Developing Skills and Confidence in Non-Formal Education

A Thesis Submitted in Fulfilment of the Requirements for the Award of Doctor of Philosophy

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Declaration

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To Janet. I love you and I like you.

Beep.

Related Publications

Journal Articles

Sullivan, K., Bray, A., & Tangney, B. (2020). Developing twenty-first-century skills in out-of-school education: the Bridge21 Transition Year programme. *Technology, Pedagogy and Education*, 1-17.

Sullivan, K., Marshall, K., & Tangney, B. (2015). Learning circles: A collaborative technology-mediated peer-teaching workshop. Journal of Information Technology Education: Innovations in Practice, 14, 63–83.

Nuhoğlu Kibar, P., Sullivan, K., & Akkoyunlu, B. (2019). Creating Infographics Based On the Bridge21 Model for Team-Based and Technology-Mediated Learning. *Journal of Information Technology Education: Innovations in Practice, 18*, 87 - 111.

Byrne, J. R., O'Sullivan, K., & Sullivan, K. (2017). An IoT and wearable technology Hackathon for promoting careers in computer science. IEEE Transactions on Education, 60(1), 50–58.

Book Chapters

Byrne, J. R., Kearney, S., & Sullivan, K. (2019). Technology-Mediated Collaborative Learning: The Bridge21 Activity Model in Theory and Practice. In *Didactics of Smart Pedagogy* (pp. 309-330): Springer.

Conference Presentations

Sullivan, K. (2016). Assessing the immediate and long-term impact of an out-of-school 21C learning programme. Paper presented at European Conference on Educational Research (ECER), Dublin, Ireland.

Sullivan, K., Kearney, S., O'Kelly, M., & Tangney, B. (2017). Bridge21 – A pragmatic approach to "21st century" teaching & learning. Paper presented at the World Conference on Computers and Education (WCCE), Dublin, Ireland.

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Summary

There is a growing recognition of the value of 21st century (21C) skills for modern learners, and many education systems are seeking to employ strategies to help their students develop those skills. This push is based on the idea that for students to thrive in a world where technology is developing rapidly and the ways in which we interact with people and information are constantly changing, they must develop relevant knowledge, skills, and confidence (Ravitz, Hixson, English, & Mergendoller, 2012). To help students acquire and improve these competencies, education systems must develop appropriate strategies and understand how to implement them for their students' benefit. The development and validation of approaches and interventions that have a meaningful and sustained impact on students' skills and confidence are a vital step in the ongoing reform of modern education systems.

21C teaching and learning refers to pedagogical approaches designed to help students develop 21C skills. These are typically social constructivist in nature and often involve students collaborating to complete challenging project work. These approaches can be used within formal education but are often more prominent in programmes situated outside of the formal system. This is primarily because these programmes have the flexibility to help students gain relevant experience and skills, without the pressure of state examinations (Cort, 2014; Fullan & Langworthy, 2014). However, it is often difficult to determine the long-term impact of non-formal interventions due to short-term funding, turnover in staff or changes in programme objectives (Souto-Otero, Ulicna, Schaepkens, & Bognar, 2013). The evaluations associated with most non-formal education take place during, or soon after, the programme and rarely have the scope to use mixed methods in data collection (Decker, McGill, & Settle, 2016).

The Bridge to College programme is a non-formal education initiative (Lawlor, Conneely, Oldham, Marshall, & Tangney, 2018) that was re-designed by the author to help students develop 21C skills and confidence. The Bridge21 pedagogical model is employed throughout the programme. Key features of the programme include working in small teams with students from other schools, completing creative technical projects, and presenting their work to their peers (Byrne, Kearney, & Sullivan, 2019). Students spend four days participating in the programme in a custom-designed learning space.

The research questions in this thesis relate to understanding the impact that participation in this programme has on the 21C skills and confidence of the students (RQ1), exploring which features of the programme help create this impact (RQ1a), and examining whether this impact is sustained in the years after completing the programme (RQ2). An evaluative case study was carried out using a concurrent mixed-methods approach. This included the collection of quantitative and qualitative data from student surveys and group interviews, both before and immediately after participation in the programme and again between one and seven years later. The aim of collecting data at various time points was to determine whether there were measurable effects at the time of the programme and, if so, to determine whether these effects were temporary or had a meaningful long-term impact.

From the quantitative data presented, students report large increases in confidence across a range of key skills following participation in the programme. Crucially, these effects remain visible several months after completing the programme. Students described learning new skills, becoming more comfortable around new people, and reduced nervousness about public speaking. The research shows that the development of these skill areas can be linked directly to aspects of the programme design.

The longitudinal aspect of this study is of particular interest. The reported effects appear to be more than a temporary spike created by the novelty of the students' experience. They are sustained and remain present over many years. In further surveys and interviews, up to seven years after participating in the programme, students reported that the boost in skills and confidence gained during their time on Bridge to College remained with them over a long period.

The scope of the study was limited by the fact that most of the data collected were self-reported by students. Other limitations to acknowledge include personal bias, as the researcher was in a participant/observer role, and that students volunteering for some aspects of the longitudinal research were likely to be positively disposed towards the Bridge to College programme.

There is strong evidence that the Bridge to College programme can provide increases in student confidence across a range of 21C skills. These increases are statistically significant with large effect sizes, and the increases can be linked to elements in the programme design. This impact has been shown to be long-lasting, remaining present in the months and years after students have completed the programme.

The main contributions of this research, in the fields of 21C learning and non-formal education, are:

i) The design of the Bridge to College programme, a non-formal education programme to promote 21C skills development.

ii) A deeper understanding of whether, and how, this programme impacts 21C skills development.

iii) An exploration of the long-term impact of this out-of-school, non-formal educational intervention.

1 Introduction

1.1 Research Context

There is a growing recognition of the value of 21C skills for modern learners, and many educators are seeking to employ strategies to help their students develop those skills. This is based on the idea that for students to thrive in a world of rapidly developing technology and changing practice, they must in turn develop relevant knowledge, skills, and confidence (Ravitz et al., 2012). Young people today face a broad range of challenges. Instant access to information and accelerating technological advances have created an increasingly connected world and changed the ways in which we interact, both personally and professionally. To be successful in the modern workplace often requires the abilities to work well as part of a team and as an individual, to be able to take instruction, to make decisions, and to possess the digital literacies required to access, analyse, and create content (Luna Scott, 2015; Stanley & McCoshen, 2012). There is an increasing importance placed on the development of 21C skills such as creativity, communication, and collaboration. The ability to work and learn with technology is a vital modern literacy and skills like self-direction and critical thinking are required of modern workers and learners as they navigate an information-saturated world (Souto-Otero, Ulicna, Schaepkens, & Bognar, 2013).

The teaching of these skills must be carried out intentionally and effectively. Some national education systems prioritise the development of these skills, but many others remain content focused. However, there is increasing recognition among educators of the value of pedagogical approaches designed to encourage the development of these skills.

21C learning refers to pedagogical approaches designed to help students develop 21C skills. These are typically social constructivist in nature and often involve students collaborating to complete challenging project work. Moyer (2016) proposes that in skills-focused education, knowledge should be treated as a tool that can be used to solve problems.

Moyer mentions characteristics of effective skills-focused education. They include:

- integration of skills and knowledge to solve problems,
- active, autonomous, decision-making students,
- collaborative construction of knowledge,
- meaningful, authentic activities,
- continuous formative assessment,
- use of reflection to enable tacit knowledge to become explicit.

Much of the innovation in 21C learning takes place in the non-formal education (NFE) sector. NFE programmes typically have the flexibility to develop new approaches away from the constraints of formal curricula and assessment systems. These approaches can be used within formal education, e.g., New Zealand and Finland (Parsons et al., 2015; Sahlberg, 2011), but globally, these systems are the exception. In most countries, formal education systems typically treat knowledge-acquisition as the goal for students and build assessments on that basis.

Non-formal education can serve two key roles:

1) As a complementary system that offers valuable educational opportunities/interventions for students, in parallel to the formal system.
2) As a testing ground for educational approaches that can be used in the formal system.

One vital step in introducing 21C learning into education, formal or non-formal, is the identification of effective approaches and an understanding of how and why they are effective. To help students acquire and improve these competencies, educators must develop appropriate strategies and understand how to implement them for their students benefit. The development and validation of practical approaches and interventions that have a meaningful and sustained impact on students' skills and confidence is a vital step in the ongoing development of modern education systems. The design of pragmatic and effective 21C learning approaches, and an understanding of how and why they are effective, is an area worthy of ongoing effort and research.

One significant issue in non-formal education is the difficulty in determining the long-term impact of short-term educational interventions. In non-formal education, factors such as short-term funding, turnover in staff or changes in programme objectives contribute to this problem (Kinsey, 1978; Souto-Otero, Ulicna, Schaepkens, & Bognar, 2013). The assessments associated with most

non-formal education take place during or immediately after the programme, and rarely have the scope to use mixed methods in data collection (Falk & Dierking, 1997). One structured literature review found that fewer than ten percent of outreach programmes in the field of computer science conducted any data collection more than nine months after completing the programme (Decker, McGill, & Settle, 2016). More recent reviews have shown that there is evidence of the short-term impact of a range of non-formal educational interventions, but that there are significant gaps in rigorous long-term evaluation data (Simac, Marcus, & Harper, 2019).

1.1.1 21C Skills & 21C Learning

The phrase "21C skills" is used frequently throughout this dissertation. "21C skills" can be used to refer to a broadly agreed upon set of skills that are believed to be more relevant in 21C life for more people than they may have been in the past (Fullan & Langworthy, 2014). These typically include collaboration, communication, critical thinking, creativity, self-direction, and technology skills. The obvious flaw with this label is that most of these skills were essential prior to the 21st century. In this dissertation, "21C skills" is used as a convenient shorthand for a set of skills (see Section 2.1) that are arguably more relevant in personal and professional settings than they have been in the past, and that have certainly been the focus of increased attention in education circles in recent years (Dede, 2010; Voogt & Roblin, 2012). The phrase "21C learning" is used to describe pedagogical approaches designed and used to promote the development of 21C skills. Once again, this does not imply that they are necessarily new ideas, but it is reasonable to say that they have been the subject of increased focus in many education systems in the last decade (Fullan & Langworthy, 2014).

1.2 Problem Statements

Problem Statement 1 (PS1): There is a need for pragmatic models for 21C learning that are proven to be effective in promoting the development of 21C skills. There is an increasing body of literature highlighting this need and, while the use of these approaches is established in some countries, it is in its infancy in most others (Ananiadou & Claro, 2009; Luna Scott, 2015; Quinn, McEachen, Fullan, Gardner, & Drummy, 2019). While there is significant evidence of the importance of 21C approaches in research, there are a variety of reasons why uptake in practice has been slower. Criticisms of 21C learning include that it can be under-scaffolded, can rely too heavily on student-led discovery learning, or can involve using technology as a means of content delivery (De Corte, 2010; Fullan & Langworthy, 2014; Lei, 2010). Further research is needed to

investigate the structure of effective approaches, to determine which pedagogical elements promote the development of specific skills, and to understand the supports and scaffolds needed to implement these approaches successfully.

Problem Statement 2 (PS2): There is some research into the immediate or short-term impact of non-formal educational activities but there are very few studies exploring their long-term impact. The assessments associated with most non-formal education take place during, or immediately after, the programme (Falk & Dierking, 1997). One structured literature review of outreach activities found that less than ten percent of programmes collected data from participants more than nine months after completing the programme, and that less than twenty percent used mixed methods in their data collection (Decker, McGill, & Settle, 2016). In non-formal education, long-term evaluation is often challenging due to problems with the programme structure. Short term funding, turnover in staff, and changes in programme objectives and content are often features of these programmes (Kinsey, 1978; Souto-Otero et al., 2013).

1.3 Research Goals

Given the problems identified through the literature review, this research had several goals. Each goal is linked to one of the problems described above.

RG1: Design a structured non-formal education programme to effectively promote the development of 21C skills. (PS1)

RG2: Develop a deeper understanding of the effectiveness of that programme in developing 21C skills, including an assessment of skills development among participating students, and an exploration of the programme structure to identify key features which support those skills. (PS1)

RG3: Explore the long-term impact of student participation in the non-formal education intervention described in RG1. (PS2)

These goals are identified to help clarify the links between the broad problem areas mentioned above, the research questions set out in Section 1.4, and the contributions to knowledge made by this study, as described in Section 1.6.

1.3.1 Pre-PhD Data – 21C Skills

This study formally began in September 2015. At that point, the Bridge to College programme had been running for eight years overall. In early iterations of the programme, the initial development

of the Bridge21 model had taken place (Lawlor et al., 2018), and had been shown to promote intrinsic motivation in participating students (Lawlor, Marshall, & Tangney, 2016). Further work in this time sought to introduce the Bridge21 model into formal education in second level schools (Conneely, Girvan, Lawlor, & Tangney, 2015). The use of 21C learning approaches in formal education, in Ireland and internationally, is discussed in Section 2.4.4.

The Bridge to College programme, as described in this study, includes a structure and content that was designed by the author. The early years of the Bridge to College programme are described in Section 3.1. The programme was re-designed in 2011 to focus on 21C skills development and, from 2011 onward, ran in a settled and consistent format. This programme design is described in Chapter 3.

In 2015, at the beginning of this PhD research, data collection had been ongoing for four years for both research and programme evaluation purposes. Participating students had completed questionnaires at the end of their week on the programme. Between the 2011/12 and 2014/15 school years, 695 students completed an end-of-week questionnaire. That questionnaire contained a series of statements about the possible impact of the programme on the participating students. It used Likert scale questions and students were asked to choose a response on a five-point scale ranging from Strongly Agree at one end to Strongly Disagree at the other. Some of these results are shown in Table 1.

N = 695	**Agree / Strongly Agree**
Improved Attitude to Teamwork	95%
Improved Communication/Presentation skills	93%
Increased Confidence with Technology	93%
Increased Independence	87%

Table 1: Programme Impact – Skills

These data suggest that this design of the Bridge to College programme has a positive impact in several 21C skill areas. This set of data has many limitations though. It does not indicate the magnitude of any improvement in skill levels or shed any light into how or why these improvements occurred. It also gives no indication as to whether these changes are sustained over time.

It was these initial findings that led to the decision to conduct a study focused on this aspect of the programme. A desire to better understand how and why this effect is achieved, and whether this

impact was sustained over time led to the development of the following hypothesis and research questions.

