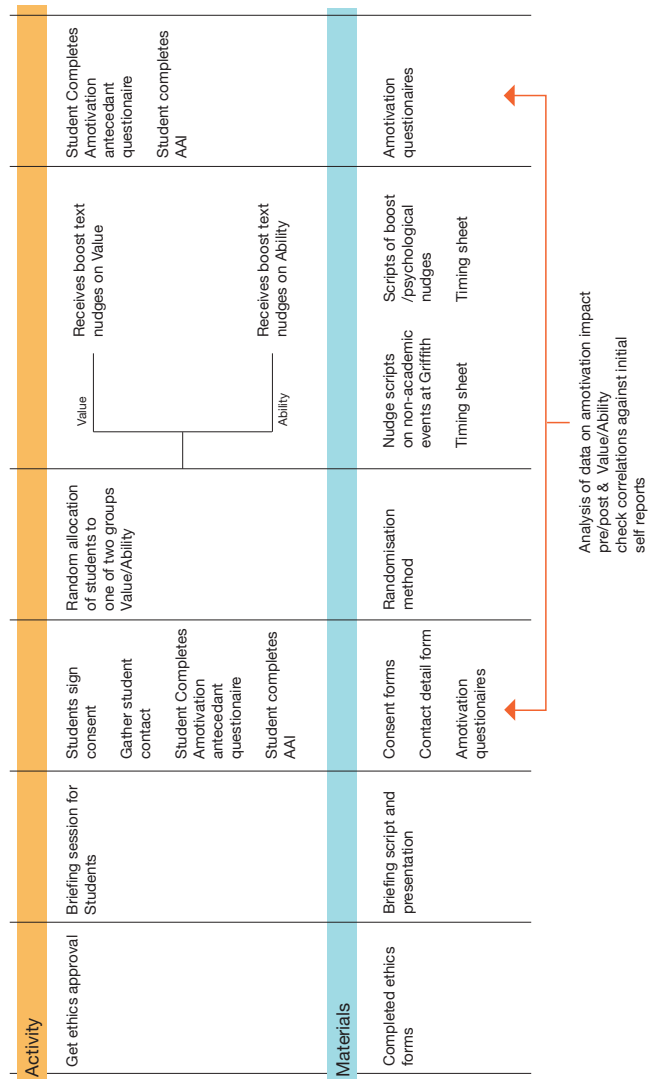
Objective 2

Develop a model of personalised amotivation-focused boost nudges based on student profiles to investigate the potential to impact on specific individual's amotivation and subsequent outcomes.

Objective 3

Develop a framework to support the intervention process, artefacts, and instruments to allow further development and analysis of focused nudging interventions on amotivation. Deploy the framework and analyse outcomes.

Initial experiment looking at potential for nudges to impact amotivation in a non-personalised intervention - @ Griffith College - Spring 2019



Griffith College Ethical Approval Form

This form should be completed by the researcher (with the advice of the research supervisor), for all research which involves human participants.

Research Title	An investigation of the potential of personalised nudging techniques on; amotivation state, associated negative beliefs and subsequent outcomes of amotivation in first year undergraduate students.
Researcher(s)/Student	Peter Gillis
Supervisor (where relevant)	Prof. Vincent Wade Trinity College, Dublin

Programme of Study (where relevant)	PhD by Research, Trinity College, Dublin
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Checklist:

<i>Please attach to all forms:</i>	
Summary of Project Proposal (no more than 500 words)	See above
Participant Information Sheet	Attached
<i>If applicable, application should also include the following:</i>	
Draft Consent Form	Attached
Draft Research Instrument e.g. survey, interview schedule, focus group questions etc	See below

Part (a)

		Yes	No	N/A
1	Will you describe the main research procedures to participants?	X		
2	Will you tell participants that their participation is voluntary?	X		
3	Will you obtain written consent for participation?	X		
4	If the research is observational, will you ask participants for their consent to being observed?			X
5	Is the right to freely withdraw from the research at any time made explicit to participants?	X		
6	Will you tell participants that their data will be treated with full confidentiality and that, if published, it will not be identifiable as theirs?	X		
7	Will you debrief participants at the end of their participation?	X		
8	Will your research involve discussion of topics which the participants might find sensitive?		X	
9	Will financial inducements (other than reasonable expenses or compensation for time) be offered to participants?		X	
10	Will your project involve deliberately misleading participants in any way?		X	
11	Is there any realistic risk of any participants experiencing either physical or psychological distress or discomfort?		X	
12	Does your research involve participants who are particularly vulnerable or who may feel unable to give informed consent e.g. prisoners; children; people for whom English is not their first language; learners in a programme you teach on?		X	
13	Will any non-anonymised and/personalised data be generated and/stored?		X	

If you answered YES to any of questions 8 to 13 please complete Part (b) of this form. If there are any other ethical issues that you think the Committee should consider, please explain them in Part Two of this form. It is the researcher's obligation to bring to the attention of the Committee any ethical issues not covered on this form.

Part (b)

For each question 8 to 13 that you answered YES, please give a summary of the issue and action to be taken to address it (no more than 300 words in total):

Signed (by Researcher): Date: 7th October 2018

Participation information Sheet

Supporting first year undergraduate students through the use of supportive text based supports

Researcher: Peter Gillis BA 1st Psy, MSc

Introduction

You are invited to take part in a research project exploring the use of text nudges to support undergraduate students in first year as they adjust to life in third level education. Please read this information sheet carefully and contact Peter Gillis at peter.gillis@griffith.ie or 087 2620411 if you have any questions before, during or after the research.

Over the period of early February 2019 to early March 2019 we will send you text nudges, approximately two per week, you are not required to respond to these texts, just to read them. Participation in the research is completely voluntary and will not affect the assessment of your college work. The sessions are being trialled as a support strategy and the research has been approved by the *Course Co-ordinator and the Head of Department*. Students are viewed as stakeholders in this trial to assist in the potential development of supports for students entering third level education. Your participation and feedback may influence whether this strategy will be used with future groups and inform potential improvements. Results of the study will be made available to you on request.

About the research

This research is being conducted by Peter Gillis as part of his studies on the PhD by research programme at Trinity College Dublin. The project is interested in examining how the use of purposefully designed text nudges might support students from an informational and motivational perspective in negotiating college academic studies.

Background and rationale for the research

“One of the most prominent academic problems plaguing today’s teenage youth is a lack of motivation toward academic activities”, (Legault, Green-Demers and Pelletier, 2006, p.567). This research is ultimately looking to investigate the potential of low cost, low effort interventions to model personalised support texts to students to assist in the development of students’ approach to their studies and academic endeavour. This particular research is a first experiment investigating the suitability of text nudges as a means to supply this support.

What does participation involve?

Students will be asked to;

- sign a consent form to participate and allow for the gathering of data, all data will be anonymised by the researcher,
- complete a short survey plus a self-evaluation survey at the beginning of the study,
- provide a contact number to receive text nudges.
- receive on average one to two text nudges a week from the researcher, students are only asked to read the nudge and do not have to respond.
- in Mach, to complete the same survey again plus a self-evaluation survey.

Anticipated risks/benefits to participants

It is not anticipated that there will be any risks involved in participation and it is expected that participants may benefit from the opportunity to receive supports over the course of the research project.

What are the implications of not participating?

Any student who does not wish to participate in the research will simply not receive the text nudges and as such will continue their academic year with no impact. Students who volunteer to participate may withdraw from the project at any time without penalty and any information already provided will be removed. The research has no direct impact on student assessment.

What information will be gathered?

The data collected from each participant will be:

- Answers to surveys
- List of text nudges sent over the period.
- Moodle activity over the period

How will my information be used?

Information collected during the research will be analysed and discussed in a written research project submitted to Trinity College, Dublin, as part of my course work on my PhD. The anonymised research may also be presented within this context. Results of the anonymised research may also be shared with the Head of Department, Course Co-ordinator and other teaching staff on the course. Separate approval will be sought for any use of the information beyond this context.

How will my identity be protected?

No personally identifying information will be used in the analysis or presentation of data and findings. All information collected by the researcher will be anonymised and stored in accordance with the Data Protection Act at Griffith College. In the unlikely event that information about illegal activities should emerge during the study, the researcher will be obliged inform the relevant authorities.

Are there any conflicts of interest involved?

The researcher is an associate lecturer at Griffith course on several modules, however, is not involved in any of the courses being asked to participate in this research. In light of this it is not deemed the researcher has any conflict of interest.

This study has been approved by the Griffith College Ethics Committee.

If you have any questions before, during or after the project, please do not hesitate to contact Peter Gillis at peter.gillis@griffith.ie or 087 2620411

Participant Consent Form

Please read the Participant Information Sheet carefully and address any questions about the research to Peter Gillis before signing this declaration.

Participant Details:

Name: _____ Student Number: _____

Mobile Phone Number: _____ Course: _____

Declaration

- I am 18 years or older and am competent to provide consent.
- I have read or had read to me the information sheet and consent form.
- I have had the opportunity to ask any questions and had them answered.
- I understand that I may ask any questions about the research project before, during and after my participation.
- I understand that I am under no obligation to take part in this project and that a decision not to participate will not affect my Griffith College course participation now or in the future.
- I understand that I have the right to withdraw from this project at any stage.
- I consent to providing my phone number and receiving text nudges over the project period.
- I consent to the researcher reviewing my usage data for Griffith Moodle over the period of the research on the understanding that it will not be shared in an identifiable way with any other person.
- I understand that the results of this research project may be published/presented and if so, any data used will be in such a way that does not reveal my identity.
- I understand that if I or anyone in my family has a history of epilepsy then I am proceeding at my own risk.
- I understand that in the unlikely event that information about illegal activities should emerge during the study, the researcher will be obliged inform the relevant authorities.

Participant's name: _____

Participant's signature: _____ Date: _____

Statement of investigator's responsibility: I have explained the nature and purpose of this research study, the procedures to be undertaken and any risks that may be involved. I have offered to answer any questions and fully answered such questions. I believe that the participant understands my explanation and has freely given informed consent.

Researcher's signature: _____ Date: _____

Project contact details: Peter Gillis Email: peter.gillis@gmail.com Mobile: 087-2620411

Note the research Tools were included in the original application. They are represented in this document as Appendix A and Appendix B.

Appendix G - Experiment One – Analyses data on full AAI scores, Pre, and Post, split by Amotivated, Middle, and Not Amotivated, groups.

Descriptive Statistics									
		N	Mean	Std. Deviation	Minimum	Maximum	Percentiles		
Amotivated, Middle group, Not Amotivated							25th	50th (Median)	75th
Not Amotivated	Amotivation Index	12	24.9167	3.91868	17.00	29.00	21.2500	27.0000	28.0000
	Amotivation Index Post	12	26.4167	6.08214	17.00	37.00	22.2500	24.5000	30.5000
Amotivated	Amotivation Index	11	45.8182	4.35473	42.00	57.00	42.0000	46.0000	48.0000
	Amotivation Index Post	11	41.4545	6.72850	28.00	54.00	38.0000	42.0000	45.0000
Middle Group	Amotivation Index	11	35.3636	4.05642	30.00	41.00	32.0000	34.0000	39.0000
	Amotivation Index Post	10	36.5000	4.19656	31.00	44.00	32.7500	36.5000	39.5000

Wilcoxon Signed Ranks Test

Ranks					
Amotivated, Middle group, Not Amotivated		N	Mean Rank	Sum of Ranks	
Not Amotivated	Amotivation Index Post - Amotivation Index	Negative Ranks	3 ^a	5.00	15.00
		Positive Ranks	7 ^b	5.71	40.00
		Ties	2 ^c		
		Total	12		
Amotivated	Amotivation Index Post - Amotivation Index	Negative Ranks	9 ^a	6.56	59.00
		Positive Ranks	2 ^b	3.50	7.00
		Ties	0 ^c		
		Total	11		
Middle Group	Amotivation Index Post - Amotivation Index	Negative Ranks	1 ^a	7.00	7.00
		Positive Ranks	6 ^b	3.50	21.00
		Ties	3 ^c		
		Total	10		

a. Amotivation Index Post < Amotivation Index

b. Amotivation Index Post > Amotivation Index

c. Amotivation Index Post = Amotivation Index

Test Statistics^a

Amotivated, Middle group, Not Amotivated		Amotivation Index Post - Amotivation Index
Not Amotivated	Z	-1.281 ^b
	Asymp. Sig. (2-tailed)	0.200
Amotivated	Z	-2.324 ^c
	Asymp. Sig. (2-tailed)	0.020
Middle Group	Z	-1.185 ^b
	Asymp. Sig. (2-tailed)	0.236

a. Wilcoxon Signed Ranks Test

b. Based on negative ranks.

c. Based on positive ranks.

Appendix H - Experiment One – Analyses data on AAI subscale scores, Pre, and Post, split by Amotivated, Middle, and Not Amotivated groups.

Descriptive Statistics									
		N	Mean	Std. Deviation	Minimum	Maximum	25th	Percentiles	
Amotivated, Middle group, Not Amotivated								50th (Median)	75th
Not Amotivated	Ability	12	5.4167	1.37895	4.00	8.00	4.0000	5.0000	6.7500
	Value	12	5.9167	1.31137	4.00	8.00	4.5000	6.0000	7.0000
	Effort	12	6.8333	1.52753	4.00	9.00	5.2500	7.0000	8.0000
	Task	12	6.7500	1.91288	5.00	10.00	5.5000	6.0000	9.0000
	Ability_Post	12	6.2500	2.05050	4.00	10.00	4.2500	6.0000	7.5000
	Value_Post	12	6.0000	2.13201	4.00	11.00	4.2500	5.5000	6.7500
	Effort Post	12	6.5000	2.50454	4.00	12.00	4.0000	6.0000	8.5000
	Task Post	12	7.6667	1.72328	5.00	10.00	6.0000	7.5000	9.0000
Amotivated	Ability	11	9.3636	2.46060	6.00	13.00	7.0000	9.0000	12.0000
	Value	11	10.0909	2.42712	6.00	14.00	8.0000	10.0000	12.0000
	Effort	11	13.6364	2.41962	10.00	18.00	12.0000	14.0000	15.0000
	Task	11	12.7273	3.52394	7.00	20.00	11.0000	13.0000	15.0000
	Ability_Post	11	7.9091	2.38556	4.00	12.00	6.0000	8.0000	10.0000
	Value_Post	11	9.0909	2.66288	5.00	12.00	6.0000	10.0000	12.0000
	Effort Post	11	11.9091	2.16585	9.00	16.00	10.0000	12.0000	13.0000
	Task Post	11	12.5455	4.08323	4.00	18.00	11.0000	14.0000	15.0000
Middle Group	Ability	11	7.6364	2.83805	5.00	12.00	5.0000	7.0000	11.0000
	Value	11	6.7273	1.79393	4.00	10.00	5.0000	7.0000	8.0000
	Effort	11	9.7273	1.95402	7.00	13.00	8.0000	10.0000	12.0000
	Task	11	11.2727	1.10371	10.00	13.00	10.0000	11.0000	12.0000
	Ability_Post	11	7.5455	1.80907	5.00	10.00	6.0000	7.0000	9.0000
	Value_Post	10	7.3000	1.05935	6.00	9.00	6.0000	7.5000	8.0000
	Effort Post	11	10.4545	1.86353	8.00	14.00	9.0000	11.0000	12.0000
	Task Post	11	11.4000	2.45855	5.00	13.00	10.7500	12.0000	13.0000

Wilcoxon Signed Ranks Test

Ranks				
	N	Mean Rank	Sum of Ranks	
Amotivated, Middle group, Not Amotivated				
Not Amotivated	Ability_Post - Ability	Negative Ranks	1 ^a	2.50
		Positive Ranks	6 ^b	4.25
		Ties	5 ^c	
		Total	12	
	Value_Post - Value	Negative Ranks	3 ^d	2.50
		Positive Ranks	2 ^e	3.75
		Ties	7 ^f	
		Total	12	
	Effort Post - Effort	Negative Ranks	7 ^g	5.00
		Positive Ranks	3 ^h	6.67
		Ties	2 ⁱ	
		Total	12	
	Task Post - Task	Negative Ranks	1 ^j	4.00
		Positive Ranks	6 ^k	4.00
		Ties	5 ^l	
		Total	12	
Amotivated	Ability_Post - Ability	Negative Ranks	8 ^a	5.06
		Positive Ranks	1 ^b	4.50
		Ties	2 ^c	
		Total	11	
	Value_Post - Value	Negative Ranks	5 ^d	3.40
		Positive Ranks	1 ^e	4.00
		Ties	5 ^f	
		Total	11	
	Effort Post - Effort	Negative Ranks	8 ^g	5.00
		Positive Ranks	1 ^h	5.00
		Ties	2 ⁱ	
		Total	11	
	Task Post - Task	Negative Ranks	6 ^j	5.17
		Positive Ranks	4 ^k	6.00
		Ties	1 ^l	
		Total	11	
Middle Group	Ability_Post - Ability	Negative Ranks	4 ^a	5.63
		Positive Ranks	5 ^b	4.50
		Ties	2 ^c	
		Total	11	
	Value_Post - Value	Negative Ranks	2 ^d	3.00
		Positive Ranks	4 ^e	3.75
		Ties	4 ^f	
		Total	10	
	Effort Post - Effort	Negative Ranks	3 ^g	6.33
		Positive Ranks	6 ^h	5.88
		Ties	0 ⁱ	
		Total	11	
	Task Post - Task	Negative Ranks	4 ^j	4.38
		Positive Ranks	6 ^k	6.25
		Ties	0 ^l	
		Total	10	

a. Ability_Post < Ability

b. Ability_Post > Ability

c. Ability_Post = Ability

d. Value_Post < Value

e. Value_Post > Value

f. Value_Post = Value

g. Effort Post < Effort

h. Effort Post > Effort

i. Effort Post = Effort

j. Task Post < Task

k. Task Post > Task

l. Task Post = Task

Test Statistics^a

	Ability_Post - Ability	Value_Post - Value	Effort Post - Effort	Task Post - Task
Amotivated, Middle group, Not Amotivated				
Not Amotivated	Z	-1.983 ^a	.000 ^c	-.777 ^d
	Asymp. Sig. (2-tailed)	0.047	1.000	0.437
Amotivated	Z	-2.155 ^a	-1.367 ^d	-2.090 ^d
	Asymp. Sig. (2-tailed)	0.031	0.172	0.037
Middle Group	Z	.000 ^c	-1.000 ^b	-1.270 ^b
	Asymp. Sig. (2-tailed)	1.000	0.317	0.204

a. Wilcoxon Signed Ranks Test

b. Based on negative ranks.

c. The sum of negative ranks equals the sum of positive ranks.

d. Based on positive ranks.