1.3.2 Hypothesis

The Bridge to College programme is a framework for developing 21C skills that is pragmatic, effective, and has a long-lasting impact.

1.4 Research Questions

In pursuit of these research goals, two main research questions were identified. The first question relates to students' experiences as reported at the time of the programme. RQ1 seeks to determine if the approaches used during the programme had an impact on the participants' confidence across a range of 21C skills. There is one sub-question. RQ1 (a) explores the structure and features of the programme to determine which elements may be contributing to the reported effects on skills.

RQ1	**Is the Bridge to College programme effective in developing 21C skills in participating students?**
RQ1(a)	**Which features of the programme help promote 21C skills development?**

RQ1 is explored through analysis of questionnaire data collected before, and immediately after, each week of the programme. The data used to answer RQ1 are presented in Chapter 5.

RQ2 relates to students' experiences as reported in the years after completing the programme. RQ2 seeks to determine if the effects described in Chapter 5 remain present between one and seven years after completing the programme.

RQ2	**Are changes in skill levels/attitudes among Bridge to College students sustained over time?**

RQ2 is explored through analysis of questionnaire and interview data collected at various time points, between one year and seven years following completion of the programme. The data used to answer RQ2 are presented in Chapter 6.

A summary of the problem statements, research goals, hypothesis, and research questions is presented in Table 2, below.

Problem Statements	
PS1: Lack of practical pedagogical models designed to promote 21C skills development and limited understanding of how and why 21C learning approaches impact 21C skills development.	**PS2:** Limited understanding of long-term impact of non-formal, out-of-school education.

Research Goals		
RG1: Design a structured non-formal education programme to promote 21C skills development.	**RG2:** Develop a deeper understanding of how and why that programme impacts 21C skills development.	**RG3:** Improved understanding of the long-term impact of the non-formal, out-of-school education programme developed in RG1.

Hypothesis
The Bridge to College programme is a framework for developing 21C skills that is pragmatic, effective, and has a long-lasting impact.

Research Questions	
RQ1: Is the Bridge to College programme effective in developing 21C skills in participating students?	**RQ2:** Are changes in skill levels/attitudes among Bridge to College students sustained over time?
RQ1 (a): Which features of the programme help promote 21C skills development?	

Table 2: Problem Statements, Research Aims, Hypothesis & Research Questions

1.5 Overview of Methodology

This research seeks to investigate the immediate and long-term effects of participation in the Bridge to College programme, particularly the development of 21C skills. An evaluative case study was carried out using a concurrent mixed-methods approach. The researcher was in a participant/observer role: both leading the workshops and carrying out the research. This included the collection of quantitative and qualitative data from student surveys (N = 1,250), both before and immediately after participating in the programme and again between one and seven years later. Group interviews were held at the end of the programme (n = 12) and again four to seven years later (n = 53). The aim of collecting data at various time points was to determine whether there were measurable effects at the time of the programme, and if so, to determine whether these effects were temporary or had a meaningful long-term impact.

1.5.1 Implementation

The Bridge to College programme is a non-formal 21C learning initiative that is designed to help students develop 21C skills and to increase their confidence. A secondary aim of the Bridge to College programme is to raise participants' aspiration towards third level education (Hannon, Faas, & O'Sullivan, 2017). This is the context in which the research took place but questions about third level education, and related attitudes, aspirations, and access are outside the scope of this dissertation.

The Bridge to College programme is a specific implementation of the Bridge21 model for collaborative, technology-mediated, project-based learning. Key features of the Bridge to College approach include working in small teams with students from other schools, completing creative technical projects, presenting their work to their peers, and experiences of working and learning in a third level education setting. Students spend four days at a time participating in the programme in a dedicated learning space on the researcher's university campus. Participants are supported throughout the programme by one lead facilitator and a team of adult volunteers.

1.5.2 Methodological Approach

To address the aims of this study and answer the research questions, various research methodologies were considered. Action research and design-based research both had their merits but, as discussed in Section 4.2.4 - Choice of Approach – Evaluative Case Study, it ultimately became clear that a case study approach was the appropriate choice for practical and theoretical

reasons. A case study is a practical examination of an identified phenomenon in its real-world context. It is a useful approach when attempting to answer “how” or “why” questions about complex situations with many more variables than can be captured in data. The study of a specific instance of a phenomenon is often used to develop or illustrate a broader principle or theory that can be applied in other contexts (Cohen, Manion, & Morrison, 2013; Yin, 2014).

An evaluative case study methodology was chosen for this research. This approach, which includes both evaluative and explanatory aspects, seeks to evaluate the impact of an intervention or phenomenon (Harrison, Birks, Franklin, & Mills, 2017). It allows for a deep description and analysis of the case in question, seeks to document the design of the Bridge to College programme, and explore the students’ experiences during and after participation. This is an instrumental case study (Stake, 1995) in that it focuses on a group of students experiencing the same phenomenon, and seeks to understand the impact of that phenomenon on those students. The focus is on the phenomenon itself rather than the experience of any specific student group.

1.5.3 Research Design

This research involves the investigation and evaluation of the Bridge to College programme. The case study is an embedded, single case study. Data were collected during each week of programme delivery across several years, but these data have ultimately been treated as one large main unit of analysis (Yin, 2014). The reason for treating these data as a single case is that the students’ collective shared experiences are more relevant to this study than the experience of one particular (weekly) programme group, their individual year group, or the experience of students from one particular school or other.

The main Evaluative Case contains three sets of data. These are:

1) Data collected from students during the Bridge to College programme between 2015 and 2018. N = 544.
2) A structured analysis of the design of the Bridge to College programme, with a particular focus on the expected use of various skills during the activities that make up the programme.
3) Data collected from students between one and seven years after their participation in the Bridge to College programme. N = 389.

1.5.4 Research Methods: Data Collection & Analysis

To answer the research questions and meet the aims of the study, a mixed methods approach was selected. A mixed methods approach is a pragmatic choice in that it makes use of both qualitative and quantitative methods, as appropriate (Cohen et al., 2013). In a case study methodology such as this, the use of various tools and sources for data collection is a natural choice. This study used a parallel mixed design, in that both quantitative and qualitative data were collected simultaneously to address the research questions (Teddlie & Tashakkori, 2011). The use of multiple sources of data leads to a triangulated view of the phenomenon and allows the researcher to have faith in this approach (Cohen et al., 2013; Yin, 2014).

The main quantitative tool is an adapted version of the Ravitz key skills framework (Ravitz et al., 2012). This was used to provide a numeric measurement of students' confidence in a range of skills areas at various time points. Additional quantitative questions addressed related points about the students' experiences on the Bridge to College programme. Qualitative tools, such as open survey questions and group interviews, were also used. Data from these sources were used to reinforce, reject, or further illuminate the outcomes of the quantitative data analysis and to explore or suggest any other significant findings.

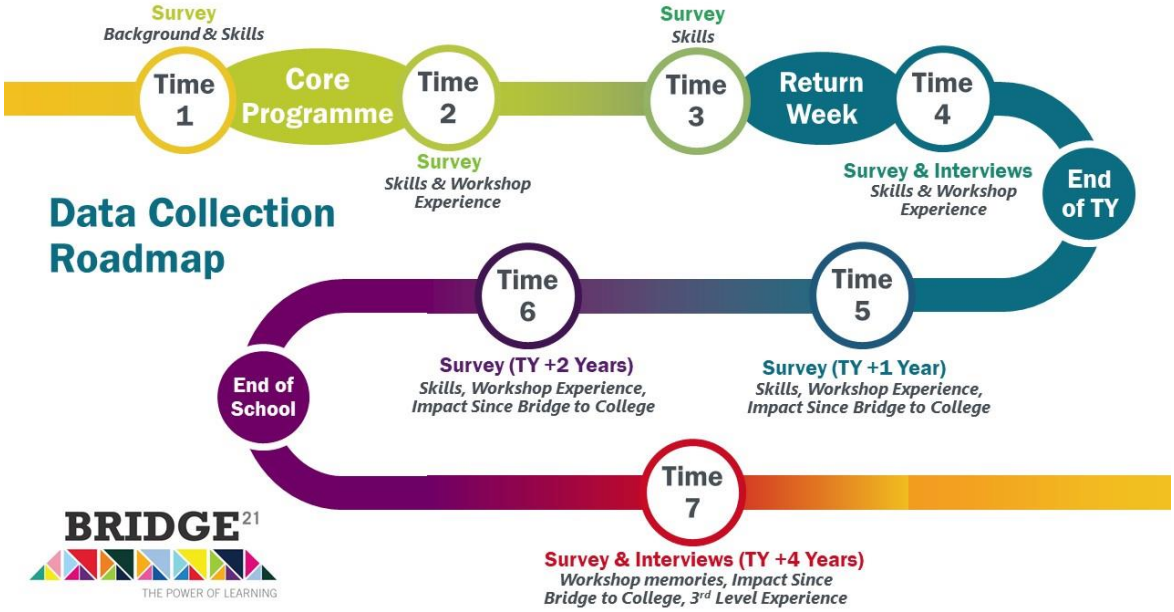


Figure 1: Data Collection Timeline

Data were collected from students at seven time points (Figure 1), beginning with their first morning on the Bridge to College programme. The programme is divided into two blocks of weeks,

"Core" weeks, in which every student participates, and "Return" weeks, which were available to about half of the students. Times 1, 2, 3 & 4 take place at the start and end of each programme week. The Return weeks typically take place three months after the students' first week on Bridge to College. Times 5 and 6 took place one and two years respectively after students took part in the programme, with Time 7 taking place in the years after students had finished school.

Student questionnaires were used at each of the seven time points and student interviews were also used at Times 4 and 7. The Time 7 interviews form a significant contribution to this study, adding a richness and depth to the longitudinal data and exploring the impact of the programme in the personal, educational, and professional lives of the participating students.

To analyse the quantitative data on 21C skills, parametric statistical tests were carried out to determine the significance and effect size of the changes reported. Additional descriptive quantitative analysis took place by determining the frequency of responses to closed questions. Content analysis, both conventional and directed, was used to analyse qualitative data. These procedures allowed for themes to be extracted from the data sets by working through a process of coding, categorising, and comparing (Cohen et al., 2013). This data analysis is described in Section 4.4.

1.6 Contributions

This thesis makes intellectual and practical contributions to the areas of 21C learning, 21C skills, and non-formal education. These contributions are described below.

1.6.1 The Design of a 21C Skills Programme (C1)

Chapter 3 describes the design of the Bridge to College programme and how it aims to help students exercise and develop the various 21C skills discussed in the literature review. It is an approach that addresses many of the concerns highlighted in literature regarding approaches to 21C learning and offers guidance for implementing 21C approaches effectively in both formal and non-formal settings. The key features of the programme are discussed along with detailed discussion of the various activities that make up the programme and how they promote the development of 21C skills.

1.6.2 An Effective Programme for 21C Skills Development (C2)

The data presented in Section 5.1 show that the structured implementation of the Bridge21 pedagogical model employed in this design of the Bridge to College programme is effective in

promoting 21C skills development among the participating students. The data presented in Section 5.1.1. demonstrate that the programme has a significant positive impact on students' confidence in the six 21C skill areas assessed, with large effect sizes in each case. This research also provides a detailed analysis of how and why the Bridge to College approach impacts students' confidence across a range of 21C skills. Section 5.1.3 presents an analysis of when and how various skills are exercised throughout the programme and qualitative data presented in Section 5.1.2 include students discussing what, and how, they learned during their participation in the programme.

1.6.3 Long-term Impact of a Non-Formal Educational Intervention (C3)

This contribution builds upon C1 and C2 in demonstrating that the 21C skills developed among the participating students remain present, and continue to benefit the students, as they progress through secondary school and into third level education. In Section 6.1, data collected in the two years after completing the programme show the students reporting on the ways in which they gained from participating in the Bridge to College programme. This included, among other things, improved skill levels. In Section 6.2, students between four and seven years out from Bridge to College describe their memories of the programme and the impact it had on them, including as they left school and progressed to third level education.

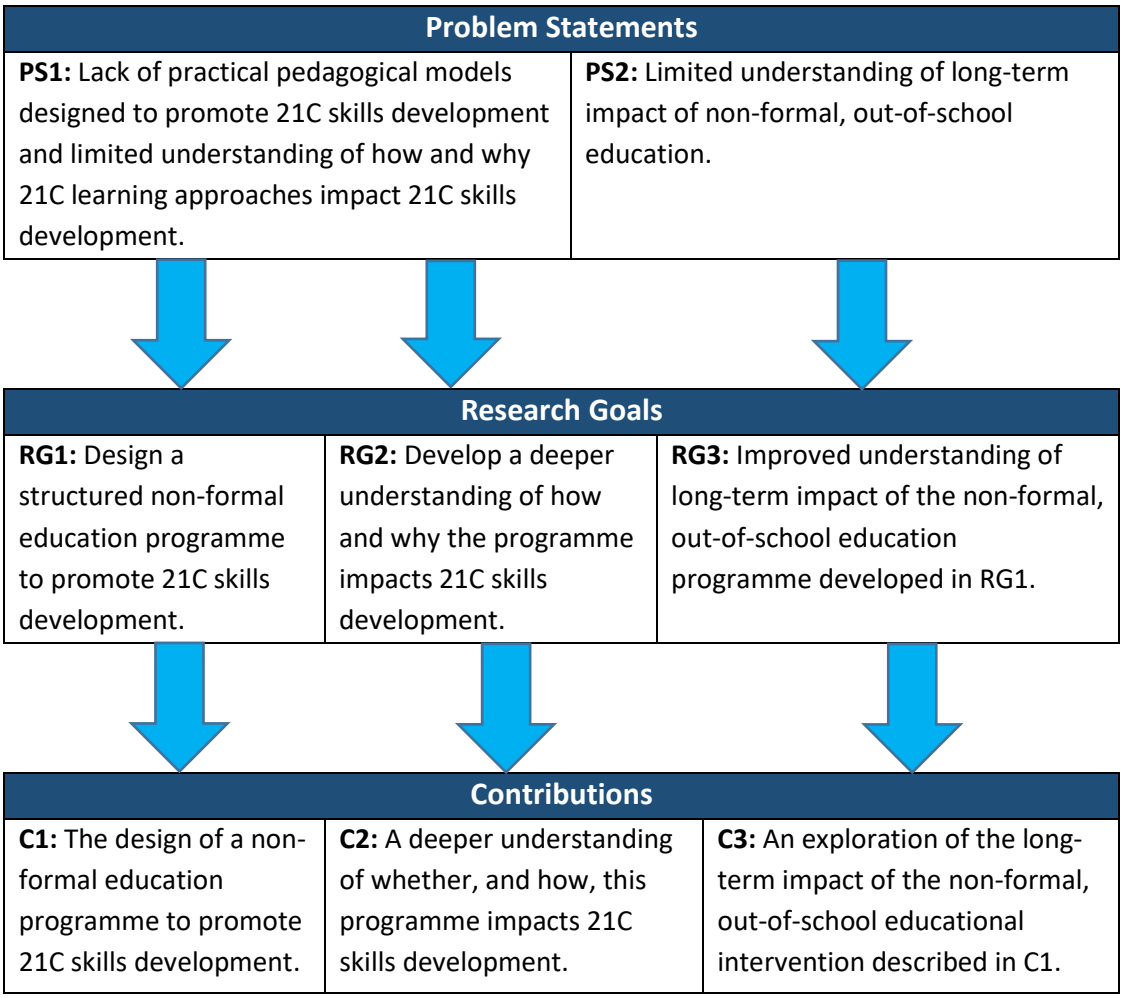


Table 3: Alignment of Problem Statements, Research Aims & Contributions

1.7 Positionality & Reflexivity

A research study such as this is an inherently personal process and one's own background, position, and biases are always present in each decision or piece of analysis. For this reason, a researcher must engage in a reflexive, self-reflective process about the research process and their role within it (Corbin & Strauss, 2008; Morrison, 2007).

The researcher came to this study as a facilitator on the Bridge to College programme. A background in software development, and an interest in education, led to volunteering as a mentor on Bridge to College, and ultimately to taking on the role of lead facilitator. It was clear that students enjoyed their time on the programme but a desire to understand how and why the programme was effective, and what impact, both immediate and long term, participation in the programme had on the students led to this study.

The researcher believes broadly in a subjective social reality, seeing the world as personally created with limited space for objective truth (Cohen et al., 2013). From an epistemological perspective, this subjectivity is tempered by a pragmatic belief that an understanding of a complex social phenomenon can best be gained by using both qualitative and quantitative data sources. This pragmatic outlook impacts many stages of the research process, particularly around setting questions, choosing research methods, and drawing conclusions. These are discussed further in Section 4.1 - Methodological Rationale.

As lead facilitator on the Bridge to College programme, the researcher worked to ensure a positive experience for all participating students. This positive position, and a belief in the effectiveness of the programme, had to be set aside to act as an impartial researcher. Steps were taken at both data collection and analysis stages to minimise this bias and to ensure an objective interpretation, but it must be acknowledged that such bias cannot be eliminated entirely.

1.8 Structure of the thesis

This chapter contains an introduction to the research discussed in the next six chapters.

Chapter 2, Literature Review, provides an overview of literature relating to 21C skills and 21C learning to give a broad background to this research. Literature on non-formal education and assessment of its impact, both immediate and long-term is also presented.

Chapter 3, Design of the Bridge to College Programme, describes the re-design of an existing programme, Bridge to College. The programme was re-developed with a structure and content focused on helping students develop 21C skills and confidence.

Chapter 4, Methodology, describes the methodological issues and approaches employed. A case-study method was deemed appropriate for this study. Data collection, analysis, and related ethical considerations are also presented in this chapter.

Chapter 5, Analysis & Findings 1 – Workshop Data, contains data and analysis related to RQ1. This includes qualitative and quantitative data on skills development and a structured analysis of the design of the Bridge to College programme. These data were collected in questionnaires before (Time 1), and immediately after (Time 2), each Core week of the programme, before and after each Return week (Times 3 & 4), and in group interviews at the end of one week of the programme (Time 4).

Chapter 6, Analysis & Findings 2 – Longitudinal Data, contains data and analysis related to RQ2. This includes qualitative and quantitative data on students' skills development, their experience since completing the programme, and where relevant, experiences of transition to third level education. These data were collected one year (Time 5), two years (Time 6), and between four and seven years after completing the programme (Time 7). These data were collected via questionnaires at each time point and via additional group interviews with the Time 7 cohort.

Chapter 7, Discussion and Conclusions, summarises the findings, draws conclusions, and contextualises them considering the literature, and describes the key contributions of this thesis to the field. It reviews the research aims and discusses the degree to which they were met, highlighting the limitations of this study, and considering which future work is needed.

2 Literature Review

2.1 Introduction

This literature review aims to initially describe and then synthesise the broad areas of 21C skills, 21C learning and non-formal education. The purpose of this review is to outline the field of research, to contribute to the formation of the research questions, to situate this research within the relevant contexts and to inform the discussion of findings and conclusions (Boote & Beile, 2005). This review employed a concept-centric approach in which the selection of key concepts determined the structure of the review (Levy & Ellis, 2006; Webster & Watson, 2002). The key concepts explored were 21C skills, 21C learning and non-formal education.

Section 2.3 introduces the concept of 21C skills, including definitions of these skills and explorations of their increased relevance in modern society.

21C learning is defined in Section 2.4 as the set of pedagogical approaches designed to develop 21C skills. Three key elements of 21C learning, each of which are frequently proposed as an effective approach to 21C skills development, are explored in detail. These are:

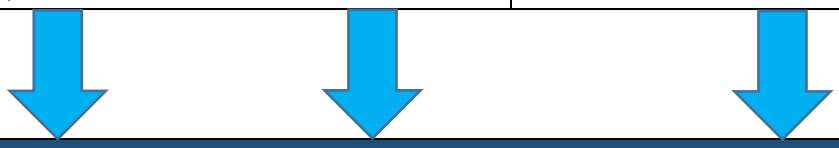
- Collaborative learning – Section 2.4.1
- Technology-mediated learning – Section 2.4.2
- Project-based learning – Section 2.4.3

The use (or relative lack thereof) of 21C learning in formal education is discussed (Section 2.4.4) and assessment of 21C skills and 21C learning is also examined (Section 2.4.5). The drawbacks/criticism of 21C learning as found in the relevant literature are highlighted in Section 2.4.6.

Section 2.5 discusses non-formal education and focuses on defining the concept (Section 2.5.2) and exploring the potential strengths as well as opportunities it offers. These include 21C skills development in out-of-school settings. Section 2.5.3 looks at assessment and evaluation in NFE, with an emphasis on effectiveness, and Section 2.5.4 follows this by reviewing literature on the long-term impact of NFE interventions.

By both defining 21C skills and exploring the environments in which they are proving most relevant, this literature review offers concrete context for the research problems and brings the research goals into sharper focus.

Problem Statements	
PS1: Lack of practical pedagogical models designed to promote 21C skills development and limited understanding of how and why 21C learning approaches impact 21C skills development.	**PS2:** Limited understanding of the long-term impact of non-formal, out-of-school education.



Research Goals		
RG1: Design a structured non-formal education programme to promote 21C skills development.	**RG2:** Develop a deeper understanding of how and why that programme impacts 21C skills development.	**RG3:** Improved understanding of the long-term impact of the non-formal, out-of-school education programme developed in RG1.

Table 4: Problem Statements and Research Goals

To address these research goals, the topics to be reviewed were 21C skills, 21C learning, and non-formal education. Section 2.2 contains a description of how this literature search was carried out.

2.2 The Literature Search

The topics to be explored in this review were 21C skills, 21C learning, and non-formal education. To identify relevant literature on these topics, several approaches were used. The literature search was primarily carried out using electronic search engines (e.g., Google Scholar) and databases relevant to the field of education (e.g., JSTOR). It is acknowledged best practice to use more than one search engine/database and to use synonyms for the main search terms (Petticrew & Roberts, 2008).

Typical synonyms used included:

- Secondary School – second-level, high school, post primary.
- Collaboration – teams, teamwork, groups, group work.
- Technology – Tech, computers, ICT, ICTs.

An initial review of abstracts allowed for a filtering of articles, books, and theses, and established a set of relevant literature. Literature was generally excluded if the students in question were outside the target demographic (e.g., young primary school students or adult professionals) but literature on 21C learning or 21C skills in both formal and non-formal education settings was

included as both contexts are relevant to this research. Brief summary documents were created for the most relevant literature. The structure of these documents was based on 'Proxy Documents' generated in software packages that can be used to manage the literature review process. The template used here was developed by Jake Byrne (2014) as part of the CAWriter package. A sample of these 'proxy docs' is shown in Table 5. These documents allowed for quick recall or a recap of literature already included in the review.

Having established a core set of literature, a "snowballing" approach was used which involved using the bibliographies in this literature to find additional relevant references (Petticrew & Roberts, 2008). The review of each topic or area followed the same general process, but as these are related areas, the search in one area occasionally yielded literature relevant to another. A literature review document was then compiled containing summaries or key points from each piece of literature, written in the researchers own words and including full references to the literature. These paragraphs became the first building blocks of the literature review.

The literature review was an iterative process with no definitive stopping point. As it developed, additional relevant references were included to address points in the discussion but, in general, the concept of theoretical saturation was relied upon. Theoretical saturation refers to the point where the addition of further references or articles does not add any new perspectives or points of view (Petticrew & Roberts, 2008). This review certainly does not include every article or policy document available within these broad fields as this would be unfeasible given the limitations of this study. In addition, to do so would not necessarily provide any more meaningful insight into the current research and thinking in these areas.

Title:	Using project-based learning to teach 21st century skills: Findings from a statewide initiative
Author(s):	Ravitz, J., Hixson, N., English, M., & Mergendoller, J.
Year:	2012
Publication Type:	
Domain/Area:	21C Skills
Number Citations: from Google Scholar	
References:	
Abstract:	This sought to determine the effect of project-based learning (PBL) professional development and implementation on teachers' perceived ability to teach and assess 21st century skills. At the end of the 2010--2011 school year, data on teaching practices and perceptions were systematically gathered and compared from two groups of teachers matched by demographics, grade and subject: teachers expected to have utilized PBL after extended professional development (44) and teachers who had not received the professional development or were not expected to have used PBL (42). Teachers who used PBL and received extensive professional development reported more teaching and assessment of 21st century skills overall, with similar patterns seen within subjects and for nearly all of the measured skills.
Aim:	Does increased CPD to lead to lead improved 21C teaching?
Methodology:	
Participants/Sample details and numbers:	
Context:	Teachers, year 4 - 11.
Data Collection:	Teacher survey, PD group and non-PD group
Data Analysis:	
Findings and Conclusion:	More CPD -> better 21C Learning

Table 5: Literature Summary - Proxy Doc

2.3 21C Skills

The phrase “21C skills” refers to a broadly agreed upon set of skills that are believed to be more relevant in 21C life than they may have been in the past (Fullan & Langworthy, 2014). These typically include collaboration, communication, critical thinking, creativity, self-direction, and technology skills. An ability to quickly find, filter, and analyse various data, to collaborate in processing or generating content, and to communicate effectively with small or large groups of people, is becoming more relevant in the modern workplace. More people are working in teams with mixed areas of expertise, and using ever-evolving information and communication technologies to communicate, collaborate, and create (Dede, 2010). In this dissertation, “21C skills” is used as a convenient shorthand for this set of skills.

Luna Scott (2015) identifies a growing international need to recognise the changing requirements for graduates in the modern world. She lists reasons for this, including globalisation, technological advances, and emerging or declining markets. In a range of employer surveys, skills such as communication, organisation/planning, decision-making, team working, confidence/autonomy, and numeracy were listed most frequently as being in demand (Souto-Otero et al., 2013).

The obvious flaw with the “21C skills” label is that most of these skills were already essential prior to the 21st century. Indeed, several of the emerging pedagogical approaches, which aim to support the development of these skills, are based on the works of Vygotsky, Montessori, Piaget, and others. However, the consequent impact of emerging digital technologies on how we work and learn has led to these skills becoming increasingly important in our knowledge-rich society (Stanley & McCoshen, 2012).

2.3.1 Defining 21C Skills

There is no universally agreed upon definition of 21C skills but there are several skills present in almost every definition or discussion of the area. These include traditional academic skills, modern technological skills, collaboration and communication skills, problem-solving and creativity skills, and self-direction and critical thinking skills (Dede, 2010; Fullan & Langworthy, 2014; Voogt & Roblin, 2012).

Binkley et al (2012) use four skills categories - Ways of Thinking, Ways of Working, Tools for Working, and Living in the World – and describe 10 skill areas. For example, Ways of Working includes communication skills and collaboration skills while Ways of Thinking includes creativity

and innovation skills, critical thinking skills, and learning to learn. Ananiadou & Claro (2009) use two dimensions - Information and Communication – to create a 21C skills framework. Each dimension has several sub-dimensions, and some skills appear within both.

Luna Scott (2015) mentions various frameworks for 21C skills including the alliteration-heavy four Cs, three Rs, another three Rs, and three Ps. She highlights inquiry, design, and collaborative learning for effective instruction as key features of the various models. Luna Scott categorises the various elements of these approaches using the Four Pillars of Education outlined by Delors (1996). These are:

1. Learning to Know: Core subjects.
2. Learning to Do: 21C Skills.
3. Learning to Be: Social and Personal Skills.
4. Learning to Live Together: Collaboration, partnership and understanding, both local and global.

Within this literature review, several meta-analyses of 21C skills frameworks identified skills such as communication, creativity, collaboration, and working/learning with technology as being fundamentally important. Voogt and Roblin compared eight different frameworks for 21C skills. They found that some key ideas appear in all definitions, with another set appearing in most frameworks. There are variations in focus but a general agreement on many key ideas. They found that 21C skills are generally characterised as transversal (i.e., not subject-specific), multidimensional (i.e., knowledge, skills, and attitudes) and include skills and abilities required to cope with complex, unpredictable problems (Voogt & Roblin, 2012).