Appendix I - Experiment One – Analyses data on full AAI scores, Pre, and Post, split by nudge type sent, and Amotivated level groups.

Descriptive Statistics											
				Percentiles							
Amotivated, Middle group, Not Amotivated		Nudge type Sent		N	Mean	Std. Deviation	Minimum	Maximum	25th	50th (Median)	75th
Not Amotivated	Value Nudge	Amotivation Index		6	24.1667	3.54495	20.00	28.00	20.7500	24.5000	27.2500
		Amotivation Index Post		6	25.1667	4.02078	21.00	31.00	21.7500	24.0000	29.5000
	Ability Nudge	Amotivation Index		6	25.6667	4.45720	17.00	29.00	23.0000	27.5000	28.2500
		Amotivation Index Post		6	27.6667	7.84007	17.00	37.00	21.5000	26.5000	36.2500
Amotivated	Value Nudge	Amotivation Index		6	46.5000	5.92453	42.00	57.00	42.0000	45.0000	50.2500
		Amotivation Index Post		6	42.0000	8.64870	28.00	54.00	35.5000	43.5000	47.2500
	Ability Nudge	Amotivation Index		5	45.0000	1.41421	43.00	46.00	43.5000	46.0000	46.0000
		Amotivation Index Post		5	40.8000	4.32435	35.00	46.00	37.0000	40.0000	45.0000
Middle Group	Value Nudge	Amotivation Index		3	38.0000	1.00000	37.00	39.00	37.0000	38.0000	39.0000
		Amotivation Index Post		3	37.6667	6.50641	31.00	44.00	31.0000	38.0000	44.0000
	Ability Nudge	Amotivation Index		8	34.3750	4.37321	30.00	41.00	30.5000	33.5000	39.2500
		Amotivation Index Post		7	36.0000	3.36650	32.00	41.00	33.0000	35.0000	39.0000

Wilcoxon Signed Ranks Test

Ranks						
Amotivated, Middle group, Not Amotivated		Nudge type Sent		N	Mean Rank	Sum of Ranks
Not Amotivated	Value Nudge	Amotivation Index Post - Amotivation Index	Negative Ranks	1 ^a	3.00	3.00
			Positive Ranks	4 ^b	3.00	12.00
			Ties	1 ^c		
			Total	6		
	Ability Nudge	Amotivation Index Post - Amotivation Index	Negative Ranks	2 ^a	2.25	4.50
			Positive Ranks	3 ^b	3.50	10.50
			Ties	1 ^c		
			Total	6		
Amotivated	Value Nudge	Amotivation Index Post - Amotivation Index	Negative Ranks	5 ^a	3.80	19.00
			Positive Ranks	1 ^b	2.00	2.00
			Ties	0 ^c		
			Total	6		
	Ability Nudge	Amotivation Index Post - Amotivation Index	Negative Ranks	4 ^a	3.25	13.00
			Positive Ranks	1 ^b	2.00	2.00
			Ties	0 ^c		
			Total	5		
Middle Group	Value Nudge	Amotivation Index Post - Amotivation Index	Negative Ranks	1 ^a	2.00	2.00
			Positive Ranks	1 ^b	1.00	1.00
			Ties	1 ^c		
			Total	3		
	Ability Nudge	Amotivation Index Post - Amotivation Index	Negative Ranks	0 ^a	0.00	0.00
			Positive Ranks	5 ^b	3.00	15.00
			Ties	2 ^c		
			Total	7		

a. Amotivation Index Post < Amotivation Index

b. Amotivation Index Post > Amotivation Index

c. Amotivation Index Post = Amotivation Index

Test Statistics^a

			Amotivation Index Post - Amotivation Index
Amotivated, Middle group, Not Amotivated	Nudge type Sent		
Not Amotivated	Value Nudge	Z	-1.236 ^b
		Asymp. Sig. (2-tailed)	0.216
	Ability Nudge	Z	-.813 ^a
		Asymp. Sig. (2-tailed)	0.416
Amotivated	Value Nudge	Z	-1.802 ^c
		Asymp. Sig. (2-tailed)	0.072
	Ability Nudge	Z	-1.483 ^c
		Asymp. Sig. (2-tailed)	0.138
Middle Group	Value Nudge	Z	-.447 ^c
		Asymp. Sig. (2-tailed)	0.655
	Ability Nudge	Z	-2.032 ^b
		Asymp. Sig. (2-tailed)	0.042

a. Wilcoxon Signed Ranks Test

b. Based on negative ranks.

c. Based on positive ranks.

Appendix J - Experiment One – Analyses data on AAI scores, Ability and Value Subscales, Pre, and Post, split by nudge type sent and Amotivated groups.

Descriptive Statistics										
Amotivated, Middle group, Not Amotivated	Nudge type Sent		N	Mean	Std. Deviation	Minimum	Maximum	Percentiles		
								25th	50th (Median)	75th
Amotivated, Middle group, Not Amotivated	Value Nudge	Ability	6	5.1667	1.60208	4.00	8.00	4.0000	4.5000	6.5000
		Value	6	5.6667	1.36626	4.00	7.00	4.0000	6.0000	7.0000
		Ability_Post	6	5.8333	1.72240	4.00	8.00	4.0000	6.0000	7.2500
	Ability Nudge	Value_Post	6	5.8333	1.94079	4.00	9.00	4.0000	5.5000	7.5000
		Ability	6	5.6667	1.21106	4.00	7.00	4.7500	5.5000	7.0000
		Value	6	6.1667	1.32916	4.00	8.00	5.5000	6.0000	7.2500
	Value Nudge	Ability_Post	6	6.6667	2.42212	4.00	10.00	4.7500	6.0000	9.2500
		Value_Post	6	6.1667	2.48328	4.00	11.00	4.7500	5.5000	7.2500
		Ability	6	10.0000	2.68328	7.00	13.00	7.0000	10.5000	12.2500
	Ability Nudge	Value	6	10.3333	1.86190	8.00	13.00	8.7500	10.0000	12.2500
		Ability_Post	6	9.3333	1.96638	6.00	12.00	8.2500	9.5000	10.5000
		Value_Post	6	8.8333	2.78687	5.00	12.00	5.7500	9.5000	11.2500
Amotivated	Value Nudge	Ability	5	8.6000	2.19088	6.00	12.00	7.0000	8.0000	10.5000
		Value	5	9.8000	3.19374	6.00	14.00	7.0000	9.0000	13.0000
		Ability_Post	5	6.2000	1.64317	4.00	8.00	4.5000	7.0000	7.5000
	Ability Nudge	Value_Post	5	9.4000	2.79285	6.00	12.00	6.5000	10.0000	12.0000
		Value	3	9.6667	4.04145	5.00	12.00	5.0000	12.0000	12.0000
		Ability_Post	3	8.3333	2.08167	6.00	10.00	6.0000	9.0000	10.0000
	Value Nudge	Value_Post	3	8.0000	1.00000	7.00	9.00	7.0000	8.0000	9.0000
		Value	3	7.6667	1.52753	6.00	9.00	6.0000	8.0000	9.0000
		Ability	7	6.2857	1.38013	5.00	8.00	5.0000	6.0000	8.0000
	Ability Nudge	Value	7	6.2857	1.38013	4.00	8.00	5.0000	7.0000	7.0000
		Ability_Post	7	7.0000	1.91485	5.00	10.00	5.0000	7.0000	9.0000
		Value_Post	7	7.1429	0.89974	6.00	8.00	6.0000	7.0000	8.0000

Wilcoxon Signed Ranks Test

Ranks						
Amotivated, Middle group, Not Amotivated	Nudge type Sent	Ability_Post - Ability	Negative Ranks	N	Mean Rank	Sum of Ranks
Amotivated, Middle group, Not Amotivated	Value Nudge	Ability_Post - Ability	Negative Ranks	1 ^a	2.00	2.00
			Positive Ranks	3 ^b	2.67	8.00
			Ties	2 ^c		
	Value Nudge	Value_Post - Value	Negative Ranks	1 ^a	1.00	1.00
			Positive Ranks	1 ^a	2.00	2.00
			Ties	4 ^c		
	Ability Nudge	Ability_Post - Ability	Negative Ranks	0 ^a	0.00	0.00
			Positive Ranks	3 ^b	2.00	6.00
			Ties	3 ^c		
	Ability Nudge	Value_Post - Value	Negative Ranks	2 ^d	1.50	3.00
			Positive Ranks	1 ^a	3.00	3.00
			Ties	3 ^c		
Amotivated	Value Nudge	Ability_Post - Ability	Negative Ranks	3 ^a	2.50	7.50
			Positive Ranks	1 ^b	2.50	2.50
			Ties	2 ^c		
	Value Nudge	Value_Post - Value	Negative Ranks	3 ^a	2.00	6.00
			Positive Ranks	0 ^a	0.00	0.00
			Ties	3 ^c		
	Ability Nudge	Ability_Post - Ability	Negative Ranks	5 ^a	3.00	15.00
			Positive Ranks	0 ^b	0.00	0.00
			Ties	0 ^c		
	Ability Nudge	Value_Post - Value	Negative Ranks	2 ^d	2.00	4.00
			Positive Ranks	1 ^a	2.00	2.00
			Ties	2 ^c		
Middle Group	Value Nudge	Ability_Post - Ability	Negative Ranks	2 ^a	2.25	4.50
			Positive Ranks	1 ^b	1.50	1.50
			Ties	0 ^c		
	Value Nudge	Value_Post - Value	Negative Ranks	2 ^d	1.50	3.00
			Positive Ranks	0 ^a	0.00	0.00
			Ties	1 ^c		
	Ability Nudge	Ability_Post - Ability	Negative Ranks	1 ^a	2.50	2.50
			Positive Ranks	4 ^b	3.13	12.50
			Ties	2 ^c		
	Ability Nudge	Value_Post - Value	Negative Ranks	0 ^d	0.00	0.00
			Positive Ranks	4 ^a	2.50	10.00
			Ties	3 ^c		

a. Ability_Post < Ability

b. Ability_Post > Ability

c. Ability_Post = Ability

d. Value_Post < Value

e. Value_Post > Value

f. Value_Post = Value

Test Statistics^a

Amotivated, Middle group, Not Amotivated	Nudge type Sent	Ability_Post - Ability	Value_Post - Value
Amotivated, Middle group, Not Amotivated	Value Nudge	Z	-1.134 ^a
		Asymp. Sig. (2-tailed)	0.257
			0.655
Amotivated	Ability Nudge	Z	-1.604 ^b
		Asymp. Sig. (2-tailed)	0.109
			1.000
Amotivated	Value Nudge	Z	-.921 ^c
		Asymp. Sig. (2-tailed)	0.357
			0.102
Amotivated	Ability Nudge	Z	-2.032 ^d
		Asymp. Sig. (2-tailed)	0.042
			0.593
Middle Group	Value Nudge	Z	-.816 ^e
		Asymp. Sig. (2-tailed)	0.414
			0.157
Middle Group	Ability Nudge	Z	-1.414 ^b
		Asymp. Sig. (2-tailed)	0.157
			0.059

a. Wilcoxon Signed Ranks Test

b. Based on negative ranks.

c. The sum of negative ranks equals the sum of positive ranks.

d. Based on positive ranks.

Appendix K - Experiment One – Analyses data on Self-report measure associated with performance, split by Amotivation level groups and Nudge type.

Descriptive Statistics										
			N	Mean	Std. Deviation	Minimum	Maximum	Percentiles		
Amotivated, Middle group, Not Amotivated	Nudge type Sent							25th	50th (Median)	75th
Not Amotivated	Value Nudge	2 performance added	6	9.1667	2.31661	5.00	11.00	7.2500	10.0000	11.0000
		2 performance added POST	4	9.7500	2.50000	7.00	13.00	7.5000	9.5000	12.2500
	Ability Nudge	2 performance added	6	11.0000	3.09839	7.00	16.00	8.5000	11.0000	13.0000
		2 performance added POST	6	10.5000	1.22474	9.00	12.00	9.0000	11.0000	11.2500
Amotivated	Value Nudge	2 performance added	6	8.8333	1.83485	6.00	11.00	7.5000	9.0000	10.2500
		2 performance added POST	5	8.2000	1.92354	6.00	11.00	6.5000	8.0000	10.0000
	Ability Nudge	2 performance added	5	9.2000	1.48324	7.00	11.00	8.0000	9.0000	10.5000
		2 performance added POST	5	9.4000	1.51658	8.00	12.00	8.5000	9.0000	10.5000
Middle Group	Value Nudge	2 performance added	3	8.6667	0.57735	8.00	9.00	8.0000	9.0000	9.0000
		2 performance added POST	3	8.3333	1.15470	7.00	9.00	7.0000	9.0000	9.0000
	Ability Nudge	2 performance added	8	9.6250	2.55999	7.00	15.00	8.0000	9.0000	10.7500
		2 performance added POST	7	9.0000	1.63299	7.00	12.00	8.0000	9.0000	10.0000

Wilcoxon Signed Ranks Test

Ranks						
Amotivated, Middle group, Not Amotivated	Nudge type Sent		N	Mean Rank	Sum of Ranks	
Not Amotivated	Value Nudge	2 performance added POST - 2 performance added	Negative Ranks	1 ^a	1.00	1.00
			Positive Ranks	2 ^b	2.50	5.00
			Ties	1 ^c		
			Total	4		
	Ability Nudge	2 performance added POST - 2 performance added	Negative Ranks	2 ^a	2.75	5.50
			Positive Ranks	2 ^b	2.25	4.50
			Ties	2 ^c		
			Total	6		
Amotivated	Value Nudge	2 performance added POST - 2 performance added	Negative Ranks	2 ^a	4.50	9.00
			Positive Ranks	3 ^b	2.00	6.00
			Ties	0 ^c		
			Total	5		
	Ability Nudge	2 performance added POST - 2 performance added	Negative Ranks	1 ^a	2.50	2.50
			Positive Ranks	2 ^b	1.75	3.50
			Ties	2 ^c		
			Total	5		
Middle Group	Value Nudge	2 performance added POST - 2 performance added	Negative Ranks	1 ^a	2.00	2.00
			Positive Ranks	1 ^b	1.00	1.00
			Ties	1 ^c		
			Total	3		
	Ability Nudge	2 performance added POST - 2 performance added	Negative Ranks	3 ^a	3.00	9.00
			Positive Ranks	3 ^b	4.00	12.00
			Ties	1 ^c		
			Total	7		

a. 2 performance added POST < 2 performance added

b. 2 performance added POST > 2 performance added

c. 2 performance added POST = 2 performance added

Test Statistics^a

Amotivated, Middle group, Not Amotivated	Nudge type Sent		2 performance added POST - 2 performance added
Not Amotivated	Value Nudge	Z	-1.089 ^a
		Asymp. Sig. (2-tailed)	0.276
	Ability Nudge	Z	-.184 ^c
		Asymp. Sig. (2-tailed)	0.854
Amotivated	Value Nudge	Z	-.412 ^c
		Asymp. Sig. (2-tailed)	0.680
	Ability Nudge	Z	-.272 ^b
		Asymp. Sig. (2-tailed)	0.785
Middle Group	Value Nudge	Z	-.447 ^c
		Asymp. Sig. (2-tailed)	0.655
	Ability Nudge	Z	-.333 ^b
		Asymp. Sig. (2-tailed)	0.739

a. Wilcoxon Signed Ranks Test

b. Based on negative ranks.

Appendix L - Experiment One – Analyses data on Self-report measures associated with maladaptive behaviour, split by Amotivation level groups and Nudge type.