Dede (2010) and Salas Pilco (2013) also found that the various frameworks were largely consistent, with slight variations in focus for each one. Salas Pilco compared 10 skills frameworks for 21C competencies published from 1997 to 2010. She used ‘competencies’ to refer to knowledge, skills, and attitudes. In the various models presented by Salas Pilco, some salient points stand out. Communication and collaboration skills were mentioned in all 10 models listed. These skills are central to these models of 21C skills. This is reflective of the requirements of working and learning in an information-rich, connected society. Critical thinking, creativity and innovation skills, and information processing were present in some earlier models but were listed more frequently in models published from 2007 onwards. Voogt and Roblin (2012) identified skills which appear in ‘all

frameworks', including communication, collaboration, and ICT literacy, and those which appeared in 'most frameworks', including creativity and critical thinking. The Salsa-Pilco review showed that self-direction skills were absent from some earlier models of 21C skills but were more frequently mentioned in later models as their value and relevance became more widely recognised. Some more recent frameworks have mentioned ideas around inclusion and diversity (Luna Scott, 2015). Risk-taking, managing conflict, and entrepreneurship are among the skills that appeared in one framework only. These are perhaps more advanced, or specialised, aspects of the broader skill sets described in most models.

In Ireland, reform of secondary school education has included the development of two skills frameworks, one each for the Junior and Senior "cycles". The Junior Cycle and Senior Cycle "key skills" frameworks (Table 6) are generally in line with the developments described here. Communication and collaboration skills are, of course, present in both. The increased importance (or recognition) of information processing is reflected in the inclusion of Managing Information and Thinking (Junior Cycle) and Information Processing (Senior Cycle). The Junior Cycle framework also includes a focus on personal wellbeing. These frameworks do not include specific headings on digital literacy but this is integrated throughout the categories listed (National Council for Curriculum and Assessment, 2014, 2017).

Junior Cycle Key Skills	**Senior Cycle Key Skills**
Working with Others	Working with Others
Communicating	Communicating
Being Creative	Critical and Creative Thinking
Managing Information and Thinking	Information Processing
Managing Myself	Being Personally Effective
Staying Well	

Table 6: Junior Cycle & Senior Cycle Key Skills

A clear pattern emerges throughout these various models and reviews. No two definitions of 21C skills are identical but most have a lot in common. There are some differences in how skills are grouped and categorised, but the fundamental ideas are largely consistent. Another framework, presented by Ravitz, Hixson, English & Mergendoller (2012), includes definitions of what some commonly included 21C skills look like in practice.

Ravitz et al created a categorised list of activities that relate to various 21C skills, including:

- Collaboration Skills
- Communication Skills
- Creativity and Innovation Skills
- Critical Thinking Skills
- Learning with Technology
- Self-Direction Skills

For example, under communication Skills, activities such as “Prepare and deliver an oral presentation to the teacher or others” and “Answer questions in front of an audience”, are included (Ravitz et al., 2012). This list of skills is aligned with the skills that are mentioned most frequently in other frameworks, as highlighted by Salas Pilco and Voogt and Roblin, and is consistent with the various other 21C skills frameworks discussed here. The subskills provide clear examples of each skill in practice and allow for a reliable count of how often a skill is used. Dede (2010) identified a possible “reverse Tower of Babel” problem around 21C skills, in which people use the same words and phrases to mean different things. The clear, practical nature of the Ravitz framework should help avoid such a problem.

In choosing an appropriate skills framework for this research, two criteria were followed. Firstly, whichever skills framework was chosen for use in this research must include the skills most frequently referenced across the various models described in this section. This framework would be used to analyse the design of the programme and to help determine the skill levels of the participating students. To this end, the second criterion was that the framework must provide a clear definition of each skill set and include the various actions or activities that constitute each one. The Ravitz skills framework met both criteria and, for this reason, was used during this research as a tool to analyse how frequently the listed skills were exercised during the programme and to assess students’ confidence in each of the six 21C skills highlighted.

In this section, a clear consensus emerges around many of the skills that should be considered as part of a 21C skills model. These skills are increasingly important and popular, both in professional and educational domains, but are not themselves new. However, these skills do have an increased value for personal and collective success in the modern world. For that reason, modern education systems must teach these skills intentionally and well (Rotherham & Willingham, 2010). The set of

pedagogical approaches designed to address these 21C skills can be broadly referred to as "21C learning".

2.4 21C Learning

Mayer (2010) describes learning as "a long-lasting change in the learner's knowledge attributable to the learner's experience" (p. 183). This section focuses on 21C learning as a means for providing experiences for learners that may lead to a change in their knowledge, which in turn may be long-lasting.

"21C learning" refers to a set of pedagogical approaches that are designed to promote the development of 21 skills (P21, 2018). There is a growing body of literature highlighting the need to develop and implement pedagogical approaches aimed at helping students develop 21C skills within formal education. These skills can be learned alongside traditional content knowledge. Skills and content are not separate or unrelated and 21C skills should be developed in the context of challenging and relevant content.

A "21C learning" curriculum should address both (Claxton, 2014; Fullan & Langworthy, 2014). 21C learning within formal education is well established in a small number of countries e.g. Finland, (Sahlberg, 2011) and New Zealand, (Parsons et al., 2015) but remains largely underdeveloped in most others (Ananiadou & Claro, 2009; Duke, Halvorsen, Strachan, Kim, & Konstantopoulos, 2018; Fullan & Langworthy, 2014; Joynes, Rossignoli, & Amonoo-Kuofi, 2019; Kalantzis & Cope, 2012; Murchan, 2018; Rotherham & Willingham, 2010). The success of this approach has not spread from one country to another. This is partly because some of the conditions (political, social, and economic) that allowed this approach to flourish in, for example, Finland, are specific to the Finnish context. Another factor is that teachers in one system are not necessarily convinced that an approach that is successful in a different context, or a different country, will be effective in their classrooms (Murchan, 2018; Sahlberg, 2011). In most countries, the development and promotion of effective approaches to 21C learning is a work in progress. In the Irish education system, while there has been an increased focus on "Key Skills" at second level since 2014, mostly in the lower three years of secondary school, i.e., Junior Cycle, aged 12 -16 (National Council for Curriculum and Assessment, 2014), this has had a limited impact on every day classroom practice (Murchan, 2018).

Literature on 21C learning often focuses on active, social constructivist pedagogies involving collaboration and problem-solving (Vygotsky, 1980). A fundamental principle of 21C learning is that students will develop 21C skills by exercising them throughout the learning experience. The 21C skills described in section 2.3 are often prominent in 21C learning models. The creation of artefacts, physical or digital, through project-based and/or technology-mediated approaches is another recurring theme (Ananiadou & Claro, 2009; Beetham & Sharpe, 2013; Conole, Dyke, Oliver, & Seale, 2004; Kalantzis & Cope, 2012). Fullan and Langworthy (2014) state that where new pedagogies are emerging in classrooms across the world, they are typically social constructivist in nature, with teachers and students working in partnership, engaging in active learning, solving contextually relevant problems, and using digital technology.

De Corte (2010) provides an historical overview of popular theories of education, from behaviourism and cognitive psychology to social constructivism and adaptive competence. He quotes Resnick (1989) in stating that constructivism is an approach based on the ideas that learning occurs "not by recording information but by interpreting it" (p. 2). Constructivist approaches emphasise the process through which the students work over the product they produce. This allows for focus to be placed on the skills the students use as they work and learn, as opposed to a sole focus on a terminal assessment of their knowledge. Social constructivism extends this idea by including a zone of proximal development, which is the difference between what a student can achieve alone and what they can achieve with the help of a more able other (Vygotsky, 1980). Social constructivist approaches typically involve students working together to complete a project or to solve a particular problem. De Corte also highlights adaptive competence as a relevant measure of a student's learning i.e., an ability to apply knowledge and skills "flexibly and creatively in different situations" (p. 45). This is beyond a simple recall of facts or procedures and is a logical outcome from a successful constructivist learning experience. The use of social constructivist pedagogies is a logical and practical choice in addressing 21C skills development as they involve more frequent use of these skills than would be asked of a student in a traditional, teacher-led classroom.

Fullan and Langworthy (2014) list building trusted relationships as a key aspect of the role of both students and teachers. They describe it as a mutual endeavour and state that, for teachers, "it involves paying attention to the well-being of the student beyond immediate cognitive achievements" (p. 15). An investment of time and energy in developing student-teacher

relationships, and student-peer relationships, is an important step in introducing, and employing, 21C learning approaches.

They also describe the early, middle, and advanced stages of 21C learning under four categories: pedagogy, tasks and assessment, tech use by students, and tech use by teachers. Under the umbrella of pedagogy, they lay out a scale from Teacher Control (early stage), through Partnership (intermediate stage) to Learner Autonomy (advanced stage). Under Tech Use by Student, Content Consumption is the early-stage marker with Tools to Create New Knowledge posited as an intermediate level, and Means to Do Real Things in the World as the advanced.

It is not necessarily wise for a teacher, or student, to jump straight to the advanced level of 21C learning without building through the lower levels and developing the skills and experience to work effectively with increased autonomy. The provision of appropriate scaffolding and support as students develop the skills to operate at these more advanced levels is an important consideration in implementing a 21C learning approach.

There are a wide range of approaches to 21C learning, each with their own features and focus. To develop 21C skills effectively, a curriculum, formal or otherwise, should include a blend of these approaches and more direct forms of instruction (Trilling & Fadel, 2009). This should include a culture that values participation, with students given regular opportunities to create, develop, refine, and present their ideas and artefacts.

Collaborative learning and project-based learning are fundamental elements of a social constructivist pedagogy. Technology-mediated learning is a logical modern extension of these ideas with computing resources utilised to support these collaborative and project-based principles. These three ideas have featured in most or all of the 21C models described in this review. The following sections (2.4.1 – 2.4.3) explore them in more detail.

2.4.1 Collaborative learning

Teamwork is a prominent feature in most models of 21C learning and the benefits of collaborating to work or learn are well established. Collaborative learning is typical of social constructivist approaches to learning as students working in teams can help and support each other's learning and serve as more able others (Vygotsky, 1980).

Slavin (2010) suggests that the benefits of teamwork may be due to two broad reasons:

1) Motivational reasons, i.e., We must all work together so I can do well.
2) Social Interdependence theory, i.e., I like my group and want us all to do well.

Stahl et al. (2006) describe how students learn through collaboration. They argue that students learn by expressing their questions, pursuing lines of inquiry together, teaching each other, and seeing how others are learning.

Roschelle and Teasley (1995) describe collaboration as…

> *"a process by which individuals negotiate and share meanings relevant to the problem-solving task at hand … a coordinated, synchronous activity that is the result of a continued attempt to construct and maintain a shared conception of a problem." (p. 70)*

Collaboration requires mutual engagement, discussion, and shared decision making. It naturally elicits verbal communication and has been shown to improve student motivation. Collaboration doesn't automatically happen when individuals sit together. It is something they must choose to do and make continued effort towards throughout the process (Roschelle & Teasley, 1995).

Collaboration and cooperation are different processes. Collaboration involves a shared or joint problem in which the learners have, or must create and maintain, a shared understanding of their goals, of the current state of the problem, of the available steps towards solving the problem, and of how these three elements relate to one another. Cooperation is an arrangement in which students work as individuals and combine their outputs but it does not necessarily involve a shared process of creation (Roschelle & Teasley, 1995; Stahl et al., 2006).

There are myriad methods and models for collaborative learning, each with their own features and focuses. Slavin (2010) describes two categories of approach towards collaborative learning: Structured Team Learning and Informal Group Learning Methods.

1) Structured Team Learning: This involves team rewards based on the individual progress of each member. It is designed to encourage team members to help one another but does not involve collaboration or shared products. The focus is on positive outcomes but not on how the students work together. It is assumed that, if it is in their interest to do so, students will collaborate effectively.
2) Informal Group Learning Methods: These include methods focusing on the social dynamics within the group, project-based work, and discussion. Mastery of specific pre-defined content is not always a priority with these approaches. It is perhaps intended that, once students have learned to collaborate effectively, they can use these skills to learn curriculum content in this way.

Many approaches to collaborative learning focus on the initial setup as being key to successful collaboration. The Learning Together approach of Johnson and Johnson (1990) emphasises team-building activities before students tackle the body of their work together, and includes regular reflective discussions within teams about their progress and how they are collaborating. Essi Vuopala (2010) found that successful collaborative learning requires a group that want to learn together. If students are not motivated to work together from the start, it is harder to adjust this outlook mid-project. Several other sources emphasise the importance of training students to work effectively in teams as an important step in any collaborative learning process (Blatchford, Galton, Kutnick, & Baines, 2005; Galton, Steward, Hargreaves, Page, & Pell, 2009; Katzenbach, 2005).

Vuopala also highlights the importance of a structured approach in helping students undertake project work successfully. Structured, scaffolded project work was found to be helpful in allowing students to work together effectively. Unscaffolded project work was more difficult for groups to take on. Judging the correct level of scaffolding for a project will depend on the particular group in question and the content being covered, among other factors. It can be more of an art than a science but, if a group is new to collaborative learning, it is reasonable to assume they will need more support than a group who have built up their collaboration skills through several project cycles.

Other pitfalls to be avoided in collaborative learning include a lack of shared understanding of the tasks, large team size, and poor communication within the team. Team selection is also important and is worth careful consideration. A random selection is unlikely to be the optimal combination of skills and needs among the group (Vuopala, 2010).

Sharan and Sharan (1992) describe Group Investigation, which includes group presentations as a key feature. The presentation serves as a "hard" deadline for project work to be completed by and adds a layer of authenticity to the students' work. To create something and present it to one's peers is a different task to creating the same artefact for assessment by a teacher. The fact that the artefact, and the presentation, are produced by the team gives a clear, shared focus to their work. Shared presentations can also serve as a reflective exercise, allowing the facilitator to discuss the project work with the team, and consequently allowing students to build up their presentation skills as part of a team, rather than having to present alone.

Shared objects or devices can be a practical strategy to help scaffold collaboration and encourage effective learning. Whether low-tech devices such as whiteboards or paper, or high-tech devices such as laptops or tablets, shared access to such objects is a useful scaffold for collaborative learning. In the case of shared computers, this has been shown to more effective than a one device per student strategy (Chih-Cheng, Hsin-Jung, & Hsiao, 2011).

Collaborative learning, when implemented with appropriate scaffolding and preparation, can be an effective approach to teaching both skills and content. Access to technology can support this process, either through shared access to documents and information, or shared use of devices. With this in mind, the next section looks at technology-mediated learning i.e., how can modern technology support the way we want our students to learn.

2.4.2 Technology-mediated learning

Alavi and Leidner (2001) define technology-mediated learning as:

> *"…an environment in which the learner's interactions with learning materials, peers, and/or instructors are mediated through advanced information technologies." (p. 2)*

Technology-mediated 21C learning can allow learners to access information and construct knowledge. 21C learning is sometimes categorised as learning supported and enabled by the use

of modern ICT. This usually involves an integrated approach to skills, technology, and learning. Fullan and Langworthy (2014) describe a quickly changing world, often rich with modern technology, and suggest that education must make the best use of these technologies to prepare students to take their place in modern society. They list examples of both "basic" tech use, e.g., finding information online, editing a document, and "high level" tech use, e.g., analysing information or the creation of multimedia presentations.

The use of technology in education has become increasingly popular but, while modern technology can allow for exciting innovations in teaching and learning, the use of technology does not automatically lead to an improved learning experience. Careful consideration must be given to the desired learning outcomes before choosing appropriate technological tools and pedagogical strategies. Mayer (2010) describes two approaches to learning with technology: technology-centred and learner-centred. A technology-centred approach starts by asking what the technology can do and then trying to build a learning experience around the technology. A learner-centred approach starts by asking what the students need to learn or what educators want them to experience, and then finding or adapting technologies to meet those needs. Conole et al. (2004) highlight the importance of links between educational theory and practice. They favour a learner-centred approach and argue that choices of technology for use in education, and educational design decisions in general, should be based on an understanding of desired learning aims and have a relevant theoretical background. Picking up a new gadget and trying to integrate it into teaching practice in whatever way possible is unlikely to be a recipe for successful learning outcomes for students.

Technology can be used to help meet a wide range of educational aims. Gagné (1977), for example, has identified five categories of learning outcomes: intellectual skills, motor skills, verbal information, cognitive strategy, and attitude. Choosing technologies and approaches should be a second step, after having first identified desired learning outcomes.

Mayer highlights three mechanisms by which learning and teaching occur. The first two, "information acquisition" and "response strengthening" involve a relatively passive experience for the learner, and one that is easy to replicate using technology (Mayer, 2010, p. 185). The third mechanism, "knowledge construction" involves a more active engagement for the learner and a different role for the teacher and the technology. The teacher acts as a facilitator or "cognitive

guide" and technology is used to scaffold the students work and provide what Papert called "objects to think with" (Papert, 1993).

In practice, technology has most often been used to provide information to learners and sometimes to assess simple responses from learners (Alavi & Leidner, 2001; Jenson, Taylor, & Fisher, 2010; McGarr, 2009). This may reduce the workload of the teacher, but the technology doesn't fundamentally change the students' experience. The role of the learner is to pay attention, store information, and provide information on request, tasks for which computers are ideal. The members of the team that designed the technology, or created the software, may have had the most meaningful learning experience of all the stakeholders in this process.

The use of technology primarily as a tool to present and share information remains common today. This is often simply substituting the role of the teacher or the textbook but not using the technology to add any value to the learners' experience. As Stahl et al (2006) point out:

> *"…it is simply not true that the posting of content, such as slides, texts or videos, makes for compelling instruction." (p. 2)*

Other studies support this position, stating that adding new technology to existing pedagogy does little to enhance learning or influence practice (Fullan & Langworthy, 2014).

> *"technology used without powerful teaching strategies (and deep learning tasks) does not get us very far." (p. 30)*

Wang and Chang (2012) argue that technical proficiency is a fundamental part of 21C learning and modern technology must be part of how we learn. They describe e-learning as a step in the right direction but highlight its limitations. E-learning has typically operated in the "information acquisition" and "response strengthening" space. Wang and Chang state that students must get hands on with technology and becomes creators as well as consumers and this is most effective if they can choose their own means of creation/consumption.

Students should be tasked with thinking, problem solving, organising, and making meaning out of the topic they are studying (Jonassen, Peck, & Wilson, 1999). Jonassen et al. argue that students should use technology to create solutions to meaningful problems and to construct knowledge for themselves. They refer to technologies that can be used to encourage higher-order learning, or as

objects to think with, as “Mindtools”. These technologies, when used in this way, can be the cornerstone of a technology-mediated 21C learning experience.

In 21C learning, the development of collaboration skills is often central to the experience. In that case, technology should be employed in a manner that supports this aim. The shared use of technology allows students to communicate more easily in that it gives them objects to manipulate and refer to as they discuss the challenge at hand. This has the added benefit of making peer learning a natural part of the process rather than a disruption (Roschelle & Teasley, 1995). Other studies have shown that shared use of technology can be more effective than a one to one ratio of students and devices (Chih-Cheng et al., 2011; Dickson & Vereen, 1983).

Technology tools for education should be chosen and used, in conjunction with appropriate pedagogical strategies, to meet relevant learning outcomes for students. Technology can be used to add reach or efficiency to a traditional content-delivery pedagogy but can, in a 21C learning approach, be used as an “object to think with” (Jonassen et al., 1999). Introducing new technology to an old pedagogy may represent a missed opportunity. By focusing on desired learning outcomes, consideration of tech tools and relevant pedagogical approaches can help students develop a broad set of skills, not least a confidence and proficiency in working and learning with technology.

A student-centred approach to 21C technology-mediated learning could include students collaborating, using shared access to digital devices, to create meaningful artefacts on their assigned/chosen topic. This would fit naturally with a project-based approach to learning. Accordingly, project-based learning is discussed in the next section.

2.4.3 Project-based learning

Project-based learning (PBL) is a social constructivist approach that involves students working together to make meaning based on their interactions with the world around them. PBL is frequently posited as an effective 21C learning technique. It is a practical method of implementing social constructivist ideas and is widely recommended as an approach to support the development of 21C skills and competencies (Condliffe, 2017; Huberman, Bitter, Anthony, & O'Day, 2014; Pellegrino & Hilton, 2012). A situated learning approach such as this, in which students investigate and solve problems, can be beneficial in that students are more likely to understand and retain a concept or process they helped design, rather than one they simply replicated step by step from a

textbook. This also makes it easier for students to apply knowledge in other contexts. Krajcik and Blumenfeld (2006) propose project-based learning as an antidote to student boredom and to the often superficial learning typical of a rote learning approach. It allows students to learn by doing and by putting ideas into practice. Barron and Darling-Hammond (2010) argue that PBL, if done well, is more effective than traditional teacher-led pedagogical approaches. This requires training for teachers, careful planning of activities, and ongoing guidance and assessment of students. It can have benefits both in terms of academic performance and knowledge retention and across a range of skill areas. Guy Claxton (2014) argues that developing 21C skills should not be an alternative to working on challenging content. Rather, that the point of the exercise should be to work on challenging content and, in the process, develop the necessary skills required to tackle demanding projects.

The importance of social interaction in learning is a significant factor in PBL and the various relationships between students, teachers, and mentors all play a part. A collaborative co-learner relationship allows for the development of a community of learning, working together to build knowledge and acting as the more able another for one another (Vygotsky, 1980). In this context, group brainstorming is an effective technique when projects are undertaken in a collaborative or cooperative fashion.

Guidance and scaffolding are needed by learners as they work. These can include different interactions or interventions by the teacher, guiding questions, project templates, access to relevant resources or peer discussions. Cognitive tools (objects to think with) can be anything from blocks for counting and sorting to a data graph or a piece of video editing software. These can allow students to plan, build, test, share, and critically analyse their work. This can lead to deeper understanding and better retention if students see the value of their work and if appropriate scaffolding is provided as students investigate, plan, and create their projects. Bransford et al (2000) found that mastery of a subject is best supported when educators teach for conceptual understanding rather than learning by rote, and work to develop and support students' intrinsic motivation.

Grant (2002) further highlights elements of successful approaches to project-based learning. In his works he notes that many models for PBL include an introduction phase, designed to set the stage for the project ahead and to increase student motivation. Grant singles out reflection as a key feature of "superior" examples of PBL. Reflection activities can provide an opportunity for

debriefing, discussing, or writing on the students' experience during the project. The beginning and end of a project cycle have an important role to play in the students' experience of, and learning from, their project experience. Barron and Darling-Hammond (2010) describe PBL as one of several forms of inquiry-based learning. Grant too, highlights that a "guiding question" is a frequently used element of PBL.

Project-based learning is a well-researched, practical approach to covering content and developing skills. PBL can incorporate collaborative and technology-mediated learning, and with appropriate setup and introductory work, and time and support for student reflection, can be an effective strategy for 21C learning. Excellent examples of PBL in action can found at PBL Works (PBLWorks, 2020) or High Tech High (HighTechHigh, 2020). In the next section, we will look at 21C skills and 21C learning in formal education.

2.4.4 21C Learning in Formal Education

The challenge of teaching 21C skills intentionally and well, at a system level, is a significant one. Rotherham and Willingham (2010) report that most teachers in America are familiar with 21C learning techniques and believe them to be effective. However, their rate of implementation of these techniques is low.

In Europe, the Lisbon Strategy, published in 2000, aimed to help the EU become a dynamic knowledge-based economy. This was to be achieved through the inclusion of skills and competences as key elements of all levels of formal education (Rodriguez, Warmerdam, & Triomphe, 2010). The aim was to develop knowledge and skills in parallel, with a focus on 21C skills, enabled by widespread access to modern ICT (Fullan & Langworthy, 2014). Various education systems have since responded with reforms or initiatives to adjust or to transform their curricula and pedagogies to incorporate skills development.

Internationally, several reviews of education policy documents have highlighted a widespread recognition of the need to develop 21C skills and competences and the emergence of "new pedagogies" has consequently accelerated, (Cort, 2014; Drew, 2012; Fullan & Langworthy, 2014). However, Voogt & Roblin (2012) highlight a continuing lack of clear-cut definitions of 21C skills and competences, as well as strategies to support and regulate their development, in national curricula.

These reforms have had mixed success in terms of changing practice in classrooms and the emerging "new pedagogies" have often remained at the fringes of formal education. Education systems continue to lag behind as society and modern economies develop and, despite ambitious intentions, continue to treat or assess knowledge as the goal in and of itself as opposed to it being a tool that can be used to solve problems (Luna Scott, 2015; Moyer, 2016; Quinn et al., 2019). There are several reasons for this.

Crowded curricula, high stakes exams, and teacher industrial relations have all presented hurdles to be overcome (Cort, 2014; Dede, 2010). 21C learning approaches can be more difficult to implement in class, often for multiple reasons. Teachers need training and support to make the leap and relinquish the perceived control they enjoy in a whole-group teacher-led session. Teachers must be comfortable with, and encouraged to develop, a wider range of skills and objectives. Fullan and Langworthy highlight several, including…

> *"Helping students to master the learning process; bringing greater visibility to that process; leveraging the power of peer teaching; connecting the learning to students' interests; and continuously analysing and evaluating learning progress and choosing learning strategies based on that analysis…" (p. ii)*

Investment in, and reform of, pre-service teacher training and CPD are necessary steps to support teachers and give them the tools to introduce 21C learning to the classroom in a consistent manner.

The underuse of technology in schools has been another issue. Budgets have traditionally been focused on providing hardware, but without providing ongoing technical support, or the necessary technical or pedagogical training required to get the most from the technology, this expenditure has tended to be ineffective. ICT resources have been locked away in computer rooms and ICT coordinators have carried out maintenance roles rather than "pedagogical leader" roles (Jenson et al., 2010; McGarr, 2009; McGarr & McDonagh, 2013).

In Ireland, where this study was conducted, an ongoing reform of the Junior Cycle (ages 12 – 16) of second level education has been taking place over the past decade. A key principle of this reform agenda has been the promotion of active and collaborative pedagogies that allow for the simultaneous development of both skills and content knowledge (O'Sullivan, Quinn, Irwin, MacGabhann, & King, 2015). In practice, elements of the early reform plans were removed or

reduced, and a more limited process has occurred than was originally described (NCCA, 2011). In reviewing this process, Murchan (2018) highlights that "best international practice" was not necessarily successful in persuading teachers that new approaches would be effective in their context.

In Ireland, and further afield, a misalignment between a skills-based approach to teaching and learning and a content-only (or content-mostly) system of formal assessment is another barrier. In light of this, the next section looks at assessment of 21C skills and 21C learning.

2.4.5 Assessment of 21C Skills & 21C learning

Skills assessment is a complex issue, with challenges including a limited understanding of the skills in question, a lack of rigorous and practical methods of assessment, and an existing culture of traditional, content-focused assessment (Bray, Byrne, & O'Kelly, 2020). The assessment of 21C skills is an area of ongoing development but remains marginal, relative to the content-based assessment systems used in formal education. The development of 21C skills in primary and secondary level schools is becoming more important within education policy and planning in many countries. Successful implementation of these policies is less frequent and effective methods to assess skills development remain largely underdeveloped (Adamson & Darling-Hammond, 2015; Care & Kim, 2018). Despite some innovative approaches to assessment developed by groups associated with UNESCO and the OECD, assessment of 21C skills remains in its infancy, relative to the content-focused assessment used in most formal education systems.

One challenge in this areas is raised by Stahl et al (2006) while discussing Vygotsky's concept of the zone of proximal development. They state that collaborative learning cannot be meaningfully measured solely by means of individual pre- and post-tests. There may be a change in what a student can do alone but this does not fully reflect any change in what that student could do with their team. Stahl et al point out that assessing collaborative learning has the advantage of requiring students to continuously display and discuss their knowledge of the topic. The nature of collaboration requires discussion and the creation of a shared understanding. This requires observation by the teacher.

Technological solutions may help address some of these issues, but these remain in the early stages of development. The OECD's PISA initiative has piloted the use of high tech approaches that can identify different strategies employed in an attempt to solve a problem, in addition to details

like time spent on a problem, or the number of attempts made (Peña-López, 2017). This may be a way marker for future development but is not representative of the current state of skills assessment in formal or non-formal education (Bennett, 2015).

In formal education, the absence of rigorous, practical approaches to assessment of 21C skills is a major hurdle to the adaptation of 21C learning approaches. Rectifying this will include a reduced emphasis on a terminal exam and increased use of classroom-based assessments. Until other solutions become available, strategies for assessing skills development are likely to rely on teacher observation and student self-reporting. The OECD, in their aforementioned 2018 PISA initiative, used self-reporting as the primary method of assessing 21C skills. This limited ability to assess skills development is one clear drawback of 21C learning. The next section discusses other criticisms/drawbacks of these approaches.