Descriptive Statistics									
		N	Mean	Std. Deviation	Minimum	Maximum	25th	50th (Median)	75th
Annotivated, Middle group, Not Annotivated									
Not Annotivated	Value Nudge	average hours studying	6	41.50	32.117	4	80	12.25	35.00
		2 behaviour added	6	6.0000	4.89042	3.00	13.00	3.0000	11.5000
		average hours studying Post	6	38.83	34.470	20	108	20.00	53.25
		2 behaviour added POST	5	5.2000	3.98232	2.00	10.00	2.0000	9.5000
	Ability Nudge	average hours studying	6	15.83	9.766	4	28	5.50	16.00
		2 behaviour added	6	6.3333	3.66970	2.00	11.00	2.0000	9.5000
		average hours studying Post	6	32.67	27.142	5	70	5.75	27.50
		2 behaviour added POST	5	5.4000	2.70185	2.00	8.00	2.5000	7.5000
	Value Nudge	average hours studying	6	13.17	8.976	5	30	6.50	11.00
		2 behaviour added	6	5.8333	2.56255	2.00	8.00	3.5000	6.5000
		average hours studying Post	6	28.50	25.889	2	72	8.00	20.00
		2 behaviour added POST	6	5.1667	2.63944	2.00	8.00	2.0000	7.2500
	Ability Nudge	average hours studying	5	20.80	4.207	14	25	17.00	24.00
		2 behaviour added	5	7.2000	4.49444	4.00	15.00	4.5000	11.0000
		average hours studying Post	5	25.40	12.482	7	40	13.50	30.00
		2 behaviour added POST	5	8.2000	2.68328	4.00	11.00	6.0000	10.5000
Middle Group	Value Nudge	average hours studying	3	17.00	20.075	3	40	3.00	40.00
		2 behaviour added	3	8.3333	1.52753	7.00	10.00	7.0000	10.0000
		average hours studying Post	3	13.00	14.933	2	30	2.00	30.00
		2 behaviour added POST	3	7.0000	1.73205	5.00	8.00	5.0000	8.0000
	Ability Nudge	average hours studying	7	12.21	7.549	4	20	5.00	10.00
		2 behaviour added	8	4.6250	2.72226	2.00	10.00	2.2500	4.0000
		average hours studying Post	8	9.88	6.833	2	25	6.25	8.50
		2 behaviour added POST	8	5.3750	2.38672	2.00	8.00	2.5000	7.0000

Wilcoxon Signed Ranks Test

Ranks							
Annotivated, Middle group, Not Annotivated		N	Mean Rank	Sum of Ranks			
Not Annotivated	Nudge type Sent						
	Value Nudge	average hours studying Post - average hours studying	Negative Ranks	3 ^a	3.50	10.50	
			Positive Ranks	3 ^a	3.50	10.50	
			Ties	0 ^b			
			Total	6			
		2 behaviour added POST - 2 behaviour added	Negative Ranks	3 ^a	2.33	7.00	
			Positive Ranks	1 ^a	3.00	3.00	
			Ties	1 ^b			
			Total	5			
		Ability Nudge	average hours studying Post - average hours studying	Negative Ranks	1 ^a	1.00	1.00
				Positive Ranks	5 ^a	4.00	20.00
				Ties	0 ^b		
				Total	6		
			2 behaviour added POST - 2 behaviour added	Negative Ranks	1 ^a	1.50	1.50
				Positive Ranks	1 ^a	1.50	1.50
				Ties	3 ^b		
				Total	5		
	Value Nudge	average hours studying Post - average hours studying	Negative Ranks	1 ^a	1.50	1.50	
			Positive Ranks	4 ^a	3.38	13.50	
			Ties	1 ^b			
			Total	6			
		2 behaviour added POST - 2 behaviour added	Negative Ranks	2 ^a	2.00	4.00	
			Positive Ranks	1 ^a	2.00	2.00	
			Ties	3 ^b			
			Total	6			
		Ability Nudge	average hours studying Post - average hours studying	Negative Ranks	2 ^a	2.00	4.00
				Positive Ranks	3 ^a	3.67	11.00
				Ties	0 ^b		
				Total	5		
			2 behaviour added POST - 2 behaviour added	Negative Ranks	1 ^a	3.00	3.00
				Positive Ranks	3 ^a	2.33	7.00
				Ties	1 ^b		
				Total	5		
Middle Group	Value Nudge	average hours studying Post - average hours studying	Negative Ranks	3 ^a	2.00	6.00	
			Positive Ranks	0 ^b	0.00	0.00	
			Ties	0 ^b			
			Total	3			
		2 behaviour added POST - 2 behaviour added	Negative Ranks	2 ^a	1.50	3.00	
			Positive Ranks	0 ^a	0.00	0.00	
			Ties	1 ^b			
			Total	3			
	Ability Nudge	average hours studying Post - average hours studying	Negative Ranks	3 ^a	4.83	14.50	
			Positive Ranks	3 ^a	2.17	6.50	
			Ties	1 ^b			
			Total	7			
		2 behaviour added POST - 2 behaviour added	Negative Ranks	2 ^a	3.50	7.00	
			Positive Ranks	4 ^a	3.50	14.00	
			Ties	2 ^b			
			Total	8			

- a. average hours studying Post < average hours studying
b. average hours studying Post > average hours studying
c. average hours studying Post = average hours studying
d. 2 behaviour added POST < 2 behaviour added
e. 2 behaviour added POST > 2 behaviour added
f. 2 behaviour added POST = 2 behaviour added

Test Statistics^a

		average hours studying Post - average hours studying	2 behaviour added POST - 2 behaviour added
Annotivated, Middle group, Not Annotivated			
Not Annotivated	Value Nudge	Z	.000 ^b
		Asymp. Sig. (2-tailed)	1.000
			0.465
	Ability Nudge	Z	-.1992 ^c
		Asymp. Sig. (2-tailed)	.000 ^b
			1.000
Annotivated	Value Nudge	Z	-.1625 ^c
		Asymp. Sig. (2-tailed)	.0593
			-.344 ^d
	Ability Nudge	Z	.345
		Asymp. Sig. (2-tailed)	.0465
			-.1414 ^d
Middle Group	Value Nudge	Z	-.1633 ^c
		Asymp. Sig. (2-tailed)	.0102
			0.157
	Ability Nudge	Z	-.841 ^c
		Asymp. Sig. (2-tailed)	.755 ^d
			0.450

- a. Wilcoxon Signed Ranks Test
b. The sum of negative ranks equals the sum of positive ranks.
c. Based on positive ranks.
d. Based on negative ranks.

Appendix M - Experiment One – Analyses data on Self-report measures associated with Self-Esteem and Intention to Drop-out, split by Amotivation level groups and Nudge type.

Descriptive Statistics										
			N	Mean	Std. Deviation	Minimum	Maximum	25th	Percentiles 50th (Median)	75th
Amotivated, Middle group, Not Amotivated	Value Nudge	four esteem added	5	18.4000	4.97998	13.00	25.00	14.0000	17.0000	23.5000
		ThreeDropout added	5	5.2000	2.48998	3.00	9.00	3.0000	5.0000	7.5000
		four esteem added Post	3	15.0000	2.64575	12.00	17.00	12.0000	16.0000	17.0000
		ThreeDropout addedPost	4	3.0000	0.00000	3.00	3.00	3.0000	3.0000	3.0000
	Ability Nudge	four esteem added	4	16.0000	2.00000	15.00	19.00	15.0000	15.0000	18.0000
		ThreeDropout added	6	3.6667	1.21106	3.00	6.00	3.0000	3.0000	4.5000
		four esteem added Post	6	16.8333	1.83485	14.00	19.00	15.5000	17.0000	18.2500
		ThreeDropout addedPost	6	5.1667	2.99444	3.00	11.00	3.0000	4.5000	6.5000
	Value Nudge	four esteem added	6	18.1667	4.95648	13.00	27.00	13.7500	18.0000	21.0000
		ThreeDropout added	6	8.5000	2.88097	4.00	12.00	6.2500	8.5000	11.2500
		four esteem added Post	6	17.5000	2.34521	15.00	21.00	15.0000	17.5000	19.5000
		ThreeDropout addedPost	5	8.6000	3.78153	3.00	12.00	5.0000	9.0000	12.0000
	Ability Nudge	four esteem added	5	17.0000	2.91548	13.00	21.00	14.5000	17.0000	19.5000
		ThreeDropout added	4	8.5000	6.13732	3.00	16.00	3.2500	7.5000	14.7500
		four esteem added Post	2	16.5000	4.94975	13.00	20.00	9.7500	16.5000	17.7500
		ThreeDropout addedPost	4	9.2500	4.34933	5.00	13.00	5.2500	9.5000	13.0000
Middle Group	Value Nudge	four esteem added	3	16.0000	1.00000	15.00	17.00	15.0000	16.0000	17.0000
		ThreeDropout added	3	3.3333	0.57735	3.00	4.00	3.0000	3.0000	4.0000
		four esteem added Post	3	15.3333	1.52753	14.00	17.00	14.0000	15.0000	17.0000
		ThreeDropout addedPost	3	4.0000	1.73205	3.00	6.00	3.0000	3.0000	6.0000
	Ability Nudge	four esteem added	8	15.3750	3.33542	11.00	22.00	13.0000	15.5000	16.7500
		ThreeDropout added	8	4.3750	1.99553	3.00	9.00	3.0000	4.0000	4.7500
		four esteem added Post	6	16.6667	2.58199	14.00	21.00	14.7500	16.0000	18.7500
		ThreeDropout addedPost	8	5.0000	2.67261	3.00	11.00	3.0000	4.5000	5.7500

Wilcoxon Signed Ranks Test

Ranks					
Amotivated, Middle group, Not Amotivated	Nudge type Sent		N	Mean Rank	Sum of Ranks
Not Amotivated	Value Nudge	four esteem added Post - four esteem added	Negative Ranks	2 ^a	1.50
			Positive Ranks	0 ^a	0.00
			Ties	1 ^c	
		Total		3	
	ThreeDropout addedPost - ThreeDropout added		Negative Ranks	2 ^a	1.50
			Positive Ranks	0 ^a	0.00
			Ties	2 ^c	
		Total		4	
	Ability Nudge	four esteem added Post - four esteem added	Negative Ranks	0 ^a	0.00
			Positive Ranks	3 ^a	2.00
			Ties	1 ^c	
		Total		4	
	ThreeDropout addedPost - ThreeDropout added		Negative Ranks	0 ^a	0.00
			Positive Ranks	4 ^a	2.50
			Ties	2 ^c	
		Total		6	
Amotivated	Value Nudge	four esteem added Post - four esteem added	Negative Ranks	3 ^a	3.67
			Positive Ranks	3 ^a	3.33
			Ties	0 ^c	
		Total		6	
	ThreeDropout addedPost - ThreeDropout added		Negative Ranks	3 ^a	2.83
			Positive Ranks	2 ^a	3.25
			Ties	0 ^c	
		Total		5	
	Ability Nudge	four esteem added Post - four esteem added	Negative Ranks	1 ^a	1.00
			Positive Ranks	1 ^a	2.00
			Ties	0 ^c	
		Total		2	
	ThreeDropout addedPost - ThreeDropout added		Negative Ranks	1 ^a	3.00
			Positive Ranks	2 ^a	1.50
			Ties	0 ^c	
		Total		3	
Middle Group	Value Nudge	four esteem added Post - four esteem added	Negative Ranks	1 ^a	2.00
			Positive Ranks	1 ^a	1.00
			Ties	1 ^c	
		Total		3	
	ThreeDropout addedPost - ThreeDropout added		Negative Ranks	1 ^a	1.00
			Positive Ranks	1 ^a	2.00
			Ties	1 ^c	
		Total		3	
	Ability Nudge	four esteem added Post - four esteem added	Negative Ranks	2 ^a	3.75
			Positive Ranks	3 ^a	2.50
			Ties	1 ^c	
		Total		6	
	ThreeDropout addedPost - ThreeDropout added		Negative Ranks	2 ^a	2.50
			Positive Ranks	3 ^a	3.33
			Ties	3 ^c	
		Total		8	

- a. four esteem added Post < four esteem added
b. four esteem added Post > four esteem added
c. four esteem added Post = four esteem added
d. ThreeDropout addedPost < ThreeDropout added
e. ThreeDropout addedPost > ThreeDropout added
f. ThreeDropout addedPost = ThreeDropout added

Test Statistics^a

Amotivated, Middle group, Not Amotivated	Nudge type Sent	Z	four esteem added Post - four esteem added	ThreeDropout addedPost - ThreeDropout added
Not Amotivated	Value Nudge	Z	-1.342 ^a	-1.342 ^a
		Asymp. Sig. (2-tailed)	0.180	0.180
	Ability Nudge	Z	-1.633 ^a	-1.841 ^c
Amotivated	Value Nudge	Z	0.102	0.066
		Asymp. Sig. (2-tailed)	-.106 ^a	-.271 ^b
	Ability Nudge	Z	0.916	0.788
Middle Group	Value Nudge	Z	-.447 ^a	-.000 ^c
		Asymp. Sig. (2-tailed)	0.655	1.000
	Ability Nudge	Z	-.447 ^a	-.447 ^c
		Asymp. Sig. (2-tailed)	0.655	0.655
		Z	.000 ^a	-.677 ^c
		Asymp. Sig. (2-tailed)	1.000	0.498

- a. Wilcoxon Signed Ranks Test
b. Based on positive ranks.
c. Based on negative ranks.
d. The sum of negative ranks equals the sum of positive ranks.

Appendix N - Ethics Approval from the School of Computer Science & Statistics,
Trinity College Dublin.

Mon, 21 Mar 2022,

12:28

rec-app-help@tchpc.tcd.ie

to pgillis

The status of 'An investigation of the potential of personalised nudging techniques on; amotivation state, associated negative beliefs and subsequent outcomes of amotivation in first year undergraduate students' has been updated by the Committee.

Title: 'An investigation of the potential of personalised nudging techniques on; amotivation state, associated negative beliefs and subsequent outcomes of amotivation in first year undergraduate students'

Applicant Name: **Peter Gillis**

Submitted by: **Peter Gillis**

Academic Supervisor: **Vincent Wade**

Application Number: **20210203**

Result of the REC Meeting: **Approved**

The Feedback from the Committee is as follows:

Hi Peter,

The revised application adequately addresses issues raised during prior review. Wishing you all the best with your research.

The application can be viewed here:

https://webhost.tchpc.tcd.ie/research_ethics/?q=node/887

If amendments are required, please use the following link to edit the application and upload the changes:

https://webhost.tchpc.tcd.ie/research_ethics/?q=node/887/edit

Appendix O - Experiment Two - full data set used for analysis

See attached SPSS file **2ndExp.sav**

Appendix P Experiment Two – Analyses data on full AAI scores, Pre, and Post, split by Amotivated, Middle, and Not Amotivated, groups.

Descriptive Statistics									
Not Amotivated, Middle Group and Amotivated Categories		N	Mean	Std. Deviation	Minimum	Maximum	25th	Percentiles 50th (Median)	75th
Not Amotivated	PRE All 16 questions from scale - Amotivation higher than 28	18	35.11	7.623	20	44	29.50	37.50	41.25
	POST All 16 questions from scale - Amotivation higher than 28	18	34.56	10.377	18	55	26.75	35.50	40.25
Middle Group	PRE All 16 questions from scale - Amotivation higher than 28	18	50.61	4.565	44	57	45.00	51.00	55.00
	POST All 16 questions from scale - Amotivation higher than 28	18	45.00	11.642	23	75	40.50	46.00	50.50
Amotivated	PRE All 16 questions from scale - Amotivation higher than 28	18	66.61	8.998	58	93	60.75	63.50	69.00
	POST All 16 questions from scale - Amotivation higher than 28	18	62.56	12.030	44	98	56.00	59.50	68.25

Wilcoxon Signed Ranks Test

Ranks		N	Mean Rank	Sum of Ranks
Not Amotivated	POST All 16 questions from scale - Amotivation higher than 28 - PRE All 16 questions from scale - Amotivation higher than 28	10 ^a	9.15	91.50
	POST All 16 questions from scale - Amotivation higher than 28 - PRE All 16 questions from scale - Amotivation higher than 28	7 ^b	8.79	61.50
	Ties	1 ^c		
	Total	18		
Middle Group	POST All 16 questions from scale - Amotivation higher than 28 - PRE All 16 questions from scale - Amotivation higher than 28	13 ^a	10.31	134.00
	POST All 16 questions from scale - Amotivation higher than 28 - PRE All 16 questions from scale - Amotivation higher than 28	5 ^b	7.40	37.00
	Ties	0 ^c		
	Total	18		
Amotivated	POST All 16 questions from scale - Amotivation higher than 28 - PRE All 16 questions from scale - Amotivation higher than 28	13 ^a	9.00	117.00
	POST All 16 questions from scale - Amotivation higher than 28 - PRE All 16 questions from scale - Amotivation higher than 28	4 ^b	9.00	36.00
	Ties	1 ^c		
	Total	18		

a. POST All 16 questions from scale - Amotivation higher than 28 < PRE All 16 questions from scale - Amotivation higher than 28

b. POST All 16 questions from scale - Amotivation higher than 28 > PRE All 16 questions from scale - Amotivation higher than 28

c. POST All 16 questions from scale - Amotivation higher than 28 = PRE All 16 questions from scale - Amotivation higher than 28

Test Statistics^a

Not Amotivated, Middle Group and Amotivated Categories		POST All 16 questions from scale - Amotivation higher than 28 - PRE All 16 questions from scale - Amotivation higher than 28
Not Amotivated	Z	-.711 ^b
	Asymp. Sig. (2-tailed)	0.477
Middle Group	Z	-2.113 ^b
	Asymp. Sig. (2-tailed)	0.035
Amotivated	Z	-1.919 ^b
	Asymp. Sig. (2-tailed)	0.055

a. Wilcoxon Signed Ranks Test

b. Based on positive ranks.

Appendix - Q . Experiment Two – Analyses data on AAI subscale scores, Pre, and Post, split by Amotivated, Middle, and Not Amotivated groups.

Sort Cases BY AmotivatedThirds.

		Descriptive Statistics								
Not Amotivated, Middle Group and Amotivated Categories		N	Mean	Std. Deviation	Minimum	Maximum	25th	Percentiles 50th (Median)	75th	
Not Amotivated	Four Ability Scores PRE Added to identify Ability Amotivation - higher than 14	18	8.33	3.926	4	20	5.75	7.00	10.25	
	Four Value Scores PRE Added to identify Value Amotivation - higher than 14	18	6.56	2.502	4	11	4.00	6.50	8.25	
	Four Effort Scores PRE Added	18	11.06	4.318	4	18	7.00	10.50	15.00	
	Four Task Scores PRE Added	18	9.17	2.915	4	15	7.00	9.50	11.25	
	Four Ability Scores POST Added	18	7.67	3.926	4	16	4.00	7.00	10.00	
	Four Value Scores POST Added	18	6.61	2.429	4	13	5.00	6.00	8.00	
	Four Effort Scores POST Added	17	9.53	4.797	4	18	4.50	10.00	13.50	
	Four Task Scores POST Added	18	9.06	3.038	4	14	6.75	9.50	11.25	
Middle Group	Four Ability Scores PRE Added to identify Ability Amotivation - higher than 14	18	11.94	5.185	4	20	6.75	12.00	17.00	
	Four Value Scores PRE Added to identify Value Amotivation - higher than 14	18	7.39	2.704	4	13	5.00	7.50	10.00	
	Four Effort Scores PRE Added	18	16.39	4.474	9	25	13.00	16.00	19.25	
	Four Task Scores PRE Added	18	14.89	3.724	9	23	12.75	14.50	17.25	
	Four Ability Scores POST Added	18	9.83	5.294	4	19	4.00	9.50	16.00	
	Four Value Scores POST Added	18	7.00	3.343	4	16	4.00	6.00	8.50	
	Four Effort Scores POST Added	18	13.61	4.421	7	24	10.00	13.50	17.00	
	Four Task Scores POST Added	18	12.94	4.491	4	21	9.50	13.00	16.00	
Amotivated	Four Ability Scores PRE Added to identify Ability Amotivation - higher than 14	18	15.22	5.462	8	27	11.00	15.00	19.00	
	Four Value Scores PRE Added to identify Value Amotivation - higher than 14	18	12.00	3.481	7	20	9.00	12.50	14.25	
	Four Effort Scores PRE Added	18	20.17	3.618	15	28	17.00	19.50	23.00	
	Four Task Scores PRE Added	18	19.22	3.828	13	26	15.50	20.00	22.00	
	Four Ability Scores POST Added	18	14.61	5.863	8	27	9.75	13.00	17.50	
	Four Value Scores POST Added	18	9.33	3.361	4	18	6.75	9.00	11.00	
	Four Effort Scores POST Added	18	18.33	3.236	13	25	15.75	18.50	21.00	
	Four Task Scores POST Added	18	18.22	4.809	12	26	14.00	16.00	23.50	

Wilcoxon Signed Ranks Test

		Ranks		
Not Amotivated, Middle Group and Amotivated Categories		N	Mean Rank	Sum of Ranks
Not Amotivated	Four Ability Scores POST Added	Negative Ranks	12 ^a	8.79
	- Four Ability Scores PRE Added to identify Ability Amotivation - higher than 14	Positive Ranks	6 ^b	10.92
		Ties	0 ^c	
		Total	18	
	Four Value Scores POST Added	Negative Ranks	8 ^d	6.25
	- Four Value Scores PRE Added to identify Value Amotivation - higher than 14	Positive Ranks	5 ^e	8.20
		Ties	5 ^f	
		Total	18	
	Four Effort Scores POST Added	Negative Ranks	9 ^g	6.78
	Four Effort Scores PRE Added	Positive Ranks	3 ^h	5.67
		Ties	5 ⁱ	
		Total	17	
	Four Task Scores POST Added	Negative Ranks	7 ^j	7.71
	Four Task Scores PRE Added	Positive Ranks	7 ^k	7.29
		Ties	4 ^l	
		Total	18	
Middle Group	Four Ability Scores POST Added	Negative Ranks	13 ^a	9.08
	- Four Ability Scores PRE Added to identify Ability Amotivation - higher than 14	Positive Ranks	3 ^b	6.00
		Ties	2 ^c	
		Total	18	
	Four Value Scores POST Added	Negative Ranks	9 ^d	6.89
	- Four Value Scores PRE Added to identify Value Amotivation - higher than 14	Positive Ranks	4 ^e	7.25
		Ties	5 ^f	
		Total	18	
	Four Effort Scores POST Added	Negative Ranks	12 ^g	10.17
	Four Effort Scores PRE Added	Positive Ranks	4 ^h	3.50
		Ties	2 ⁱ	
		Total	18	
	Four Task Scores POST Added	Negative Ranks	13 ^j	9.73
	Four Task Scores PRE Added	Positive Ranks	4 ^k	6.63
		Ties	1 ^l	
		Total	18	
Amotivated	Four Ability Scores POST Added	Negative Ranks	8 ^a	8.63
	- Four Ability Scores PRE Added to identify Ability Amotivation - higher than 14	Positive Ranks	7 ^b	7.29
		Ties	3 ^c	
		Total	18	
	Four Value Scores POST Added	Negative Ranks	11 ^d	9.50
	- Four Value Scores PRE Added to identify Value Amotivation - higher than 14	Positive Ranks	4 ^e	3.88
		Ties	3 ^f	
		Total	18	
	Four Effort Scores POST Added	Negative Ranks	12 ^g	9.88
	Four Effort Scores PRE Added	Positive Ranks	5 ^h	6.90
		Ties	1 ⁱ	
		Total	18	
	Four Task Scores POST Added	Negative Ranks	10 ^j	9.25
	Four Task Scores PRE Added	Positive Ranks	6 ^k	7.25
		Ties	2 ^l	
		Total	18	

- a. Four Ability Scores POST Added < Four Ability Scores PRE Added to identify Ability Amotivation - higher than 14
- b. Four Ability Scores POST Added > Four Ability Scores PRE Added to identify Ability Amotivation - higher than 14
- c. Four Ability Scores POST Added = Four Ability Scores PRE Added to identify Ability Amotivation - higher than 14
- d. Four Value Scores POST Added < Four Value Scores PRE Added to identify Value Amotivation - higher than 14
- e. Four Value Scores POST Added > Four Value Scores PRE Added to identify Value Amotivation - higher than 14
- f. Four Value Scores POST Added = Four Value Scores PRE Added to identify Value Amotivation - higher than 14
- g. Four Effort Scores POST Added < Four Effort Scores PRE Added
- h. Four Effort Scores POST Added > Four Effort Scores PRE Added
- i. Four Effort Scores POST Added = Four Effort Scores PRE Added
- j. Four Task Scores POST Added < Four Task Scores PRE Added
- k. Four Task Scores POST Added > Four Task Scores PRE Added
- l. Four Task Scores POST Added = Four Task Scores PRE Added

		Test Statistics ^a			
Not Amotivated, Middle Group and Amotivated Categories		Four Ability Scores POST Added - Four Ability Scores PRE Added to identify Ability Amotivation - higher than 14	Four Value Scores POST Added - Four Value Scores PRE Added to identify Value Amotivation - higher than 14	Four Effort Scores POST Added - Four Effort Scores PRE Added	Four Task Scores POST Added - Four Task Scores PRE Added
Not Amotivated	Z	-.876 ^b	-.316 ^b	-1.731 ^b	-.098 ^b
	Asymp. Sig. (2-tailed)	0.381	0.752	0.083	0.922
Middle Group	Z	-2.603 ^b	-1.159 ^b	-2.811 ^b	-2.383 ^b
	Asymp. Sig. (2-tailed)	0.009	0.247	0.005	0.017
Amotivated	Z	-.513 ^b	-2.535 ^b	-2.001 ^b	-1.277 ^b
	Asymp. Sig. (2-tailed)	0.608	0.011	0.045	0.202

a. Wilcoxon Signed Ranks Test

b. Based on positive ranks.

Appendix R - Experiment Two – Analyses data on AAI scores, Ability, and Value Subscales, Pre, and Post, split by nudge type sent and Amotivated groups.

Descriptive Statistics										
Not Amotivated, Middle Group and Amotivated Categories	Allocated by level of amot in Value and ability, then checked task linked to valuer, effort linked to ability		N	Mean	Std. Deviation	Minimum	Maximum	Percentiles		
								25th	50th (Median)	75th
Not Amotivated	Value Messages	PRE All 16 questions from scale	10	32.60	7.589	20	44	25.00	33.00	38.50
		Four Ability Scores PRE Added	10	6.30	1.337	4	8	5.00	6.50	7.25
		Four Value Scores PRE Added	10	7.00	2.867	4	11	4.00	6.50	10.25
		POST All 16 questions from scale	10	32.00	11.333	18	55	21.25	31.00	38.50
		Four Ability Scores POST Added	10	6.40	3.239	4	13	4.00	4.50	9.25
		Four Value Scores POST Added	10	6.70	1.947	4	10	5.00	7.00	8.25
	Ability Messages	PRE All 16 questions from scale	8	38.25	6.840	22	43	37.50	40.50	42.00
		Four Ability Scores PRE Added	8	10.88	4.673	5	20	7.00	10.50	13.25
		Four Value Scores PRE Added	8	6.00	2.000	4	9	4.00	6.00	7.75
		POST All 16 questions from scale	8	37.75	8.681	23	52	32.75	37.00	44.00
		Four Ability Scores POST Added	8	9.25	4.334	4	16	5.50	8.50	13.75
		Four Value Scores POST Added	8	6.50	3.071	4	13	4.25	5.00	8.00
	Value Messages	PRE All 16 questions from scale	5	51.60	4.393	44	55	48.00	53.00	54.50
		Four Ability Scores PRE Added	5	5.80	1.924	4	9	4.50	5.00	7.50
		Four Value Scores PRE Added	5	6.20	3.899	4	13	4.00	4.00	9.50
		POST All 16 questions from scale	5	48.40	16.622	31	75	36.50	42.00	63.50
		Four Ability Scores POST Added	5	5.00	1.732	4	8	4.00	4.00	6.50
		Four Value Scores POST Added	5	7.80	5.495	4	16	4.00	4.00	13.50
Middle Group	Ability Messages	PRE All 16 questions from scale	13	50.23	4.746	44	57	45.00	50.00	55.50
		Four Ability Scores PRE Added	13	14.31	3.881	7	20	11.50	15.00	17.50
		Four Value Scores PRE Added	13	7.85	2.115	5	11	5.50	8.00	10.00
		POST All 16 questions from scale	13	43.69	9.656	23	56	40.00	47.00	49.50
		Four Ability Scores POST Added	13	11.69	5.023	4	19	7.00	12.00	16.00
		Four Value Scores POST Added	13	6.69	2.323	4	11	4.50	6.00	8.00
Amotivated	Value Messages	PRE All 16 questions from scale	9	65.44	8.002	58	82	59.50	62.00	71.00
		Four Ability Scores PRE Added	9	11.44	3.844	8	19	8.00	12.00	14.00
		Four Value Scores PRE Added	9	13.33	3.464	9	20	10.00	13.00	15.50
		POST All 16 questions from scale	9	62.22	8.585	53	82	57.50	60.00	65.00
		Four Ability Scores POST Added	9	12.22	4.944	8	24	8.50	11.00	13.50
		Four Value Scores POST Added	9	9.11	2.369	6	13	7.00	9.00	11.00
	Ability Messages	PRE All 16 questions from scale	9	67.78	10.244	59	93	62.00	65.00	70.00
		Four Ability Scores PRE Added	9	19.00	4.062	13	27	16.00	19.00	21.50
		Four Value Scores PRE Added	9	10.67	3.122	7	16	7.50	11.00	13.00
		POST All 16 questions from scale	9	62.89	15.284	44	98	54.00	59.00	68.50
		Four Ability Scores POST Added	9	17.00	5.979	9	27	12.00	16.00	22.00
		Four Value Scores POST Added	9	9.56	4.275	4	18	6.50	9.00	12.50

Wilcoxon Signed Ranks Test

Ranks						
Not Amotivated, Middle Group and Amotivated Categories	Allocated by level of amot in Value and ability, then checked task linked to valuer, effort linked to ability			N	Mean Rank	Sum of Ranks
Not Amotivated	Value Messages	POST All 16 questions from scale - PRE All 16 questions from scale	Negative Ranks	5 ^a	5.30	26.50
			Positive Ranks	4 ^b	4.63	18.50
			Ties	1 ^c		
			Total	10		
		Four Ability Scores POST Added - Four Ability Scores PRE Added	Negative Ranks	6 ^a	4.33	26.00
			Positive Ranks	4 ^a	7.25	29.00
			Ties	0 ^c		
			Total	10		
		Four Value Scores POST Added - Four Value Scores PRE Added	Negative Ranks	4 ^a	4.00	16.00
			Positive Ranks	3 ^b	4.00	12.00
			Ties	3 ^c		
			Total	10		
	Ability Messages	POST All 16 questions from scale - PRE All 16 questions from scale	Negative Ranks	5 ^a	4.00	20.00
			Positive Ranks	3 ^b	5.33	16.00
			Ties	0 ^c		
			Total	8		
		Four Ability Scores POST Added - Four Ability Scores PRE Added	Negative Ranks	6 ^a	4.58	27.50
			Positive Ranks	2 ^a	4.25	8.50
			Ties	0 ^c		
			Total	8		
		Four Value Scores POST Added - Four Value Scores PRE Added	Negative Ranks	4 ^a	2.63	10.50
			Positive Ranks	2 ^b	5.25	10.50
			Ties	2 ^c		
			Total	8		
Middle Group	Value Messages	POST All 16 questions from scale - PRE All 16 questions from scale	Negative Ranks	4 ^a	2.50	10.00
			Positive Ranks	1 ^b	5.00	5.00
			Ties	0 ^c		
			Total	5		
		Four Ability Scores POST Added - Four Ability Scores PRE Added	Negative Ranks	4 ^a	2.75	11.00
			Positive Ranks	1 ^a	4.00	4.00
			Ties	0 ^c		
			Total	5		
		Four Value Scores POST Added - Four Value Scores PRE Added	Negative Ranks	2 ^a	1.50	3.00
			Positive Ranks	1 ^b	3.00	3.00
			Ties	2 ^c		
			Total	5		
	Ability Messages	POST All 16 questions from scale - PRE All 16 questions from scale	Negative Ranks	9 ^a	8.33	75.00
			Positive Ranks	4 ^a	4.00	16.00
			Ties	0 ^c		
			Total	13		
		Four Ability Scores POST Added - Four Ability Scores PRE Added	Negative Ranks	9 ^a	6.89	62.00
			Positive Ranks	2 ^a	2.00	4.00
			Ties	2 ^c		
			Total	13		
		Four Value Scores POST Added - Four Value Scores PRE Added	Negative Ranks	7 ^a	6.00	42.00
			Positive Ranks	3 ^b	4.33	13.00
			Ties	3 ^c		
			Total	13		
Amotivated	Value Messages	POST All 16 questions from scale - PRE All 16 questions from scale	Negative Ranks	7 ^a	4.14	29.00
			Positive Ranks	1 ^b	7.00	7.00
			Ties	1 ^c		
			Total	9		
		Four Ability Scores POST Added - Four Ability Scores PRE Added	Negative Ranks	2 ^a	7.00	14.00
			Positive Ranks	6 ^a	3.67	22.00
			Ties	1 ^c		
			Total	9		
		Four Value Scores POST Added - Four Value Scores PRE Added	Negative Ranks	7 ^a	5.00	35.00
			Positive Ranks	1 ^b	1.00	1.00
			Ties	1 ^c		
			Total	9		
	Ability Messages	POST All 16 questions from scale - PRE All 16 questions from scale	Negative Ranks	6 ^a	5.67	34.00
			Positive Ranks	3 ^b	3.67	11.00
			Ties	0 ^c		
			Total	9		
		Four Ability Scores POST Added - Four Ability Scores PRE Added	Negative Ranks	6 ^a	3.67	22.00
			Positive Ranks	1 ^a	6.00	6.00
			Ties	2 ^c		
			Total	9		
		Four Value Scores POST Added - Four Value Scores PRE Added	Negative Ranks	4 ^a	4.63	18.50
			Positive Ranks	3 ^b	3.17	9.50
			Ties	2 ^c		
			Total	9		