2.4.6 Criticism/Drawbacks

For all the potential benefits of 21C learning approaches, there are many reasons why the positive tone frequently seen in the relevant literature is not always reflected by widespread usage in the classroom (Rotherham & Willingham, 2010). There can be significant challenges in employing, and particularly in introducing, 21C learning approaches. There are critics of these approaches to be found in the literature too.

One pitfall to avoid with 21C learning is giving the students too much freedom or too many choices. Providing the correct level of scaffolding for a particular group is a complex task, with unique factors to weigh in each setting, so this is usually a judgement call for the teacher. Equally, over-scaffolding can remove the need for students to be creative, to exercise their skills, or to take ownership of, and feel invested in, their project work. Kirschner et al (2006) state that 'unguided' approaches to teaching are less effective than direct instruction. They argue that the way an expert works is not the same as the way in which a person becomes an expert. Accordingly, the guidance of a teacher that is both an expert in the topic, and in how to teach it, cannot be outdone by discovery learning. They believe that unguided learning is mostly inefficient. The importance of employing 21C learning with appropriate scaffolding is frequently highlighted (De Corte, 2010; Mayer, 2004). Mayer has demonstrated that "pure" discovery is not the most effective approach but that, with appropriate guidance and scaffolding, 21C learning approaches can be more effective than a traditional "chalk and talk" approach.

Another common problem is the use of technology simply as a means of content delivery. Stahl et al (2006) point out that the use of technology in education is sometimes based on the idea that content can be distributed to large numbers of students quickly, easily, and cheaply, and with little or no direct contact between teachers and students. Massive Open Online Courses are an example of this approach but drop-out rates of around 96 percent (Stein & Allione, 2014) suggest there are limits to when and how this approach can be useful. Technology is typically included in descriptions of 21C learning but the use of technology doesn't automatically imply that 21C methods are employed, or that the technology is used effectively (Fullan & Langworthy, 2014; Jenson et al., 2010; Lei, 2010). The choice of an appropriate technology, and how that technology is used, can be key decisions in planning how to meet desired learning outcomes. A technology-centred approach, e.g., "This gadget is great. I must find a way to use it in my classroom", is best avoided.

Another variable in the success, or otherwise, of 21C learning approaches is the teacher's level of comfort, experience, or skill in working and teaching this way. 21C learning approaches have been found to be more popular, and more effective, in the hands of "early adopters" who are motivated to make them a success (Barron & Darling-Hammond, 2010). The same approach, when used by a wider teaching population, may not be so effective. One likely factor in this is that 21C learning is typically more complex than a traditional teacher-led lesson. A teacher adapting to a new approach may experience an initial dip in effectiveness as they, and their students, learn how to operate within a changed structure. They may feel a loss of control over the classroom or feel concerned about the appearance of a classroom that could seem loud, messy, or unstructured to the untrained eye. However, with training, perseverance, and ongoing support, the move to 21C learning can lead to a range of positive outcomes, including improvements in student attendance and fewer disciplinary issues (Blatchford et al., 2005; Pell, Galton, Steward, Page, & Hargreaves, 2007). Any plan to introduce 21C learning into formal classrooms, or other education settings, may require significant investment in training or continuous professional development for the teachers involved (Barron & Darling-Hammond, 2010).

Care and Kim (2018) highlight a lack of reliable approaches to assessment of these skills as an ongoing issue. A system of assessment that is purely summative is also likely to be incompatible with 21C learning approaches (Fullan & Langworthy, 2014). If the feedback or guidance the

students receive is ineffective, this can also leave them struggling to work effectively or failing to process or understand key elements of the learning experience.

Each of these issues represent a significant barrier to the widespread, effective use of 21C learning approaches. However, the development of pragmatic, structured, and rigorously verified models of 21C learning can help avoid or minimise these potential problems. Non-formal education settings may offer an opportunity to develop, explore, and assess these models. This is discussed in the next section.

2.5 Non-Formal Education

Eshach (2007) describes formal, informal, and non-formal learning environments on a spectrum of 'formality' in education, with formal and informal education sitting at opposite ends, and non-formal education sitting in the middle. Non-formal education adds a third option to a previously oversimplified model of formal (in school) or informal (everything else).

2.5.1 Formal V Informal Education

Informal learning is defined as a lifelong process through which every person develops and accumulates knowledge, skills, attitudes, and insights from their daily experiences and exposure to the world around them (Coombs, Prosser, & Ahmed, 1973). It takes place in homes, playgrounds, museums, among peers, and in other settings where a sustained, intentional educational agenda is absent (Bransford et al., 2006). Informal learning is often unintentional learning from the learner's point of view. Formal learning is intentional at all levels.

According to Coombs and Ahmed (1974), formal learning is a structured, graded, and organised education system. It runs from lower primary school through to the upper levels of university. It is generally a full-time pursuit for the learner and is usually sanctioned and/or funded by the state. It is school as most people know it. It is organised and structured and designed as an ongoing learning experience. It is intentional from the learner's perspective and it typically leads to a formal recognition, certification or qualification (Colardyn & Bjornavold, 2004).

2.5.2 What is Non-Formal Education?

Non-formal education (NFE) typically takes places outside of school but is structured and teacher-led. It is usually pre-arranged, and students participate on a voluntary basis. NFE includes a wide range of learning activities that are organised and intentional but outside the formal system (Colardyn & Bjornavold, 2004). It includes educational activities, designed to meet specific learning

goals for a defined cohort of learners, taking place outside the formal education system (Coombs et al., 1973). Eshach (2007) describes NFE as follows:

> *"Non-formal learning occurs in a planned but highly adaptable manner in institutions, organizations, and situations beyond the spheres of formal or informal education. It shares the characteristic of being mediated with formal education, but the motivation for learning may be wholly intrinsic to the learner." (p. 173)*

Non-formal education covers a wide range of approaches. Many of these have been documented and labelled: para-formal learning, popular education, and professional and vocational training, each with their own focus and features. Some exist to replace absent formal education services whereas others are complementary to the formal system (Hoppers, 2006; Yasunaga, 2014). Hoppers describes NFE as often "short-term, problem-oriented training activities serving distinct … learning needs" (p. 23) and often based on the idea that formal education "is missing vital elements in children's or young people's personal development" (p.84).

NFE programmes can have some key advantages over formal education. They can be more flexible than formal systems. They are often more agile and can be early adopters of innovative technologies or ideas. They can be designed to address the context-specific needs of learners and can adapt to emerging needs more quickly than formal education systems can. NFE often serves to fill gaps left in formal education systems (Sharma & Choudhary, 2015; Yasunaga, 2014). When students are engaged in formal education, NFE activities can provide additional development and learning, and can boost engagement and motivation within the formal system (Akinsola & Petersen, 2018; Forneris, Camiré, & Williamson, 2015). On the other hand, Eshach (2007) states that the novelty of out-of-school learning environments can be a source of anxiety among students and that steps should be taken to minimise this where possible.

Mass formal education, free at the point of delivery, is one of the key reasons we live in an information-rich modern society. However, formal education systems are now struggling to keep pace with a rapidly developing world. The means that NFE, as a complementary system and as a test-bed for potential system-wide innovation, is increasingly important (Sharma & Choudhary, 2015). NFE has a significant role to play in providing a balanced, rounded 21C education. This applies to supplementary learning programmes for young students through to adult/life-long

learning. UNESCO has recognised this need since the 1960's (Souto-Otero et al., 2013). NFE represents an obvious opportunity to help young people develop 21C skills and to create approaches to skills development that can be employed in the formal system too.

21C Skills in NFE

There are several studies that point to NFE programmes designed to promote skills development. In a 2013 survey of 245 youth organisations across 40 European countries, it was found that the skills most frequently developed in NFE are: communications skills, collaboration skills, adaptability and flexibility, self-confidence, and intercultural skills (Souto-Otero et al., 2013).

As part of the same study, a survey was made of 1,301 students, from primary school students through to postgraduate students. Participants were asked to rate which skills and attitudes they believed they had gained from their participation in NFE. Communication skills came out as the most highly ranked, with collaboration skills, confidence, creativity, and decision-making all prominent.

Erasmus Plus projects (EU funded) have shown a trend towards youth activities that are employment/skills oriented and which utilise pedagogical approaches aimed at skills development in areas such as self-direction, creativity, and learning with ICT (Wochowska, 2015). Overall, Souto-Otero et al found that, despite the fact that there are seemingly large numbers of NFE programmes in action, there is limited academic documentation on these organisations or the work they do.

Moyer (2016) describes some features of pedagogical approaches that are effective in developing skills in non-formal education. These include:

- integration of skills and knowledge to solve problems
- students as active, autonomous, self-regulated decision-makers
- collaborative construction of knowledge
- meaningful, authentic activities
- continuous formative and authentic assessment within tasks
- an emphasis on reflection and articulation, in order to foster the formation of abstractions and enable tacit knowledge to become explicit.

These ideas are not unique to non-formal education settings. They may, however, be more frequently used or more easily introduced outside of formal systems. To explore this further, the next section looks at the measurement and evaluation of NFE programmes.

2.5.3 Is NFE effective?

One criticism of non-formal education is the effect of the novelty of a short visit to a new location with new people. This has obvious benefits (a fresh start) and disadvantages (nervous students). One question raised in this context is that students may have fun and make new friends, but will they learn anything?

In non-formal education, assessments of learning are typically short-term measures, occurring either at the end of, or very soon after, the programme or visit. Evaluation of NFE is too often aimed at providing feedback to funders rather than building positive outcomes for students. Learning can be oversimplified and seen as a clean linear process but research in neurological- and cognitive- sciences have shown it to be a messy series of complex interactions and feedback loops (Kinsey, 1978). The memories created by this process are webs of overlapping pieces of information including emotions and ideas and people and places. Overall, there is limited literature available on the impact of participation in NFE on skills development in young people.

In NFE, evaluation is often challenging due to problems with the programme structure. Short term funding, turnover in staff, and changes in programme objectives and content are often features of NFE programmes. Wridt (2018) highlights that principles such as respect, benefit, and justice should underpin all research and assessment activities. This includes weighing the possible harms or benefits of programme evaluation, protecting participants confidentiality, and safely obtaining informed consent. These may represent additional challenges for assessment of an NFE programme. Kinsey (1978) suggests that one way to address this is for practitioners to be involved in the evaluation of their own programmes.

Colardyn & Bjornavold (2004) describe five categories of activities aimed at collecting evidence of learning in NFE. These are: examination, student self-declaration, observation, simulation, and evidence extracted from work or action. These can all be externally validated with a view to awarding formal credits for work completed. Examples of these approaches in action include coding of video recordings of students in action, and of recorded interviews immediately post the

activity (Moyer, 2016), as well as assessment of skill levels through student portfolios (Polymeropoulou & Kameas, 2012).

In a structured literature review of computer science outreach activities from 2009 to 2015, Decker (2016) found that just 19% of studies used a mixed methods approach. Quantitative approaches accounted for 61% of studies. The use of a quantitative only approach may limit the participants' voices within these studies and prevent the specific details of their context, or their subjective experience of the programme, being recorded or analysed. Most of these activities (80%) were aimed at students in their mid-teens and sought to increase diversity in one form or another (Decker et al., 2016).

Decker also found that most studies of NFE programmes (92%) did not collect longitudinal data. This is also reflected in several other studies. A 2015 review of out-of-school academic improvement programmes in America found significant short-term benefits for participants in a range of initiatives but had insufficient evidence to reach any long-term conclusions (Knopf et al., 2015). A 2017 review of literature on NFE programme for girls in developing countries found that very few studies carried out longer-term evaluations or sought to understand participants' perceptions of the long-term impacts of their participation (Marcus, Gupta-Archer, Darcy, & Page, 2017). An international review from 2019 found that while there is evidence of the short-term impact of a range of non-formal educational interventions, there are significant gaps in rigorous long-term evaluation data (Simac et al., 2019).

In the study carried out by Souto-Otero et al, students were asked to self-evaluate what they learned from their participation in NFE. There is a clear pattern observable in the data that shows older students (post-secondary) gave higher ratings to their learning from NFE. Students who reported more frequent or more sustained involvement in NFE also reported higher levels of skills development. However, even students with relatively low involvement in NFE still reported moderate gains in skills (Souto-Otero et al., 2013). It should be noted, however, that in parallel studies of both NFE organisations and their participating students, students tended to rate their own skills development more highly than the organisations did.

The assessments described here are, in almost all NFE cases, immediate or short-term measures. Capturing a longer-term view on student learning would be valuable but is often beyond the scope of the programme or the capabilities of the organisation. In the Decker review, just 8% of studies

collected data more than nine months after completion of the programme. It is clear that long-term studies are needed to explore long-term impacts of short-term education activities.

2.5.4 Longitudinal impact

There are very few studies exploring the long-term impact of non-formal education. Their findings suggest that there is reason to believe that this impact can be meaningful and sustained but these are typically small, opportunistic surveys and do not represent a strong evidence base.

A literature search in this area yielded a small number of relevant studies. One phone-based survey of students who had taken part in a series of pre-college enrichment activities showed positive outcomes in terms of choice of college course, preparation for third level and college performance, versus a control group (Mckendall, Simoyi, Chester, & Rye, 2000). A study found that students who took part in an eight-week science/medicine summer camp were likely to go on and pursue further study in this area. It should be noted that these students had a pre-existing interest in this area and applied for the programme on that basis (Helm, Parker, & Russell, 1999). Another study found that students who had taken part in a science summer camp believed that the programme had a strongly positive impact on their academic performance in Biology and the likelihood of them pursuing further study or a career in this area. These students were surveyed between one and seven years later via an optional, postal survey (Markowitz, 2004). A series of studies, carried out in America between 1989 and 1995, examining learning from museum visits and field trips, found that what students learned from their experience only became apparent weeks, months, or years after the event. People recalled non-learning elements such as the food they ate or the people they met, and almost everyone was able to recall at least one thing they learned on a trip in elementary school with most able to list three or more things. Several years later, these short educational experiences were memorable (Falk & Dierking, 1997).