- a. POST All 16 questions from scale - Amotivation higher than 28 < PRE All 16 questions from scale - Amotivation higher than 28
b. POST All 16 questions from scale - Amotivation higher than 28 > PRE All 16 questions from scale - Amotivation higher than 28
c. POST All 16 questions from scale - Amotivation higher than 28 = PRE All 16 questions from scale - Amotivation higher than 28
d. Four Ability Scores POST Added > Four Ability Scores PRE Added to identify Ability Amotivation - higher than 14
e. Four Ability Scores POST Added < Four Ability Scores PRE Added to identify Ability Amotivation - higher than 14
f. Four Ability Scores POST Added = Four Ability Scores PRE Added to identify Ability Amotivation - higher than 14
g. Four Value Scores POST Added < Four Value Scores PRE Added to identify Value Amotivation - higher than 14
h. Four Value Scores POST Added > Four Value Scores PRE Added to identify Value Amotivation - higher than 14
i. Four Value Scores POST Added = Four Value Scores PRE Added to identify Value Amotivation - higher than 14

Test Statistics ^a						
Not Amotivated, Middle Group and Amotivated Categories	Allocated by level of amot in Value and ability, then checked task linked to valuer, effort linked to ability		POST All 16 questions from scale - PRE All 16 questions from scale	Four Ability Scores POST Added - Four Ability Scores PRE Added	Four Value Scores POST Added - Four Value Scores PRE Added	
Not Amotivated	Value Messages	Z	-.475 ^a	-.154 ^a	-.339 ^b	
		Asymp. Sig. (2-tailed)	0.635	0.877	0.734	
	Ability Messages	Z	-.280 ^a	-.1338 ^b	.000 ^c	
		Asymp. Sig. (2-tailed)	0.779	0.181	1.000	
Middle Group	Value Messages	Z	-.677 ^a	-.962 ^b	.000 ^c	
		Asymp. Sig. (2-tailed)	0.498	0.336	1.000	
	Ability Messages	Z	-2.063 ^a	-2.586 ^b	-1.485 ^c	
		Asymp. Sig. (2-tailed)	0.039	0.010	0.138	
Amotivated	Value Messages	Z	-1.542 ^a	-.584 ^a	-2.383 ^b	
		Asymp. Sig. (2-tailed)	0.123	0.573	0.017	
	Ability Messages	Z	-1.362 ^a	-1.362 ^b	-.768 ^b	
		Asymp. Sig. (2-tailed)	0.173	0.173	0.443	

- a. Wilcoxon Signed Ranks Test
b. Based on positive ranks.
c. Based on negative ranks.
d. The sum of negative ranks equals the sum of positive ranks.

Appendix S – Experiment Two Analyses data on Self-report measures associated with, performance, maladaptive behaviour, self-esteem, and intention to drop-out, split by Amotivated groups

Descriptive Statistics											
Not Amotivated, Middle Group and Amotivated Categories	Allocated by level of amot in Value and ability, then checked task intent to value, effort linked to study	Value Messages	Please rate your own perceived proficiency in this module - "Your perceived self proficiency in this module?"	N	Mean	Std. Deviation	Minimum	Maximum	Percentiles		
									25th	50th (Median)	75th
Not Amotivated		Value Messages	Please rate your own perceived proficiency in this module - "Your perceived self proficiency in this module?"	10	4.9000	0.73788	3.00	6.00	5.0000	5.0000	5.0000
			Outside classes and tutorials what is your weekly average, in hours, spent studying and doing assignments (total)	10	21.80	8.162	8	30	13.75	25.00	28.50
			Adding Late Class and Miss Class to give self report Problem Behaviour	9	5.56	2.920	2	10	3.50	4.00	8.50
			Post Self esteem All four allowing for negative marking	8	10.8750	3.97886	7.00	18.00	7.2500	10.5000	13.0000
			adding 3 Dropout intent	10	4.3000	2.79086	3.00	12.00	3.0000	3.0000	4.2500
			POST Please rate your own perceived proficiency in this module - "Your perceived self proficiency in this module?"	9	5.2222	0.66667	4.00	6.00	5.0000	5.0000	6.0000
			POST Outside classes and tutorials what is your weekly average, in hours, spent studying and doing assignments (total)	10	22.60	10.035	6	35	14.00	26.50	30.00
			POST Adding Late Class and Miss Class to give self report Problem Behaviour	10	5.1000	3.14289	2.00	11.00	3.0000	3.5000	7.0000
			Post Self esteem All four allowing for negative marking	9	10.6667	4.27200	6.00	18.00	6.5000	10.0000	14.0000
			POST adding 3 Dropout intent	10	3.9000	1.62388	3.00	7.00	3.0000	3.0000	5.2500
		Ability Messages	Please rate your own perceived proficiency in this module - "Your perceived self proficiency in this module?"	7	4.1429	0.89974	3.00	5.00	3.0000	4.0000	5.0000
			Outside classes and tutorials what is your weekly average, in hours, spent studying and doing assignments (total)	7	23.14	12.760	6	40	14.00	20.00	37.00
			Adding Late Class and Miss Class to give self report Problem Behaviour	8	3.88	1.642	2	6	2.25	3.50	5.75
			Post Self esteem All four allowing for negative marking	8	11.5000	4.17475	7.00	19.00	8.2500	10.5000	15.0000
			adding 3 Dropout intent	8	3.8750	2.10817	3.00	9.00	3.0000	3.0000	5.7500
			POST Please rate your own perceived proficiency in this module - "Your perceived self proficiency in this module?"	8	4.8750	0.99103	3.00	6.00	4.2500	5.0000	5.7500
			POST Outside classes and tutorials what is your weekly average, in hours, spent studying and doing assignments (total)	8	22.75	18.132	0	55	10.50	16.50	38.00
			POST Adding Late Class and Miss Class to give self report Problem Behaviour	8	5.1250	2.53194	2.00	9.00	3.0000	5.0000	7.5000
			Post Self esteem All four allowing for negative marking	6	10.5000	5.08620	6.00	19.00	6.7500	8.5000	15.2500
			POST adding 3 Dropout intent	8	5.1250	3.13676	3.00	11.00	3.0000	3.0000	7.7500
Middle Group		Value Messages	Please rate your own perceived proficiency in this module - "Your perceived self proficiency in this module?"	5	5.2000	1.48324	3.00	7.00	4.0000	5.0000	6.0000
			Outside classes and tutorials what is your weekly average, in hours, spent studying and doing assignments (total)	5	7.40	5.771	2	17	3.50	6.00	12.50
			Adding Late Class and Miss Class to give self report Problem Behaviour	4	3.25	1.893	2	6	2.00	2.50	5.25
			Post Self esteem All four allowing for negative marking	5	11.0000	3.93700	7.00	17.00	7.5000	11.0000	14.5000
			adding 3 Dropout intent	4	6.0000	4.69042	3.00	13.00	3.2500	4.0000	10.7500
			POST Please rate your own perceived proficiency in this module - "Your perceived self proficiency in this module?"	5	6.0000	0.70711	5.00	7.00	5.5000	6.0000	6.5000
			POST Outside classes and tutorials what is your weekly average, in hours, spent studying and doing assignments (total)	5	13.00	6.083	5	20	7.50	12.00	19.00
			POST Adding Late Class and Miss Class to give self report Problem Behaviour	3	4.6667	3.05505	2.00	8.00	2.0000	4.0000	8.0000
			Post Self esteem All four allowing for negative marking	4	8.2500	2.21736	6.00	11.00	6.2500	8.0000	10.5000
			POST adding 3 Dropout intent	5	4.8000	2.68328	3.00	9.00	3.0000	3.0000	7.5000
		Ability Messages	Please rate your own perceived proficiency in this module - "Your perceived self proficiency in this module?"	10	3.4000	1.97762	1.00	6.00	2.5000	3.5000	4.2500
			Outside classes and tutorials what is your weekly average, in hours, spent studying and doing assignments (total)	12	16.92	9.558	4	30	8.50	17.50	27.50
			Adding Late Class and Miss Class to give self report Problem Behaviour	12	4.33	1.775	3	8	3.00	3.50	5.75
			Post Self esteem All four allowing for negative marking	8	16.0000	4.81070	7.00	20.00	11.7500	18.0000	19.5000
			adding 3 Dropout intent	12	7.5000	4.87196	3.00	18.00	3.0000	6.0000	11.0000
			POST Please rate your own perceived proficiency in this module - "Your perceived self proficiency in this module?"	10	4.8000	0.78881	4.00	6.00	4.0000	5.0000	5.2500
			POST Outside classes and tutorials what is your weekly average, in hours, spent studying and doing assignments (total)	12	16.33	7.750	5	30	8.00	19.00	20.00
			POST Adding Late Class and Miss Class to give self report Problem Behaviour	12	4.0000	2.08893	2.00	8.00	2.0000	3.5000	5.7500
			Post Self esteem All four allowing for negative marking	8	13.8750	5.89037	6.00	20.00	7.5000	17.0000	18.5000
			POST adding 3 Dropout intent	10	6.7000	4.37290	3.00	14.00	3.0000	5.0000	12.0000

Anecdotal	Value Messages	Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module?	8	4.7500	1.48805	2.00	8.00	3.9000	6.0000	6.0000
		Outside classes and tutorials what is your weekly average, in hours, spent studying and doing assignments (total)	9	12.89	10.006	4	30	5.50	7.00	21.50
		Adding Late Class and Miss Class to give self report Problem Behaviour	8	5.00	3.071	2	11	2.50	4.00	7.25
		Pre Self esteem All four allowing for negative marking	8	14.1250	4.12094	10.00	21.00	11.2500	12.5000	18.5000
		adding 3 Dropout intent	8	7.5000	3.77864	4.00	13.00	4.2500	6.0000	12.0000
		POST Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module?	9	5.0000	1.11803	3.00	7.00	4.5000	5.0000	5.5000
		POST Outside classes and tutorials what is your weekly average, in hours, spent studying and doing assignments (total)	8	18.25	8.972	8	30	8.50	20.00	27.50
		POST Adding Late Class and Miss Class to give self report Problem Behaviour	9	4.4444	2.24227	2.00	8.00	2.0000	4.0000	6.5000
		Post Self esteem All four allowing for negative marking	7	13.1429	4.41318	7.00	18.00	8.0000	16.0000	16.0000
		POST adding 3 Dropout intent	8	7.2500	4.20034	3.00	13.00	3.2500	6.5000	11.5000
	Ability Messages	Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module?	9	3.2222	1.20185	1.00	5.00	2.5000	3.0000	4.0000
		Outside classes and tutorials what is your weekly average, in hours, spent studying and doing assignments (total)	9	17.56	7.230	10	35	13.50	15.00	19.00
		Adding Late Class and Miss Class to give self report Problem Behaviour	9	4.89	3.621	2	13	2.50	3.00	7.00
		Pre Self esteem All four allowing for negative marking	7	19.0000	5.16398	13.00	27.00	14.0000	18.0000	23.0000
		adding 3 Dropout intent	9	9.1111	3.78961	4.00	16.00	5.5000	10.0000	11.5000
		POST Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module?	7	3.7143	1.38013	2.00	5.00	2.0000	4.0000	5.0000
		POST Outside classes and tutorials what is your weekly average, in hours, spent studying and doing assignments (total)	9	23.89	15.062	8	60	15.50	20.00	27.50
		POST Adding Late Class and Miss Class to give self report Problem Behaviour	8	4.2500	2.69822	2.00	8.00	2.5000	3.0000	7.0000
		Post Self esteem All four allowing for negative marking	8	20.2500	4.52769	15.00	28.00	16.2500	19.5000	24.2500
		POST adding 3 Dropout intent	8	8.8750	4.08613	3.00	15.00	5.2500	9.0000	12.0000

Wilcoxon Signed Ranks Test

		Ranks				
Not Amotivated, Middle Group and Amotivated Categories		Allocated by level of interest in Value and ability, then checked task linked to value, effort linked to ability		N	Mean Rank	Sum of Ranks
Not Amotivated	Value Messages	POST Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module? - Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module?	Negative Ranks	1 ^a	3.00	3.00
			Positive Ranks	3 ^a	2.33	7.00
			Ties	5 ^a		
			Total	9		
		POST Outside classes and tutorials what is your weekly average, in hours, spent studying and doing assignments (total) - Outside classes and tutorials what is your weekly average, in hours, spent studying and doing assignments (total)	Negative Ranks	5 ^a	4.00	20.00
			Positive Ranks	5 ^a	7.00	35.00
			Ties	0 ^a		
			Total	10		
		POST Adding Late Class and Miss Class to give self report Problem Behaviour - Adding Late Class and Miss Class to give self report Problem Behaviour	Negative Ranks	4 ^a	4.00	16.00
			Positive Ranks	2 ^a	2.50	5.00
			Ties	3 ^a		
			Total	9		
		Post Self esteem All four allowing for negative marking - Pre Self esteem All four allowing for negative marking	Negative Ranks	3 ^a	4.50	13.50
			Positive Ranks	3 ^a	2.50	7.50
			Ties	1 ^a		
			Total	7		
		POST adding 3 Dropout intent - adding 3 Dropout intent	Negative Ranks	2 ^a	2.00	4.00
			Positive Ranks	1 ^a	2.00	2.00
			Ties	7 ^a		
			Total	10		
	Ability Messages	POST Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module? - Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module?	Negative Ranks	1 ^a	2.50	2.50
			Positive Ranks	4 ^a	3.13	12.50
			Ties	2 ^a		
			Total	7		
		POST Outside classes and tutorials what is your weekly average, in hours, spent studying and doing assignments (total) - Outside classes and tutorials what is your weekly average, in hours, spent studying and doing assignments (total)	Negative Ranks	1 ^a	5.00	5.00
			Positive Ranks	4 ^a	2.50	10.00
			Ties	2 ^a		
			Total	7		
		POST Adding Late Class and Miss Class to give self report Problem Behaviour - Adding Late Class and Miss Class to give self report Problem Behaviour	Negative Ranks	1 ^a	3.00	3.00
			Positive Ranks	4 ^a	3.00	12.00
			Ties	3 ^a		
			Total	8		
		Post Self esteem All four allowing for negative marking - Pre Self esteem All four allowing for negative marking	Negative Ranks	3 ^a	2.83	8.50
			Positive Ranks	2 ^a	3.25	6.50
			Ties	1 ^a		
			Total	6		
		POST adding 3 Dropout intent - adding 3 Dropout intent	Negative Ranks	2 ^a	1.50	3.00
			Positive Ranks	2 ^a	3.50	7.00
			Ties	4 ^a		
			Total	8		
Middle Group	Value Messages	POST Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module? - Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module?	Negative Ranks	0 ^a	0.00	0.00
			Positive Ranks	2 ^a	1.50	3.00
			Ties	3 ^a		
			Total	5		
		POST Outside classes and tutorials what is your weekly average, in hours, spent studying and doing assignments (total) - Outside classes and tutorials what is your weekly average, in hours, spent studying and doing assignments (total)	Negative Ranks	0 ^a	0.00	0.00
			Positive Ranks	4 ^a	2.50	10.00
			Ties	1 ^a		
			Total	5		
		POST Adding Late Class and Miss Class to give self report Problem Behaviour - Adding Late Class and Miss Class to give self report Problem Behaviour	Negative Ranks	0 ^a	0.00	0.00
			Positive Ranks	2 ^a	1.50	3.00
			Ties	1 ^a		
			Total	3		
		Post Self esteem All four allowing for negative marking - Pre Self esteem All four allowing for negative marking	Negative Ranks	3 ^a	2.33	7.00
			Positive Ranks	1 ^a	3.00	3.00
			Ties	0 ^a		
			Total	4		
		POST adding 3 Dropout intent - adding 3 Dropout intent	Negative Ranks	3 ^a	2.00	6.00
			Positive Ranks	0 ^a	0.00	0.00
			Ties	1 ^a		
			Total	4		
	Ability Messages	POST Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module? - Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module?	Negative Ranks	0 ^a	0.00	0.00
			Positive Ranks	7 ^a	4.00	28.00
			Ties	2 ^a		
			Total	9		
		POST Outside classes and tutorials what is your weekly average, in hours, spent studying and doing assignments (total) - Outside classes and tutorials what is your weekly average, in hours, spent studying and doing assignments (total)	Negative Ranks	2 ^a	6.00	12.00
			Positive Ranks	9 ^a	3.20	16.00
			Ties	5 ^a		
			Total	12		
		POST Adding Late Class and Miss Class to give self report Problem Behaviour - Adding Late Class and Miss Class to give self report Problem Behaviour	Negative Ranks	5 ^a	6.20	31.00
			Positive Ranks	5 ^a	4.80	24.00
			Ties	2 ^a		
			Total	12		
		Post Self esteem All four allowing for negative marking - Pre Self esteem All four allowing for negative marking	Negative Ranks	4 ^a	2.75	11.00
			Positive Ranks	1 ^a	4.00	4.00
			Ties	0 ^a		
			Total	5		
		POST adding 3 Dropout intent - adding 3 Dropout intent	Negative Ranks	2 ^a	5.50	11.00
			Positive Ranks	4 ^a	2.50	10.00
			Ties	4 ^a		
			Total	10		

a. POST Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module? < Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module?

b. POST Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module? < Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module?

c. POST Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module? < Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module?

d. POST Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module? < Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module?

e. POST Outside classes and tutorials what is your weekly average, in hours, spent studying and doing assignments (total) < Outside classes and tutorials what is your weekly average, in hours, spent studying and doing assignments (total)

f. POST Outside classes and tutorials what is your weekly average, in hours, spent studying and doing assignments (total) < Outside classes and tutorials what is your weekly average, in hours, spent studying and doing assignments (total)

g. POST Outside classes and tutorials what is your weekly average, in hours, spent studying and doing assignments (total) < Outside classes and tutorials what is your weekly average, in hours, spent studying and doing assignments (total)

h. POST Adding Late Class and Miss Class to give self report Problem Behaviour < Adding Late Class and Miss Class to give self report Problem Behaviour

i. POST Adding Late Class and Miss Class to give self report Problem Behaviour < Adding Late Class and Miss Class to give self report Problem Behaviour

j. POST Adding Late Class and Miss Class to give self report Problem Behaviour < Adding Late Class and Miss Class to give self report Problem Behaviour

k. POST Self esteem All four allowing for negative marking < Pre Self esteem All four allowing for negative marking

l. POST Self esteem All four allowing for negative marking < Pre Self esteem All four allowing for negative marking

m. POST Self esteem All four allowing for negative marking < Pre Self esteem All four allowing for negative marking

n. POST adding 3 Dropout intent + adding 3 Dropout intent

o. POST adding 3 Dropout intent + adding 3 Dropout intent

p. POST adding 3 Dropout intent + adding 3 Dropout intent

[illegible]

b. Based on negative ranks.
c. Based on positive ranks.

Appendix T – Experiment Three - full data set used for analysis.

See attached SPSS file **3rdExp.sav**

Appendix U Experiment Three –Analyses data on full AAI scores, Pre, and Post, split by Amotivated, Middle, and Not Amotivated, groups.

Descriptive Statistics									
AAI Pre intervention scores grouped in thirds		N	Mean	Std. Deviation	Minimum	Maximum	Percentiles		
							25th	50th (Median)	75th
Amotivated	Pre_AAI_All16	39	65.9744	7.99502	57.00	90.00	59.0000	64.0000	70.0000
	PostAAI_All16	39	62.2308	11.19319	46.00	95.00	55.0000	61.0000	68.0000
Middle Third	Pre_AAI_All16	39	49.9487	4.23611	42.00	55.00	46.0000	50.0000	54.0000
	PostAAI_All16	39	49.2564	10.65665	24.00	81.00	44.0000	49.0000	56.0000
Not Amotivated	Pre_AAI_All16	39	32.9487	6.36168	17.00	42.00	28.0000	34.0000	39.0000
	PostAAI_All16	38	36.0263	11.02206	16.00	67.00	27.7500	36.5000	42.2500

Wilcoxon Signed Ranks Test

AAI Pre intervention scores grouped in thirds		Ranks			
			N	Mean Rank	Sum of Ranks
Amotivated	PostAAI_All16 - Pre_AAI_All16	Negative Ranks	26 ^a	21.31	554.00
		Positive Ranks	12 ^b	15.58	187.00
		Ties	1 ^c		
		Total	39		
Middle Third	PostAAI_All16 - Pre_AAI_All16	Negative Ranks	19 ^a	20.79	395.00
		Positive Ranks	17 ^b	15.94	271.00
		Ties	3 ^c		
		Total	39		
Not Amotivated	PostAAI_All16 - Pre_AAI_All16	Negative Ranks	13 ^a	15.46	201.00
		Positive Ranks	24 ^b	20.92	502.00
		Ties	1 ^c		
		Total	38		

a. PostAAI_All16 < Pre_AAI_All16

b. PostAAI_All16 > Pre_AAI_All16

c. PostAAI_All16 = Pre_AAI_All16

Test Statistics^a

AAI Pre intervention scores grouped in thirds		PostAAI_All16 - Pre_AAI_All16
Amotivated	Z	-2.664 ^b
	Asymp. Sig. (2-tailed)	0.008
Middle Third	Z	-.975 ^b
	Asymp. Sig. (2-tailed)	0.330
Not Amotivated	Z	-2.273 ^c
	Asymp. Sig. (2-tailed)	0.023

a. Wilcoxon Signed Ranks Test

b. Based on positive ranks.

c. Based on negative ranks.

Appendix - V. Experiment Three – Analyses data on AAI subscale scores, Pre, and Post, split by Amotivated Group, Middle Group, and Not Amotivated Group.

Descriptive Statistics									
AAI Pre intervention scores grouped in thirds			N	Mean	Std. Deviation	Minimum	Maximum	25th	Percentiles 50th (Median) 75th
Amotivated	ABILITY_PRE		39	14.9744	6.43791	4.00	28.00	9.0000	15.0000 19.0000
	VALUE_PRE		39	11.9231	4.48615	4.00	23.00	9.0000	11.0000 15.0000
	EFFORT_PRE		39	20.6923	5.20199	9.00	28.00	18.0000	21.0000 25.0000
	TASK_PRE		39	18.3846	3.57341	12.00	26.00	15.0000	18.0000 20.0000
	ABILITY_POST		39	13.7692	6.09340	4.00	25.00	8.0000	13.0000 19.0000
	VALUE_POST		39	10.8205	3.90595	4.00	18.00	8.0000	10.0000 14.0000
Middle Third	EFFORT_POST		39	20.1538	5.49420	6.00	28.00	18.0000	20.0000 24.0000
	TASK_POST		39	17.4872	4.32174	8.00	25.00	14.0000	17.0000 21.0000
	ABILITY_PRE		39	9.3333	4.57299	4.00	20.00	5.0000	9.0000 11.0000
	VALUE_PRE		39	9.0000	2.90191	4.00	17.00	8.0000	9.0000 10.0000
	EFFORT_PRE		39	17.2308	4.60813	6.00	27.00	15.0000	17.0000 20.0000
	TASK_PRE		39	14.3846	3.89071	7.00	22.00	11.0000	16.0000 17.0000
Not Amotivated	ABILITY_POST		39	9.6923	5.42486	4.00	23.00	6.0000	8.0000 12.0000
	VALUE_POST		39	9.2821	3.53143	4.00	21.00	7.0000	9.0000 11.0000
	EFFORT_POST		39	15.7692	4.48660	7.00	27.00	13.0000	15.0000 19.0000
	TASK_POST		39	14.5128	3.92611	4.00	21.00	12.0000	14.0000 18.0000
	ABILITY_PRE		39	6.3590	2.64065	4.00	15.00	4.0000	6.0000 8.0000
	VALUE_PRE		39	6.2051	2.14205	4.00	12.00	4.0000	6.0000 8.0000
	EFFORT_PRE		39	11.1282	3.62868	4.00	18.00	9.0000	11.0000 14.0000
	TASK_PRE		39	9.2564	3.01503	4.00	15.00	7.0000	9.0000 12.0000
	ABILITY_POST		39	7.5641	4.56990	4.00	21.00	4.0000	5.0000 10.0000
	VALUE_POST		39	7.1026	3.11866	4.00	14.00	4.0000	7.0000 8.0000
	EFFORT_POST		38	11.1842	4.31750	4.00	21.00	9.0000	11.0000 14.2500
	TASK_POST		39	10.3590	3.16291	4.00	16.00	8.0000	11.0000 13.0000

Wilcoxon Signed Ranks Test

Ranks				
AAI Pre intervention scores grouped in thirds			N	Mean Rank
Amotivated	ABILITY_POST - ABILITY_PRE	Negative Ranks	23 ^a	20.87
		Positive Ranks	13 ^b	14.31
		Ties	3 ^c	
		Total	39	
	VALUE_POST - VALUE_PRE	Negative Ranks	23 ^a	17.46
		Positive Ranks	11 ^b	17.59
		Ties	5 ^c	
		Total	39	
	EFFORT_POST - EFFORT_PRE	Negative Ranks	18 ^a	18.75
		Positive Ranks	15 ^b	14.90
		Ties	6 ^c	
		Total	39	
	TASK_POST - TASK_PRE	Negative Ranks	20 ^a	19.10
		Positive Ranks	14 ^b	15.21
		Ties	5 ^c	
		Total	39	
Middle Third	ABILITY_POST - ABILITY_PRE	Negative Ranks	17 ^a	17.91
		Positive Ranks	17 ^b	17.09
		Ties	5 ^c	
		Total	39	
	VALUE_POST - VALUE_PRE	Negative Ranks	18 ^a	14.83
		Positive Ranks	14 ^b	18.64
		Ties	7 ^c	
		Total	39	
	EFFORT_POST - EFFORT_PRE	Negative Ranks	24 ^a	17.88
		Positive Ranks	9 ^b	14.67
		Ties	6 ^c	
		Total	39	
	TASK_POST - TASK_PRE	Negative Ranks	17 ^a	16.00
		Positive Ranks	16 ^b	18.06
		Ties	6 ^c	
		Total	39	
Not Amotivated	ABILITY_POST - ABILITY_PRE	Negative Ranks	7 ^a	5.79
		Positive Ranks	13 ^b	13.04
		Ties	19 ^c	
		Total	39	
	VALUE_POST - VALUE_PRE	Negative Ranks	10 ^a	12.45
		Positive Ranks	16 ^b	14.16
		Ties	13 ^c	
		Total	39	
	EFFORT_POST - EFFORT_PRE	Negative Ranks	17 ^a	15.06
		Positive Ranks	15 ^b	18.13
		Ties	6 ^c	
		Total	38	
	TASK_POST - TASK_PRE	Negative Ranks	10 ^a	14.50
		Positive Ranks	23 ^b	18.09
		Ties	6 ^c	
		Total	39	

- a. ABILITY_POST < ABILITY_PRE
b. ABILITY_POST > ABILITY_PRE
c. ABILITY_POST = ABILITY_PRE
d. VALUE_POST < VALUE_PRE
e. VALUE_POST > VALUE_PRE
f. VALUE_POST = VALUE_PRE
g. EFFORT_POST < EFFORT_PRE
h. EFFORT_POST > EFFORT_PRE
i. EFFORT_POST = EFFORT_PRE
j. TASK_POST < TASK_PRE
k. TASK_POST > TASK_PRE
l. TASK_POST = TASK_PRE

Test Statistics^a

AAI Pre intervention scores grouped in thirds		ABILITY_POST - ABILITY_PRE	VALUE_POST - VALUE_PRE	EFFORT_POST - EFFORT_PRE	TASK_POST - TASK_PRE
Amotivated	Z	-2.320 ^a	-1.788 ^b	-1.026 ^b	-1.453 ^a
	Asymp. Sig. (2-tailed)	0.020	0.074	0.305	0.146
Middle Third	Z	-.120 ^a	-.056 ^b	-2.667 ^b	-.152 ^a
	Asymp. Sig. (2-tailed)	0.904	0.955	0.008	0.879
Not Amotivated	Z	-2.418 ^a	-1.300 ^b	-.150 ^b	-2.435 ^a
	Asymp. Sig. (2-tailed)	0.016	0.194	0.880	0.015

- a. Wilcoxon Signed Ranks Test
b. Based on positive ranks.
c. Based on negative ranks.

Appendix W – Experiment Three Analyses data on AAI scores, Ability, and Value Subscales, Pre, and Post, split by nudge type sent and Amotivated groups.

Descriptive Statistics										
AAI Pre intervention scores grouped in thirds			N	Mean	Std. Deviation	Minimum	Maximum	Percentiles		
Ability	Value	Nudge						25th	50th (Median)	75th
Amotivated	Value	Pre_AAI_Ali16	13	65.8462	7.86179	57.00	82.00	58.5000	66.0000	72.5000
		ABILITY_PRE	13	8.7692	3.44369	4.00	17.00	6.5000	8.0000	10.5000
		VALUE_PRE	13	15.6923	3.30113	11.00	23.00	13.5000	16.0000	17.5000
		PostAAI_Ali16	13	62.3846	9.19727	51.00	85.00	55.0000	60.0000	69.0000
		ABILITY_POST	13	9.6923	5.85071	4.00	22.00	5.5000	8.0000	13.0000
		VALUE_POST	13	12.9231	3.49908	8.00	18.00	9.0000	13.0000	16.0000
	Ability	Pre_AAI_Ali16	26	66.0385	8.21453	57.00	90.00	61.7500	64.0000	67.7500
		ABILITY_PRE	26	18.0769	5.22244	8.00	28.00	14.7500	18.0000	22.2500
		VALUE_PRE	26	10.0385	3.77869	4.00	20.00	7.7500	10.0000	12.0000
		PostAAI_Ali16	26	62.1538	12.23991	46.00	95.00	52.0000	61.5000	67.5000
		ABILITY_POST	26	15.8077	5.20015	4.00	25.00	12.0000	16.5000	19.2500
		VALUE_POST	26	9.7692	3.72352	4.00	17.00	7.5000	9.0000	12.0000
Middle Third	Value	Pre_AAI_Ali16	23	50.5652	3.88267	42.00	55.00	48.0000	51.0000	54.0000
		ABILITY_PRE	23	6.3478	2.40471	4.00	11.00	4.0000	6.0000	9.0000
		VALUE_PRE	23	9.6957	3.22539	4.00	17.00	8.0000	10.0000	11.0000
		PostAAI_Ali16	23	48.6957	10.12394	34.00	81.00	42.0000	47.0000	54.0000
		ABILITY_POST	23	7.0870	3.24616	4.00	20.00	5.0000	7.0000	8.0000
		VALUE_POST	23	10.1739	3.70076	5.00	21.00	9.0000	10.0000	12.0000
	Ability	Pre_AAI_Ali16	16	49.0625	4.68286	43.00	55.00	45.0000	48.5000	53.7500
		ABILITY_PRE	16	13.6250	3.34415	10.00	20.00	11.0000	13.0000	15.0000
		VALUE_PRE	16	8.0000	2.06559	4.00	11.00	6.5000	8.0000	10.0000
		PostAAI_Ali16	16	50.0625	11.67030	24.00	73.00	45.5000	51.0000	56.7500
		ABILITY_POST	16	13.4375	5.80768	4.00	23.00	11.2500	12.5000	17.7500
		VALUE_POST	16	8.0000	2.92119	4.00	13.00	5.2500	8.0000	9.7500
Not Amotivated	Value	Pre_AAI_Ali16	25	31.6800	6.57470	17.00	42.00	28.0000	33.0000	36.0000
		ABILITY_PRE	25	5.0000	1.41421	4.00	8.00	4.0000	4.0000	6.0000
		VALUE_PRE	25	6.7200	2.31876	4.00	12.00	5.0000	6.0000	8.0000
		PostAAI_Ali16	25	33.1200	8.95507	16.00	51.00	26.0000	34.0000	38.5000
		ABILITY_POST	25	5.9200	2.95691	4.00	15.00	4.0000	4.0000	7.0000
		VALUE_POST	25	6.8800	3.10000	4.00	14.00	4.0000	7.0000	8.0000
	Ability	Pre_AAI_Ali16	14	35.2143	5.46568	24.00	41.00	31.0000	37.0000	40.0000
		ABILITY_PRE	14	8.7857	2.60705	5.00	15.00	7.7500	8.0000	10.0000
		VALUE_PRE	14	5.2857	1.43734	4.00	8.00	4.0000	5.0000	7.0000
		PostAAI_Ali16	13	41.6154	12.75760	26.00	67.00	29.0000	41.0000	50.5000
		ABILITY_POST	14	10.5000	5.51571	4.00	21.00	6.5000	8.0000	15.5000
		VALUE_POST	14	7.5000	3.22848	4.00	13.00	4.7500	6.5000	10.2500