One study, carried out over two years in Israel, found that extra-curricular activities delivered in secondary school had a sustained impact on the attitudes and behaviour of participating students (Shoshani, Steinmetz, & Kanat-Maymon, 2016). This study involved the collection of data at four time points: prior to participation in the programme, immediately at the end of the programme, eight months after completion of the programme, and finally one year after completing the programme. The in-school implementation allowed for the creation and assessment of a matched control group of students who did not participate in the programme. They found that student impact was sustained up to one year after completion of the programme but that this was reduced

over time. The authors of that study speculated that booster sessions may be an effective approach to maintaining the initial programme impact. This study featured a timeframe and structure that allowed the researchers to conclude that extra-curricular programmes can have positive long-term impacts but that, in most cases, these approaches have not been employed in NFE settings.

Each of these studies offer some positive evidence of long-term impact but, given the small number of studies and their methodological limitations, this is clearly an area where further research is required. The challenges to assessment of NFE programmes highlighted by Kinsey (1978), short-term funding, staff turnover and shifting programme objectives, are even bigger problems when looking at long-term assessment. This partly explains why there is such a shortage of longitudinal evaluation of NFE programmes.

Longitudinal studies, particularly where participants self-select to contribute, will contain an inherent bias that cannot be fully controlled for. Attrition within the overall cohort, and its impact on the study, is also something which cannot be accurately controlled for without possibly ignoring differences between those included or not included in the data (Chan, Ou, & Reynolds, 2014; Stacy, 2015). These challenges are present with any longitudinal study but are particularly relevant to informal or non-formal settings where engagements are short-term, and turnover of programme staff may be relatively high.

There is an opportunity, and a need, for rigorous, longitudinal studies, to examine various aspects of NFE programmes including skills development, employment, educational choices and progression, and social impact. A deeper understanding of the long-term impact of NFE programmes, and what factors lead to this impact, could be valuable for both formal and non-formal education sectors.

We have seen in this section that non-formal education refers to a very broad range of activities, groups, and intended outcomes. It covers almost any organised or structured teaching and learning that takes place outside of formal education. NFE programmes can often be flexible and innovative, away from set curricula and terminal exams. They often promote the development of 21C skills and use 21C learning approaches. Assessment of the effectiveness of these programmes can be challenging, and longitudinal impact measures in particular are often very limited or completely absent.

2.6 Conclusion

It is evident from this literature review that there is an ongoing need for effective strategies to teach 21C skills in all areas of education. Non-formal education is a sector that can be complementary to formal systems in providing experiences that schools cannot and can serve as a testbed for ideas and approaches that may ultimately be integrated into formal education.

There is broad agreement on which skills fall under the "21C" banner as well as increasing recognition of their value and relevance in our modern information-rich society. There are many definitions of 21C skills, each with their own emphasis and focus, but there are some central ideas present in most or all of these definitions. The Ravitz framework stands out, not only as it includes the skills most commonly mentioned in other frameworks, but also because it provides a detailed breakdown of the kinds of tasks and actions that make up each skill category. This can be an effective tool in determining how often certain skills are used, and especially in helping to assess students' abilities with each skill set.

The increased recognition for 21C skills has been followed by moves in education to integrate 21C learning approaches at all levels. Progress in this area has been mixed. While some national systems, (Finland, New Zealand) have integrated content delivery and skills development throughout primary and secondary education, this remains largely underdeveloped in most other countries. Reasons for this include crowded curricula, content-focused assessment, and limited training for pre-service or in-service teachers. Others have highlighted that 21C learning approaches can be difficult to implement well, that they can be ineffective if under-scaffolded, and that meaningful assessment of skills development remains a problem to be solved. The development of an approach to 21C learning that could address many of these concerns is a significant part of this research.

In approaching the development of a model of 21C learning, social constructivism provides a well-established theoretical framework within which to operate. Social constructivist approaches to education include many elements that involve the use, and development, of 21C skills. The three pedagogical approaches highlighted above i.e., collaborative learning, project-based learning, and technology-mediated learning, are all social constructivist in nature. In this way, social constructivism is a logical and pragmatic choice of theoretical framework to use in describing and discussing the use of a model for 21C learning. This choice is in keeping with the pragmatic nature

of this study and with the epistemological perspective of the author, as described in the positionality statement in Section 4.1.1.

Non-formal education covers a broad set of education activities that are intentional, organised, and teacher-led but sit outside of the formal system. These programmes often have more flexibility than formal education so can adapt to trends more quickly and can deliver programmes in a shared context with their target students. NFE programmes have been shown to be effective in helping to develop 21C skills in their participating students and can complement, and support development within, the formal education system. One area within NFE that is under-developed is assessment. Assessment is often focused on providing reports to funders and is almost always done on an immediate or short-term basis.

The first goal of the study involves the design of a structured non-formal education programme to effectively promote the development of 21C skills. The Bridge to College programme, as described in Chapter 3 - Design of the Bridge to College Programme, is presented as a candidate model to meet that goal. The programme, and its implementation of the Bridge21 model for 21C learning, are the focus of this study. The Bridge21 model is a practical implementation of many social constructivist pedagogical principals, including collaborative and project-based learning.

Data on the impact of the programme, and how this design contributes to these outcomes, are presented in Chapter 5 - Analysis & Findings 1 – Workshop Data. This chapter addresses the first research question, RQ1.

RQ1	**Is the Bridge to College programme effective in developing 21C skills in participating students?**
RQ1(a)	**Which features of the programme help promote 21C skills development?**

Longer term assessment of the impact of NFE programmes has been identified as a gap in the literature and this represents a significant element of this study. The data collection and analysis around the long-term impact of the Bridge to College programme is discussed in Chapter 4 - Methodology - and these data are presented in Chapter 6 - Analysis & Findings 2 – Longitudinal Data. These sections address the second research question, RQ2.

RQ2	**Are changes in skill levels/attitudes among Bridge to College students sustained over time?**

These questions are answered through the design, implementation, and analysis of Bridge to College programme. The impact of the programme on student skill levels (RQ1) is explored through analysis of questionnaire data collected before and immediately after each week of the programme. These data, in conjunction with a detailed analysis of the programme design, are used to determine which elements of the design can be linked to various skills outcomes (RQ1 [a]). The long-term impact of the programme (RQ2) is explored through analysis of questionnaire and interview data collected at various time points, between one year and seven years following completion of the programme.

The design of the Bridge to College programme is discussed in the next chapter.

3 Design of the Bridge to College Programme

This chapter describes the design of the Bridge to College programme, with reference to the concepts discussed previously in the literature review. Bridge to College employs a particular model of social constructivist 21C learning, namely Bridge21, in an out-of-school non-formal education setting.

Bridge to College is an education programme for second level students. It is run in a custom-designed learning space on the campus of Trinity College Dublin, the University of Dublin. The learning space was designed to support collaborative, project-based learning. Each week, approximately 25 students, from four or five schools, take part in an iteration of the programme. In a typical year, the programme will run for between 12 and 16 weeks, allowing between 200 and 300 students to take part. Since its inception in 2007, 3,250 students have taken part in at least one Bridge to College programme week. This chapter describes a version of the programme, designed by the author, that is focused on the development of 21C skills.

The programme lasts four days and each day the students work in teams of four or five to complete a creative project using technology. The teams complete a full project cycle, from initial ideas and the development of a digital artefact through to presentation and reflection, on each day of the programme. The Bridge21 learning model (Lawlor, 2016) and the Bridge21 activity model (Byrne et al., 2019) were developed in this context prior to this research.

The Bridge to College programme is part of the work of the Centre for Research in Information Technology in Education (CRITE) research group, a collaboration between the School of Education and the School of Computer Science and Statistics in Trinity College Dublin, the author's university. There is substantial and ongoing research exploring various aspects of the Bridge to College programme and the Bridge21 model. There have been several studies carried out, including PhD and M.Sc. dissertations, and journal articles, in these areas. Some of these are described in Appendix 1 – Bridge21 Research.

Section 3.1 describes the programme background in the years before this study began. Section 3.2 introduces the Bridge21 pedagogical model and the Bridge21 activity model. The rest of the chapter describes the design features of the Bridge to College programme, including those present in the early iterations and highlighting the features and content introduced in the programme re-design. Section 3.3 describes the student selection process, the role of the facilitator, the

programme setting, and the content for the Core programme. Section 3.4 describes the use of the Bridge21 activity model during the re-designed programme and describes how six 21C skills are integrated into this programme design. Finally, curriculum-themed Return weeks, a significant feature of the new programme design, are also described.

3.1 Programme Background

In 2007, as part of the university's outreach activities, a non-formal education programme, Bridge to College, was developed for Transition Year students (~15/16 years old). Transition Year is an optional year in Irish second level education during which students focus on non-academic education. This typically includes work experience placements, voluntary community service, and opportunities to learn outside the usual formal curriculum. The students taking part in Bridge to College were from schools that were designated as disadvantaged and linked with the university outreach programme. The programme involved Transition Year students spending four days working together on the university campus with the aim of raising their educational aspirations, working and learning with modern technology, and developing collaboration and project skills.

Between 2007 and 2010, the structured approach to collaborative, project-based learning employed on the programme was developed and codified. The resulting Bridge21 learning model captured the key pedagogical principles that inform the Bridge to College programme (Lawlor et al., 2018). The Bridge21 activity model was developed to help guide the design of Bridge21 learning activities and clarify the project cycle that students work through (Byrne et al., 2019). The Bridge21 learning and activity models are described in Section 3.2, below. From 2009 onwards, work was begun to take the ideas used and the experience gained in delivering the Bridge to College programme, and developing the Bridge21 model, into the formal education system in Ireland. Student workshops were delivered in schools and various teacher professional development activities were piloted (Conneely et al., 2015).

From the early days of the programme, some key ideas were in place. The model of collaboration was adapted from the World Scout Movement (WOSM, 1998) and included teams remaining fixed for the duration of the programme, having a dedicated team space and resources, and teams nominating their own team leader. The shared use of technology by each team became another fundamental element of the programme. Each team of four or five students shared the use of two computers. In this time, the learning space was designed to support this approach to learning, the four day (Tuesday to Friday) structure of the programme emerged, the use of daily team

presentations was established, and rounding off each project with a reflection activity became part of programme (Lawlor, 2016). As these ideas emerged and became fixed, the programme content developed concurrently. Different project ideas were piloted, developed, pursued, or dropped, and student feedback was carefully noted.

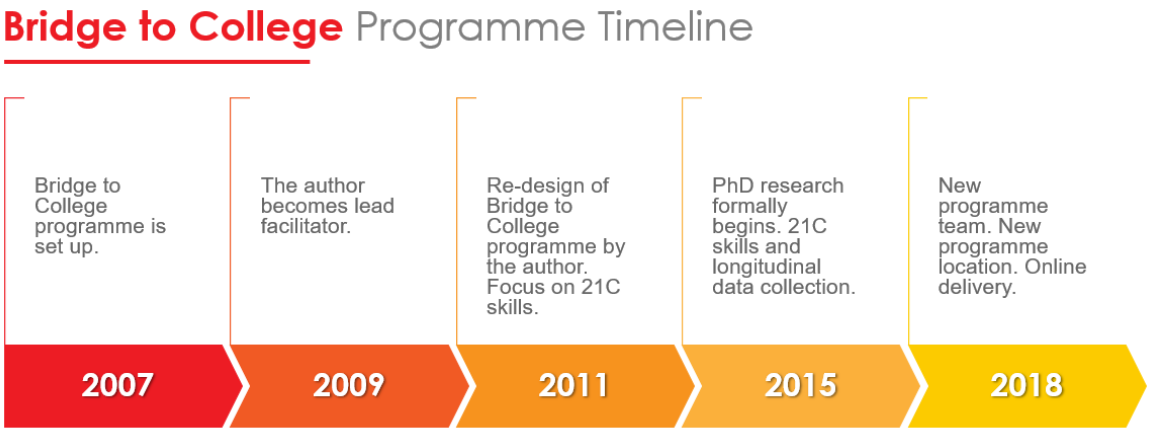


Figure 2: Programme Timeline

Between 2007 and 2011, the research carried out by the programme team suggested that the Bridge21 model was effective in promoting student motivation and encouraging students to be responsible for their own learning (Lawlor, 2016). This research included some evidence that the Bridge21 approach could be effective in promoting skills development. The potential use of the model in other learning contexts was also highlighted and the work of Conneely et al (2015) has grown to include a Postgraduate Certificate in 21st Century Teaching and Learning, delivered in the author's university, and various other professional development offerings including teacher conferences and in-school professional development workshops (Fisher, 2018) – See Appendix 1 – Bridge21 Research.

The author became a lead facilitator of the Bridge to College programme in 2009 and contributed to the ongoing development of the Bridge to College programme, and the growing teacher professional development work, between 2009 and 2011, see Figure 2 above. In 2011, the Bridge to College programme was redesigned by the author, retaining the key ideas established up to that point but with a renewed focus on the development of 21C skills among the participating students. The Bridge to College programme described in this chapter is the product of that re-design and was delivered between 2011 and 2018. This design is intended to meet the first research goal of this study.

Research Goals		
RG1: Design a structured non-formal education programme to promote 21C skills development.	**RG2:** Develop a deeper understanding of how and why that programme impacts 21C skills development.	**RG3:** Improved understanding of the long-term impact of the non-formal, out-of-school education programme developed in RG1.

When this PhD study formally began in 2015, there was initial evidence that the Bridge21 model in general, and this iteration of the Bridge to College programme in particular, were effective in helping students develop 21C skills. However, this data was limited and lacked rigour. At this point, the second and third research goals were devised, and a structured, rigorous, and longitudinal study was undertaken to explore the effectiveness of the Bridge to College programme in this area. The design of this study is described in Chapter 4 - Methodology.

3.1.1 Non-Formal Education & Bridge to College

The Bridge to College programme is a non-formal education programme, featuring many of the typical advantages and disadvantages of NFE programmes, as discussed in Section 2.5 - Non-Formal Education. Eshach (2007) raised several concerns about the limitations of NFE programmes. These include students feeling nervous in a new environment, the facilitator not knowing the students or having the chance to build a trusting relationship with them, and the novelty of a short-term intervention potentially making it difficult to assess whether or not the programme has any real impact on the participating students. These issues are all relevant to the Bridge to College setting and must be considered in the programme design. The steps taken to address these concerns were established in the early design of the programme. They were retained by the author following the re-design of the programme. The NFE setting of the Bridge to College programme is discussed in Appendix 2 – NFE & Bridge to College.

One typical NFE feature that is central to this design of the programme is the frequent use of 21C skills. The programme content designed by the author explicitly sought to include a range of 21C skills and to exercise them in a structured and complementary manner.