Wilcoxon Signed Ranks Test

		Ranks					
AAI Pre intervention scores grouped in thirds		Ability	ValueNudge	N	Mean Rank	Sum of Ranks	
Amotivated	Value	PostAAI_All16 - Pre_AAI_All16	Negative Ranks	9 ^a	8.00	72.00	
			Positive Ranks	4 ^b	4.75	19.00	
			Ties	0 ^c			
			Total	13			
		ABILITY_POST - ABILITY_PRE	Negative Ranks	5 ^d	5.60	28.00	
			Positive Ranks	6 ^e	6.33	38.00	
			Ties	2 ^f			
			Total	13			
		VALUE_POST - VALUE_PRE	Negative Ranks	10 ^g	7.30	73.00	
			Positive Ranks	2 ^h	2.50	5.00	
			Ties	1 ⁱ			
			Total	13			
	Ability	PostAAI_All16 - Pre_AAI_All16	Negative Ranks	17 ^a	14.29	243.00	
			Positive Ranks	8 ^b	10.25	82.00	
			Ties	1 ^c			
			Total	26			
		ABILITY_POST - ABILITY_PRE	Negative Ranks	18 ^d	15.03	270.50	
			Positive Ranks	7 ^e	7.79	54.50	
			Ties	1 ^f			
			Total	26			
		VALUE_POST - VALUE_PRE	Negative Ranks	13 ^g	10.62	138.00	
			Positive Ranks	9 ^h	12.78	115.00	
			Ties	4 ⁱ			
			Total	26			
Middle Third	Value	PostAAI_All16 - Pre_AAI_All16	Negative Ranks	12 ^a	13.75	165.00	
			Positive Ranks	9 ^b	7.33	66.00	
			Ties	2 ^c			
			Total	23			
		ABILITY_POST - ABILITY_PRE	Negative Ranks	9 ^d	9.39	84.50	
			Positive Ranks	10 ^e	10.55	105.50	
			Ties	4 ^f			
			Total	23			
		VALUE_POST - VALUE_PRE	Negative Ranks	10 ^g	9.80	98.00	
			Positive Ranks	9 ^h	10.22	92.00	
			Ties	4 ⁱ			
			Total	23			
	Ability	PostAAI_All16 - Pre_AAI_All16	Negative Ranks	7 ^a	7.71	54.00	
			Positive Ranks	8 ^b	8.25	66.00	
			Ties	1 ^c			
			Total	16			
		ABILITY_POST - ABILITY_PRE	Negative Ranks	8 ^d	8.13	65.00	
			Positive Ranks	7 ^e	7.86	55.00	
			Ties	1 ^f			
			Total	16			
		VALUE_POST - VALUE_PRE	Negative Ranks	8 ^g	5.56	44.50	
			Positive Ranks	5 ^h	9.30	46.50	
			Ties	3 ⁱ			
			Total	16			
Not Amotivated	Value	PostAAI_All16 - Pre_AAI_All16	Negative Ranks	10 ^a	10.55	105.50	
			Positive Ranks	14 ^b	13.89	194.50	
			Ties	1 ^c			
			Total	25			
		ABILITY_POST - ABILITY_PRE	Negative Ranks	1 ^d	4.50	4.50	
			Positive Ranks	7 ^e	4.50	31.50	
			Ties	17 ^f			
			Total	25			
		VALUE_POST - VALUE_PRE	Negative Ranks	9 ^g	7.56	68.00	
			Positive Ranks	7 ^h	9.71	68.00	
			Ties	9 ⁱ			
			Total	25			
	Ability	PostAAI_All16 - Pre_AAI_All16	Negative Ranks	3 ^a	5.67	17.00	
			Positive Ranks	10 ^b	7.40	74.00	
			Ties	0 ^c			
			Total	13			
		ABILITY_POST - ABILITY_PRE	Negative Ranks	6 ^d	3.58	21.50	
			Positive Ranks	6 ^e	9.42	56.50	
			Ties	2 ^f			
			Total	14			
		VALUE_POST - VALUE_PRE	Negative Ranks	1 ^g	5.50	5.50	
			Positive Ranks	9 ^h	5.50	49.50	
			Ties	4 ⁱ			
			Total	14			

a. PostAAI_All16 < Pre_AAI_All16

b. PostAAI_All16 > Pre_AAI_All16

c. PostAAI_All16 = Pre_AAI_All16

d. ABILITY_POST < ABILITY_PRE

e. ABILITY_POST > ABILITY_PRE

f. ABILITY_POST = ABILITY_PRE

g. VALUE_POST < VALUE_PRE

h. VALUE_POST > VALUE_PRE

i. VALUE_POST = VALUE_PRE

Test Statistics^a

AAI Pre intervention scores grouped in thirds		Ability	ValueNudge	PostAAI_All16 - Pre_AAI_All16	ABILITY_POST - ABILITY_PRE	VALUE_POST - VALUE_PRE
Amotivated	Value	Z		-1.858 ^a	-.443 ^b	-2.698 ^c
		Asymp. Sig. (2-tailed)		0.063	0.653	0.007 ^d
	Ability	Z		-2.168 ^a	-2.917 ^b	-.375 ^c
		Asymp. Sig. (2-tailed)		0.030	0.004	0.708
Middle Third	Value	Z		-1.722 ^a	-.426 ^b	-.121 ^c
		Asymp. Sig. (2-tailed)		0.085	0.670	0.903
	Ability	Z		-.341 ^a	-.285 ^b	-.070 ^c
		Asymp. Sig. (2-tailed)		0.733	0.776	0.944
Not Amotivated	Value	Z		-1.273 ^a	-1.895 ^b	.000 ^c
		Asymp. Sig. (2-tailed)		0.203	0.058	1.000
	Ability	Z		-1.993 ^a	-1.381 ^b	-2.253 ^c
		Asymp. Sig. (2-tailed)		0.046	0.167	0.024

a. Wilcoxon Signed Ranks Test

b. Based on positive ranks.

c. Based on negative ranks.

d. The sum of negative ranks equals the sum of positive ranks.

Appendix X – Experiment Three Analyses data on Self-report measures associated with, performance, maladaptive behaviour, self-esteem, and intention to drop-out, split by Amotivated groups.

Descriptive Statistics														
AAI Pre intervention scores grouped in thirds			Percentiles											
Ability	Value	N	Mean	Std. Deviation	Minimum	Maximum	25th	50th (Median)	75th					
Amotivated	Value	Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module?	13	4.9231	1.03775	3.00	7.00	4.0000	5.0000	5.5000				
		Pre Add late and skip class	13	4.3846	2.63117	2.00	10.00	2.0000	3.0000	6.5000				
		Pre 4 x SE added	13	17.3846	3.57161	12.00	23.00	14.0000	18.0000	20.5000				
		Pre 3 x DO added	13	6.6154	3.88455	3.00	15.00	3.0000	6.0000	10.0000				
		Outside classes and tutorials what is your weekly average, in hours, spent studying and doing assignments (total)	13	13.38	8.780	3	30	7.50	11.00	20.50				
		Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module?	13	5.0000	1.15470	3.00	7.00	4.5000	5.0000	6.0000				
		Post Add late and skip class	13	5.3846	2.69377	2.00	9.00	2.5000	5.0000	8.0000				
		Post 4 x SE added	12	16.7500	2.00567	13.00	20.00	15.2500	16.5000	18.7500				
		Post 3 x DO added	13	5.8462	4.45058	3.00	16.00	3.0000	3.0000	9.0000				
		Outside classes and tutorials what is your weekly average, in hours, spent studying and doing assignments (total)	13	12.38	7.972	3	25	4.50	12.50	20.50				
		Ability	Value	Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module?	24	3.1667	1.37261	1.00	5.00	2.0000	3.0000	5.0000		
				Pre Add late and skip class	25	5.3600	2.94222	2.00	11.00	3.0000	4.0000	8.0000		
				Pre 4 x SE added	24	17.9167	2.48328	14.00	23.00	16.0000	18.0000	19.7500		
				Pre 3 x DO added	25	9.1200	4.30426	3.00	19.00	5.0000	9.0000	12.0000		
Outside classes and tutorials what is your weekly average, in hours, spent studying and doing assignments (total)	25			12.86	9.924	1	35	4.50	9.00	21.00				
Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module?	24			3.5417	1.38247	1.00	6.00	3.0000	3.0000	5.0000				
Post Add late and skip class	25			5.1600	2.51131	2.00	10.00	3.5000	4.0000	7.0000				
Post 4 x SE added	22			17.4091	3.24638	9.00	24.00	15.7500	17.0000	20.0000				
Post 3 x DO added	22			8.1818	3.81272	3.00	17.00	4.7500	8.0000	11.2500				
Outside classes and tutorials what is your weekly average, in hours, spent studying and doing assignments (total)	25			13.76	9.278	0	36	6.00	10.00	20.50				
Middle Third	Value			Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module?	23	5.4348	0.84348	4.00	7.00	5.0000	6.0000	6.0000		
				Pre Add late and skip class	23	5.0000	2.95420	2.00	12.00	3.0000	4.0000	6.0000		
				Pre 4 x SE added	19	14.7368	1.19453	12.00	16.00	14.0000	15.0000	16.0000		
				Pre 3 x DO added	22	5.0455	1.98752	3.00	9.00	3.0000	5.0000	6.2500		
		Outside classes and tutorials what is your weekly average, in hours, spent studying and doing assignments (total)	23	11.89	6.011	3	25	8.00	10.00	15.00				
		Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module?	22	5.6818	0.94548	3.00	7.00	5.0000	6.0000	6.0000				
		Post Add late and skip class	23	5.7826	2.92258	2.00	11.00	3.0000	5.0000	8.0000				
		Post 4 x SE added	22	15.1818	1.81623	13.00	20.00	14.0000	15.0000	16.2500				
		Post 3 x DO added	22	5.9545	3.49799	3.00	17.00	3.0000	5.0000	7.0000				
		Outside classes and tutorials what is your weekly average, in hours, spent studying and doing assignments (total)	23	10.96	7.138	1	25	5.00	10.00	17.00				
		Ability	Value	Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module?	14	3.7143	1.48989	1.00	6.00	2.7500	4.0000	5.0000		
				Pre Add late and skip class	16	4.9375	2.08066	2.00	9.00	3.0000	5.0000	6.7500		
				Pre 4 x SE added	11	18.6364	4.05642	9.00	23.00	17.0000	19.0000	21.0000		
				Pre 3 x DO added	15	6.9333	3.80726	3.00	13.00	3.0000	7.0000	11.0000		
Outside classes and tutorials what is your weekly average, in hours, spent studying and doing assignments (total)	16			13.59	9.039	2	40	9.25	12.00	15.75				
Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module?	15			4.4000	1.40408	2.00	7.00	3.0000	5.0000	5.0000				
Post Add late and skip class	16			4.4375	2.50250	2.00	10.00	3.0000	3.5000	5.0000				
Post 4 x SE added	8			16.6250	2.61520	14.00	22.00	15.0000	16.0000	18.2500				
Post 3 x DO added	14			6.2143	3.88644	3.00	13.00	3.0000	4.5000	9.7500				
Outside classes and tutorials what is your weekly average, in hours, spent studying and doing assignments (total)	16			14.41	9.002	3	35	5.25	13.50	20.00				

Not Amotivated	Value	Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module?	25	5.5200	0.82260	4.00	7.00	5.0000	6.0000	6.0000
		Pre Add late and skip class	25	3.9200	2.58070	2.00	10.00	2.0000	3.0000	5.5000
		Pre 4 x SE added	22	15.8636	2.31549	11.00	21.00	14.0000	16.0000	17.0000
		Pre 3 x DO added	25	5.1200	3.24448	3.00	15.00	3.0000	4.0000	6.5000
		Outside classes and tutorials what is your weekly average, in hours, spent studying and doing assignments (total)	24	15.40	7.842	4	35	10.50	15.00	20.00
		Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module?	23	5.6957	1.01957	3.00	7.00	5.0000	6.0000	6.0000
		Post Add late and skip class	24	4.4583	2.60400	2.00	10.00	2.0000	4.0000	5.7500
		Post 4 x SE added	22	15.6364	2.36130	12.00	22.00	14.7500	15.0000	17.0000
		Post 3 x DO added	25	5.5200	3.70945	3.00	14.00	3.0000	3.0000	8.0000
		Outside classes and tutorials what is your weekly average, in hours, spent studying and doing assignments (total)	25	16.70	8.853	3	40	10.00	15.00	20.00
	Ability	Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module?	13	4.6923	1.03155	3.00	6.00	4.0000	5.0000	5.5000
		Pre Add late and skip class	13	4.6154	2.39925	2.00	10.00	3.0000	4.0000	6.5000
		Pre 4 x SE added	11	15.5455	2.50454	11.00	19.00	14.0000	16.0000	18.0000
		Pre 3 x DO added	14	3.5714	0.93761	3.00	6.00	3.0000	3.0000	4.0000
		Outside classes and tutorials what is your weekly average, in hours, spent studying and doing assignments (total)	14	15.96	9.262	4	35	9.25	13.75	22.00
		Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module?	13	4.6923	1.54837	2.00	7.00	3.0000	5.0000	6.0000
		Post Add late and skip class	14	4.5000	2.37778	2.00	9.00	3.0000	3.0000	7.0000
		Post 4 x SE added	11	17.0909	2.02260	14.00	20.00	16.0000	16.0000	19.0000
		Post 3 x DO added	14	3.5714	0.75593	3.00	5.00	3.0000	3.0000	4.0000
		Outside classes and tutorials what is your weekly average, in hours, spent studying and doing assignments (total)	14	15.36	8.473	4	30	9.50	13.00	25.00

Wilcoxon Signed Ranks Test

		Ranks			
PRE_AmotY_N			N	Mean Rank	Sum of Ranks
Amotivated	Post Add late and skip class - Pre Add late and skip class	Negative Ranks	16 ^a	14.16	226.50
		Positive Ranks	15 ^b	17.97	269.50
		Ties	7 ^c		
		Total	38		
	Post 3 x DO added - Pre 3 x DO added	Negative Ranks	18 ^d	14.06	253.00
		Positive Ranks	7 ^e	10.29	72.00
		Ties	10 ^f		
		Total	35		
	Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module? - Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module?	Negative Ranks	7 ^g	12.50	87.50
		Positive Ranks	13 ^h	9.42	122.50
		Ties	15 ⁱ		
		Total	35		
	Self esteem POST with Neg marking - Self esteem PRE with Neg marking	Negative Ranks	18 ^j	14.47	260.50
		Positive Ranks	10 ^k	14.55	145.50
		Ties	5 ^l		
		Total	33		
Not Amotivated	Post Add late and skip class - Pre Add late and skip class	Negative Ranks	26 ^a	24.37	633.50
		Positive Ranks	26 ^b	28.63	744.50
		Ties	24 ^c		
		Total	76		
	Post 3 x DO added - Pre 3 x DO added	Negative Ranks	22 ^d	21.82	480.00
		Positive Ranks	26 ^e	26.77	696.00
		Ties	25 ^f		
		Total	73		
	Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module? - Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module?	Negative Ranks	16 ^g	18.00	288.00
		Positive Ranks	24 ^h	22.17	532.00
		Ties	30 ⁱ		
		Total	70		
	Self esteem POST with Neg marking - Self esteem PRE with Neg marking	Negative Ranks	26 ^j	23.87	620.50
		Positive Ranks	18 ^k	20.53	369.50
		Ties	10 ^l		
		Total	54		

a. Post Add late and skip class < Pre Add late and skip class

b. Post Add late and skip class > Pre Add late and skip class

c. Post Add late and skip class = Pre Add late and skip class

d. Post 3 x DO added < Pre 3 x DO added

e. Post 3 x DO added > Pre 3 x DO added

f. Post 3 x DO added = Pre 3 x DO added

g. Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module? < Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module?

h. Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module? > Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module?

i. Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module? = Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module?

j. Self esteem POST with Neg marking < Self esteem PRE with Neg marking

k. Self esteem POST with Neg marking > Self esteem PRE with Neg marking

l. Self esteem POST with Neg marking = Self esteem PRE with Neg marking

Test Statistics^a

PRE_AmotY_N		Post Add late and skip class - Pre Add late and skip class	Post 3 x DO added - Pre 3 x DO added	Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module? - Please rate your own perceived proficiency in this module - Your perceived self proficiency in this module?	Self esteem POST with Neg marking - Self esteem PRE with Neg marking
Amotivated	Z	-.426 ^b	-2.449 ^c	-.674 ^a	-1.314 ^a
	Asymp. Sig. (2-tailed)	0.670	0.014	0.501	0.189
Not Amotivated	Z	-.514 ^b	-1.131 ^b	-1.734 ^b	-1.473 ^c
	Asymp. Sig. (2-tailed)	0.607	0.258	0.083	0.141

a. Wilcoxon Signed Ranks Test

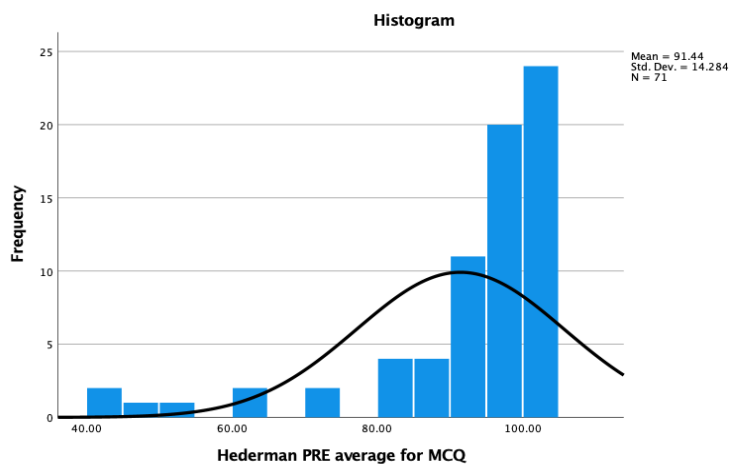
b. Based on negative ranks.

c. Based on positive ranks.

Appendix Y – Experiment Three Engineering Students / Pre- MCQ Performance, frequencies, and distribution histogram

Statistics						
Hederman PRE average for MCQ						
N	Valid					71
	Missing					46
Mean						91.4444
Median						96.8492
Mode						100.00
Skewness						-2.351
Std. Error of Skewness						0.285
Kurtosis						5.006
Std. Error of Kurtosis						0.563
Sum						6492.55

Hederman PRE average for MCQ						
		Frequency	Percent	Valid Percent	Cumulative Percent	
Valid	40.00	1	0.9	1.4	1.4	
	40.60	1	0.9	1.4	2.8	
	49.55	1	0.9	1.4	4.2	
	50.71	1	0.9	1.4	5.6	
	60.00	1	0.9	1.4	7.0	
	62.01	1	0.9	1.4	8.5	
	70.50	1	0.9	1.4	9.9	
	72.90	1	0.9	1.4	11.3	
	80.00	3	2.6	4.2	15.5	
	83.62	1	0.9	1.4	16.9	
	87.86	1	0.9	1.4	18.3	
	88.99	1	0.9	1.4	19.7	
	89.93	1	0.9	1.4	21.1	
	89.94	1	0.9	1.4	22.5	
	90.58	1	0.9	1.4	23.9	
	90.70	1	0.9	1.4	25.4	
	91.96	1	0.9	1.4	26.8	
	91.97	1	0.9	1.4	28.2	
	92.21	1	0.9	1.4	29.6	
	92.89	2	1.7	2.8	32.4	
	93.02	1	0.9	1.4	33.8	
	93.35	1	0.9	1.4	35.2	
	93.80	1	0.9	1.4	36.6	
	94.90	1	0.9	1.4	38.0	
	95.03	1	0.9	1.4	39.4	
	95.35	2	1.7	2.8	42.3	
	96.30	1	0.9	1.4	43.7	
	96.49	1	0.9	1.4	45.1	
	96.74	1	0.9	1.4	46.5	
	96.85	1	0.9	1.4	47.9	
	96.85	2	1.7	2.8	50.7	
	97.21	1	0.9	1.4	52.1	
	97.78	1	0.9	1.4	53.5	
	98.14	2	1.7	2.8	56.3	
	98.46	1	0.9	1.4	57.7	
	98.57	2	1.7	2.8	60.6	
	98.60	2	1.7	2.8	63.4	
	98.71	1	0.9	1.4	64.8	
	99.07	1	0.9	1.4	66.2	
	100.00	24	20.5	33.8	100.0	
	Total	71	60.7	100.0		
Missing	System	46	39.3			
Total		117	100.0			



Appendix Z – Experiment Three Engineering Students / Pre- Programming Test
Scores, frequencies, and distribution histogram

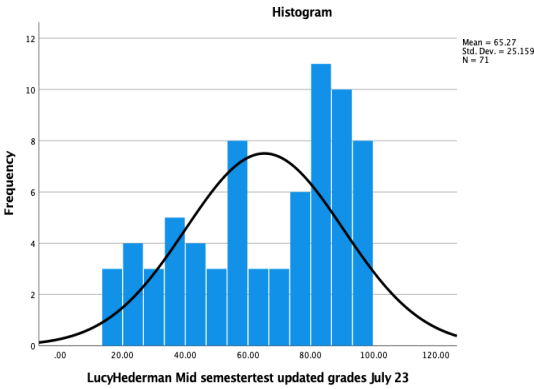
Statistics

Mid semestertest

N	Valid	71
	Missing	46
Mean		65.2676
Median		70.5000
Skewness		-0.413
Std. Error of Skewness		0.285
Kurtosis		-1.140
Std. Error of Kurtosis		0.563

LucyHederman Mid semestertest updated grades July 23

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	17.50	1	0.9	1.4	1.4
	19.50	2	1.7	2.8	4.2
	20.50	2	1.7	2.8	7.0
	22.50	1	0.9	1.4	8.5
	24.00	1	0.9	1.4	9.9
	27.00	1	0.9	1.4	11.3
	30.50	1	0.9	1.4	12.7
	33.00	1	0.9	1.4	14.1
	35.00	2	1.7	2.8	16.9
	35.50	1	0.9	1.4	18.3
	39.00	1	0.9	1.4	19.7
	39.50	1	0.9	1.4	21.1
	40.00	1	0.9	1.4	22.5
	41.50	1	0.9	1.4	23.9
	46.00	1	0.9	1.4	25.4
	46.50	1	0.9	1.4	26.8
	48.50	2	1.7	2.8	29.6
	49.50	1	0.9	1.4	31.0
	53.50	1	0.9	1.4	32.4
	54.00	1	0.9	1.4	33.8
	54.50	1	0.9	1.4	35.2
	55.00	2	1.7	2.8	38.0
	56.00	2	1.7	2.8	40.8
	58.00	1	0.9	1.4	42.3
	60.50	1	0.9	1.4	43.7
	62.50	1	0.9	1.4	45.1
	65.50	1	0.9	1.4	46.5
	68.00	1	0.9	1.4	47.9
	68.50	1	0.9	1.4	49.3
	70.50	1	0.9	1.4	50.7
	73.50	1	0.9	1.4	52.1
	74.00	1	0.9	1.4	53.5
	75.00	1	0.9	1.4	54.9
	77.00	1	0.9	1.4	56.3
	78.00	1	0.9	1.4	57.7
	79.50	1	0.9	1.4	59.2
	80.00	1	0.9	1.4	60.6
	81.50	1	0.9	1.4	62.0
	83.00	1	0.9	1.4	63.4
	84.00	2	1.7	2.8	66.2
	85.00	1	0.9	1.4	67.6
	85.50	4	3.4	5.6	73.2
	86.00	1	0.9	1.4	74.6
	87.00	2	1.7	2.8	77.5
	88.00	1	0.9	1.4	78.9
	89.50	2	1.7	2.8	81.7
	91.50	1	0.9	1.4	83.1
	92.00	3	2.6	4.2	87.3
	92.50	1	0.9	1.4	88.7
	93.50	2	1.7	2.8	91.5
	96.00	2	1.7	2.8	94.4
	96.50	1	0.9	1.4	95.8
	98.50	1	0.9	1.4	97.2
	100.00	2	1.7	2.8	100.0
Total		71	60.7	100.0	
Missing	System	46	39.3		
Total		117	100.0		



Appendix AA – Experiment Three Computer Science Students / Pre- Practice Test

Scores, frequencies, and distribution histogram

Statistics

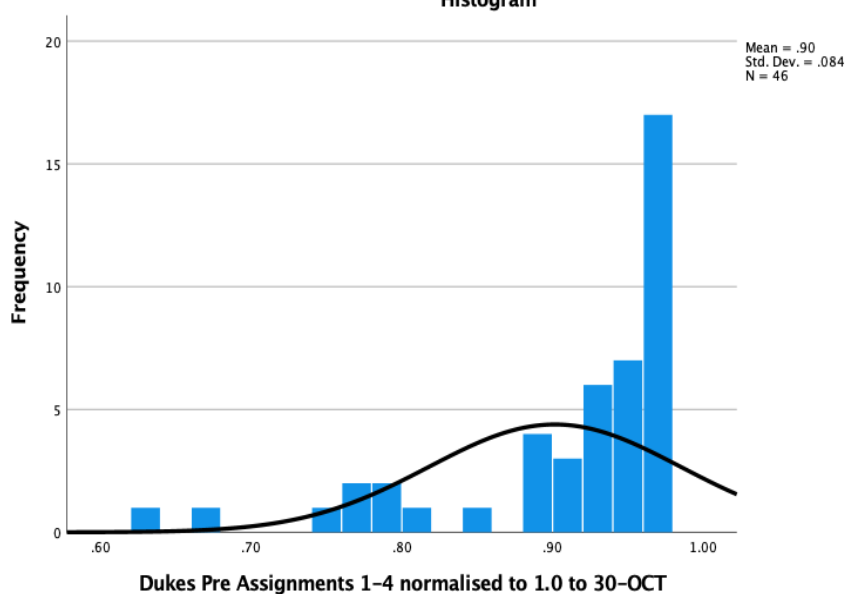
Dukes Pre Assignments 1-4
normalised to 1.0 to 30-OCT

N	Valid	46
	Missing	71
Mean		0.9015
Median		0.9400
Mode		0.96
Skewness		-1.778
Std. Error of Skewness		0.350
Kurtosis		2.543
Std. Error of Kurtosis		0.688
Sum		41.47

CompSci Pre Assignments 1-4 normalised to 1.0 to 30-OCT

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.63	1	0.9	2.2	2.2
	.66	1	0.9	2.2	4.3
	.74	1	0.9	2.2	6.5
	.76	2	1.7	4.3	10.9
	.78	2	1.7	4.3	15.2
	.81	1	0.9	2.2	17.4
	.84	1	0.9	2.2	19.6
	.88	3	2.6	6.5	26.1
	.89	1	0.9	2.2	28.3
	.90	2	1.7	4.3	32.6
	.91	1	0.9	2.2	34.8
	.92	1	0.9	2.2	37.0
	.93	5	4.3	10.9	47.8
	.94	7	6.0	15.2	63.0
	.96	17	14.5	37.0	100.0
Total		46	39.3	100.0	
Missing	System	71	60.7		
Total		117	100.0		

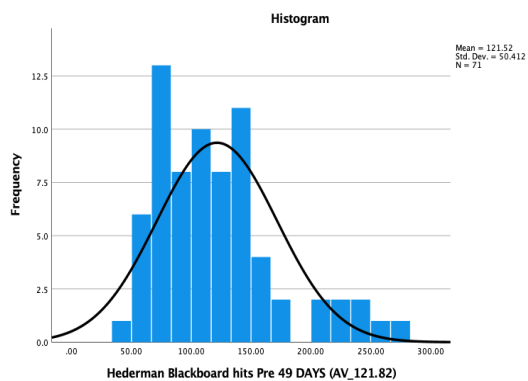
Histogram



Appendix BB – Experiment Three Engineering Students / Pre- VLE access, frequencies, and distribution histogram

Statistics					
Hederman Blackboard hits Pre 49 DAYS (AV_121.82)					
N	Valid				71
	Missing				46
Mean					121.5211
Median					112.0000
Mode					78.00
Skewness					1.132
Std. Error of Skewness					0.285
Kurtosis					1.007
Std. Error of Kurtosis					0.563
Sum					8628.00

Engineering Blackboard hits Pre 49 DAYS (AV_121.82)					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	48.00	1	0.9	1.4	1.4
	54.00	1	0.9	1.4	2.8
	61.00	1	0.9	1.4	4.2
	63.00	3	2.6	4.2	8.5
	66.00	1	0.9	1.4	9.9
	67.00	1	0.9	1.4	11.3
	74.00	1	0.9	1.4	12.7
	77.00	1	0.9	1.4	14.1
	78.00	4	3.4	5.6	19.7
	79.00	3	2.6	4.2	23.9
	80.00	1	0.9	1.4	25.4
	81.00	2	1.7	2.8	28.2
	87.00	1	0.9	1.4	29.6
	89.00	1	0.9	1.4	31.0
	92.00	2	1.7	2.8	33.8
	95.00	1	0.9	1.4	35.2
	96.00	1	0.9	1.4	36.6
	97.00	1	0.9	1.4	38.0
	99.00	1	0.9	1.4	39.4
	101.00	1	0.9	1.4	40.8
	105.00	2	1.7	2.8	43.7
	106.00	1	0.9	1.4	45.1
	108.00	1	0.9	1.4	46.5
	110.00	1	0.9	1.4	47.9
	111.00	1	0.9	1.4	49.3
	112.00	1	0.9	1.4	50.7
	114.00	1	0.9	1.4	52.1
	116.00	1	0.9	1.4	53.5
	118.00	1	0.9	1.4	54.9
	120.00	1	0.9	1.4	56.3
	123.00	1	0.9	1.4	57.7
	124.00	1	0.9	1.4	59.2
	125.00	1	0.9	1.4	60.6
	127.00	1	0.9	1.4	62.0
	130.00	1	0.9	1.4	63.4
	133.00	1	0.9	1.4	64.8
	134.00	2	1.7	2.8	67.6
	135.00	1	0.9	1.4	69.0
	137.00	2	1.7	2.8	71.8
	139.00	1	0.9	1.4	73.2
	140.00	1	0.9	1.4	74.6
	141.00	1	0.9	1.4	76.1
	142.00	1	0.9	1.4	77.5
	143.00	1	0.9	1.4	78.9
	147.00	1	0.9	1.4	80.3
	150.00	2	1.7	2.8	83.1
	164.00	1	0.9	1.4	84.5
	165.00	1	0.9	1.4	85.9
	171.00	1	0.9	1.4	87.3
	173.00	1	0.9	1.4	88.7
	203.00	1	0.9	1.4	90.1
	206.00	1	0.9	1.4	91.5
	224.00	1	0.9	1.4	93.0
	225.00	1	0.9	1.4	94.4
	239.00	1	0.9	1.4	95.8
	243.00	1	0.9	1.4	97.2
	252.00	1	0.9	1.4	98.6
	272.00	1	0.9	1.4	100.0
	Total	71	60.7	100.0	
Missing	System	46	39.3		
Total		117	100.0		



Appendix CC – Experiment Three Computer Science Students / Pre- VLE access, frequencies, and distribution histogram

Statistics

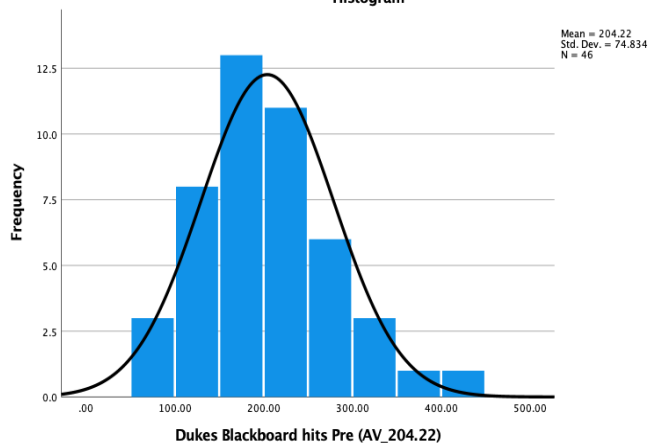
CompSci Blackboard hits Pre
(AV_204.22)

N	Valid	46
	Missing	71
Mean		204.2174
Median		189.0000
Mode		189.00
Skewness		0.625
Std. Error of Skewness		0.350
Kurtosis		0.466
Std. Error of Kurtosis		0.688
Sum		9394.00

Computer Science Students Blackboard hits Pre (AV_204.22)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	62.00	1	0.9	2.2	2.2
	77.00	1	0.9	2.2	4.3
	87.00	1	0.9	2.2	6.5
	120.00	1	0.9	2.2	8.7
	123.00	1	0.9	2.2	10.9
	125.00	1	0.9	2.2	13.0
	127.00	1	0.9	2.2	15.2
	134.00	1	0.9	2.2	17.4
	143.00	2	1.7	4.3	21.7
	149.00	1	0.9	2.2	23.9
	158.00	1	0.9	2.2	26.1
	159.00	1	0.9	2.2	28.3
	165.00	2	1.7	4.3	32.6
	170.00	1	0.9	2.2	34.8
	171.00	1	0.9	2.2	37.0
	179.00	1	0.9	2.2	39.1
	185.00	1	0.9	2.2	41.3
	186.00	2	1.7	4.3	45.7
	189.00	3	2.6	6.5	52.2
	205.00	1	0.9	2.2	54.3
	207.00	1	0.9	2.2	56.5
	209.00	1	0.9	2.2	58.7
	212.00	1	0.9	2.2	60.9
	214.00	1	0.9	2.2	63.0
	220.00	1	0.9	2.2	65.2
	224.00	1	0.9	2.2	67.4
	227.00	1	0.9	2.2	69.6
	234.00	1	0.9	2.2	71.7
	238.00	1	0.9	2.2	73.9
	243.00	1	0.9	2.2	76.1
	257.00	1	0.9	2.2	78.3
	259.00	1	0.9	2.2	80.4
	263.00	1	0.9	2.2	82.6
	264.00	1	0.9	2.2	84.8
	274.00	1	0.9	2.2	87.0
	280.00	1	0.9	2.2	89.1
	329.00	1	0.9	2.2	91.3
	335.00	1	0.9	2.2	93.5
	340.00	1	0.9	2.2	95.7
	374.00	1	0.9	2.2	97.8
	405.00	1	0.9	2.2	100.0
	Total	46	39.3	100.0	
Missing	System	71	60.7		
Total		117	100.0		

Histogram



Appendix DD – Experiment Three Computer Science Students / Pre- Optional test attempts, frequencies, and distribution histogram

Statistics		
Dukes Pre Optional exercises attempted (regardless of mark)		
N	Valid	46
	Missing	71
Mean		0.7550
Median		0.9300
Mode		0.93
Skewness		-1.254
Std. Error of Skewness		0.350
Kurtosis		0.037
Std. Error of Kurtosis		0.688
Sum		34.73

Dukes Pre Optional exercises attempted (regardless of mark)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	1	0.9	2.2	2.2
	.07	1	0.9	2.2	4.3
	.14	3	2.6	6.5	10.9
	.21	2	1.7	4.3	15.2
	.43	3	2.6	6.5	21.7
	.50	2	1.7	4.3	26.1
	.64	2	1.7	4.3	30.4
	.86	1	0.9	2.2	32.6
	.93	23	19.7	50.0	82.6
	1.00	8	6.8	17.4	100.0
	Total	46	39.3	100.0	
Missing	System	71	60.7		
Total		117	100.0		