In evaluating NFE programmes, including Bridge to College, factors such as turnover of staff, frequently changing programme content, and a lack of ongoing contact with participants are often highlighted as barriers, see Section 2.5.3. For the period of this study - 2011 to 2018 - the Bridge to

College programme addressed these challenges in the following ways. There was a stable programme team, consistent content, and ongoing relationships with partner schools. This allowed the author to include students that had participated in Bridge to College over several years as part of a larger unit of analysis, and to maintain contact with those students after they completed the programme. The research methodologies used in this study are discussed in detail in Chapter 4.

The next section introduces the Bridge21 model for 21C learning.

3.2 Bridge21

As discussed in Section 2.3, there is a growing recognition of the importance of 21C skills in modern society in general, and in education settings in particular. The development and implementation of effective 21C learning has been a growing ambition in both formal and informal education (Fullan & Langworthy, 2014; O'Sullivan et al., 2015). Various features of successful 21C learning have been proposed, or identified, including social constructivist ideas around knowledge construction (Vygotsky, 1980), careful team selection and team formation (Johnson & Johnson, 1990), shared technology resources (Wang & Chang, 2012), and project-based learning with appropriate scaffolding to allow a student-led element into the work (Barron & Darling-Hammond, 2010). Good practice in this area also includes the creative and productive use of technology by students in creating digital artefacts and presenting their work to their peers, the design and configuration of a learning space to support this style of learning, and the use of student reflection to reinforce this learning (Beetham & Sharpe, 2013; Condliffe, 2017; Grant, 2002). Taken in isolation, each of these ideas is sensible and practical. Their use in combination offers potential for a very positive student experience. In addition, the structure of the learning experience must enable students to use and develop their 21C skills without becoming overwhelmed (Fullan & Langworthy, 2014).

The Bridge21 learning model is a practical manifestation of social constructivist, 21C learning ideas and incorporates many of the suggested best practice features of 21C skills development in a pragmatic manner. Bridge21 combines collaborative learning, project-based learning, and technology-mediated learning in a structured and organised framework (Dede, 2010; Salas Pilco, 2013).

In describing Bridge21 and how it works, two "models" are referenced. These are:

- The Bridge21 Learning Model: The eight key educational ideas that are used within the Bridge21 approach, e.g., teamwork, project-based learning, and technology-mediated learning (Figure 3).
- The Bridge21 Activity Model: The seven stages of a Bridge21 project cycle from Setup through to Presentation and Reflection activities (Figure 4).

Figure 3: The Bridge21 Learning Model (Lawlor, 2016)

The use of the Bridge21 approach has been shown to promote intrinsic student motivation (Lawlor et al., 2016). This motivation is a key factor in the successful implementation of a student-centred pedagogy in an out-of-school setting.

The Bridge21 activity model comprises seven distinct stages, see Figure 4, each of which requires the students to use certain 21C skills. This structure allows the facilitator to plan for the students' skills development, and to place an emphasis on different skills at different times (Byrne et al., 2019).

Figure 4: Bridge21 Activity Model (Byrne et al., 2019)

The Bridge21 learning model and the Bridge21 activity model are described in the next sections.

3.2.1 The Bridge21 Learning Model

The model comprises eight ideas, each of which supports, or interacts with, the others. It is the view of the author that three of these ideas are central to the Bridge21 learning model: teamwork,

project-based learning, and technology-mediated learning. The remaining five elements are logical extensions of these three key ideas or best practice in their implementation.

Teamwork

Collaborative learning is fundamental to the Bridge21 learning model. It is based on a Vygotskian, social constructivist approach in which students work and learn together. Vygotsky's Zone of Proximal Development suggests that students can achieve more together, learning with and from one another, than they could if working alone (Vygotsky, 1980). This is best achieved with mixed ability teams where students with different skills or different levels of ability can work together and learn from one another.

Project-Based Learning

Project-based learning is a logical approach to the development of 21C skills and is widely recommended in the relevant literature (Condliffe, 2017; Huberman et al., 2014; Pellegrino & Hilton, 2012). Project-based learning has been posited as an engaging experience for students, in contrast to potentially boring or passive teacher-led lessons (Krajcik & Blumenfeld, 2006). Each project should require collaboration within the team and can be designed to emphasise the use of specific 21C skills. The projects should be sufficiently complex to allow for each member of a mixed ability team to find a role and make a meaningful contribution. The project should also be of sufficient scale that a single team member cannot take sole charge and complete it without their team-mates (Byrne et al., 2019).

Technology-Mediated Learning

The Bridge21 learning model involves 'learning with technology', as opposed to learning about technology (Jonassen et al., 1999). Lawlor (2018) describes technology as 'both integral and ancillary' to the Bridge21 approach (p. 6). The use of technology enables and supports this collaborative, project-based approach and allows students to work together to find information and create digital artefacts. The students may develop new technical skills as they work through this process, but those technical skills alone are not the sole aim of the exercise. Bridge21 employs on a learner-centred approach where technology is used to support learning and is adapted to suit what we want to do or learn (Mayer, 2010).

Learning Space

Any learning space should reflect the style of learning intended to take place within it. If using the Bridge21 learning model, or any other approach to collaborative or project-based learning, a traditional classroom layout with all students facing forward is unlikely to be an ideal setting. A flexible space, that allows for both whole group discussion and presentation, and small-team work, is ideal for the Bridge21 approach (Lawlor et al., 2018).

Social Learning Protocols

The Bridge21 learning model uses social constructivist pedagogies and to support this, a social learning environment should be cultivated (Blatchford et al., 2005). Learners should be able to collaborate with their peers (and the facilitator) in an atmosphere of trust and personal responsibility. To help create this environment, a level of social informality, relative to a traditional school classroom, is helpful (Lawlor et al., 2018).

Role of the Facilitator

The role of the facilitator in the Bridge21 learning model is to create and maintain an environment in which students want to work and learn together. They act as guide, supporter, and co-learner (Lawlor et al., 2018). The facilitator oversees the work of the teams and is available to intervene or troubleshoot as needed but respects the integrity of the team and its place as the primary location for learning and support for each student. The team structure allows students to take responsibility for their own learning.

Mastery Goal Orientation

The aim within the Bridge21 approach is to support students to do their best, not to determine which student or which team is the best. Mastery of skills and content knowledge is promoted over a performance-focused outlook, which aims to demonstrate relative superiority within the group (Chiaburu & Marinova, 2005). The challenge for each team - and each individual - is to develop relative to their own ability and experience, rather than that of their peers. The team structure encourages students to help, and sometimes teach, their team-mates, and cooperation between teams is enabled where possible.

Reflection

Student reflection is a vital part of the Bridge21 approach. Students reflect individually or in teams, or both, at the end of the project cycle. Individual reflection serves to develop understanding and to reinforce learning (Kolb, 1985). Team reflection tends to build and strengthen the team and helps them create a cycle of 'plan-do-review' (Trilling & Fadel, 2009). Reflection is recognised as a valuable element of effective project-based learning (Grant, 2002). Scaffolds such as written questionnaires can be a useful aid for student reflection. This approach supports the idea of mastery goal orientation as teams and individuals can reflect on their progress towards or attainment of their unique learning goals (Byrne et al., 2019).

The various elements of the Bridge21 learning model described here interact with and build upon one another to create a cohesive approach that allows students to engage in social constructivist learning. It is a sensible and realistic combination of ideas. The shared use of technology is a logical step when collaborative learning is prioritised. The layout of the learning space should support collaborative and project-based learning. The emphasis on reflection and the use of facilitation rather than didactic teaching are appropriate for a project-based approach to learning. These ideas are implemented in a structured fashion throughout each Bridge21 project cycle. This structure is represented in the Bridge21 activity model, which is described in the next section.

3.2.2 The Bridge21 Activity Model

The Bridge21 activity model describes the key stages of a Bridge21 project cycle. This not a rigid template that must be followed in the same way for each project. Instead, it describes the typical stages of a Bridge21 project and allows for increased emphasis on one stage or other, in whatever way is appropriate for the material to be covered or to focus on the development of particular skills. It was codified by Byrne (2019) and builds on the design thinking process, as developed in the 'd.school' in Stanford University (Banerjee & Gibbs, 2016).

Setup

The setup phase is focused on introductions and initial team formation (Lawlor et al., 2018). This is a vital step in effective collaborative learning (Galton et al., 2009; Johnson & Johnson, 1990). The setup and warmup phases of the Bridge21 activity model are an investment in the development of communication and collaboration skills by setting a tone and creating an environment that students want to experience and contribute to.

Warmup

Warmup activities are short tasks that allow teams to work together on something small and achievable. This serves to help build the team, can be used to introduce a new topic or technique, and they are often quick and engaging. They can also help to establish an environment in which students feel safe to share their ideas and opinions (Byrne et al., 2019).

Investigate

The investigate phase is the preparation for the main project of the day and will vary significantly depending on the nature of that project. This can include discussing or exploring a particular problem or context, divergent thinking exercises, online research on a relevant topic or any exercise, possibly teacher-led, to develop relevant content knowledge among the students (Byrne et al., 2019).

Plan

The planning phase sees the teams getting organised and starting to manage their project. This will typically include establishing a task list, working out a timeline or prioritising tasks, and deciding who among the team will take on which roles. Depending on the level of experience within the team, this process can be left completely to the team or scaffolded to varying degrees (Byrne et al., 2019).

Create

The create phase is where the teams work on their project, complete the various tasks required, and prepare something to present to the group. This can be a single linear process or, if time allows, an iterative process with cycles of review and improvement included (Byrne et al., 2019). In addition to monitoring and facilitating the various teams' work, team leader meetings are used during this phase to get updates from each team, to share information with the teams, and to allow the team leaders to hear from one another. This structure helps teams to take ownership of their project work and feel that they are managing it themselves.

Present

Students present their work to their peers at the end of the project cycle. This can involve introducing whatever they have created, describing the roles played by each member of the team

in completing their work, sharing their project work, and discussing any limitations to the work or possible improvements that could be made with more time or resources. This serves as a hard deadline for their project work (Sharan & Sharan, 1992). The presentations add a layer of authenticity to the project work as the students know they will have to stand up and take ownership of the overall output, and their own role within the team.

Reflect

The final stage of the Bridge21 activity model is reflection. This is often supported with a structured worksheet to be completed by each team or by each student. This could include questions on what the students thought went well within the team, what they learned during the project, or areas where they would like to improve.

3.3 Programme Design

The Bridge to College programme had run for several years before the author became lead facilitator (see Figure 2). The programme design presented here is the work of the author, but it builds upon the earlier iterations of the programme, including the continued use of the Bridge21 model. The aim was to teach 21C skills intentionally and well (Rotherham & Willingham, 2010). The existing structure was adapted, and new content was introduced to promote the use of 21C skills in a structured and organised manner, as described in Section 2.4 - 21C Learning.

There are several frequently cited drawbacks in the use of 21C learning approaches highlighted in the literature review (see Section 2.4.6). These include under-scaffolding, the use of technology simply as a means of content delivery, limited flexibility in school settings due to curriculum and timetable pressures, and limited experience or training for teachers (Barron & Darling-Hammond, 2010; Fullan & Langworthy, 2014; Kirschner et al., 2006). The same lack of experience with social constructivist, 21C learning approaches applies to students. The use of the Bridge21 model and this design of the Bridge to College programme addresses each of these concerns directly.

The Bridge21 approach can be heavily scaffolded to avoid students being left with too many choices and too much to manage on their own. The level of scaffolding required by a group of students for any specific project is a judgement call on the part of the facilitator. This will be based on the students' level of experience or ability in several areas, including the material to be covered, the technology tools to be used, and their experience of project-based learning in

general. Some teams will need more support than others and this approach allows the facilitator to be strategic in where they spend their time.

The Bridge to College facilitator and mentors provide support for students in their teamwork, planning, creation, and presentation of project work. When covering any curriculum material, the investigate phase of the activity model allows for any necessary direct instruction on a given topic. Technology is used as a tool for learning and as an 'object to think with' (Papert, 1993). The out-of-school setting means there are no restrictions such as short class periods or content to be covered to prepare for a written exam. The lead facilitator (the author) has extensive experience of teaching using social constructivist ideas and, while the students typically do not share this prior experience, this is an ideal setting for them to gain their first experience of working and learning in this way. It is clear that the Bridge21 approach, as implemented on the Bridge to College programme, can avoid the major pitfalls related to 21C learning and, if successful, could help prepare students to engage more effectively with social constructivist approaches in formal education.

3.3.1 Student Background

For the years covered by this study - 2011 to 2018 - many of the Bridge to College students (>80%) came from schools that were designated as disadvantaged or linked to the university's access programme. This is the context in which the programme re-design took place but was not a specific feature of the new design. More information on student background and selection is presented in Appendix 3 – Student Background and Selection.

In the re-design of the programme, in order to create a situation where more students were meeting and working with new people, the author decided to increase the number of different schools participating in each Bridge to College week. Rather than groups of 12/13 students from two schools, each week would be made up of students from four or five schools. This meant that the overall group was more diverse and that each team was formed with students who did not know one another. It was the experience of the author that this change would lead to some increased nerves or awkwardness on the first morning of the programme but would ultimately create a more engaging experience for the students.

3.3.2 Core Programme Content

A typical Core programme week is outlined below:

Day One: Icebreakers & Video Editing

On the first morning of the programme, there is a strong emphasis on helping the students get to know one another and to become comfortable in an unfamiliar environment. The day would begin with some ice-breaker activities for the whole group. These are quick games that encouraged the students to speak to one another and work together. This would be followed by an activity where students were asked to anonymously raise any fears or concerns they may have about taking part in the programme. Each student writes any fears on a slip of paper and then places them in a box. These fears are then shared back to the group by the facilitator and discussed, as needed. Meeting new people is often cited as a source of nerves on the first day.

The students are assigned to a team and remain in the same team for the week. The facilitators would not know the students well so there are some general guidelines used to pick teams. Students from the same school are usually separated and gender balanced teams are created where possible. Some changes to the team lists may be made before they are announced based on how the students performed in the ice-breaker games. Strong characters are sometimes separated and students who seem particularly shy or nervous are put with a friend or someone who can provide some support.

A typical project for day one would be for the team to create a short film. They would be assigned a topical theme (First Day of College, Halloween, Christmas, Valentine's Day etc.) and they would create a story, plan out a storyboard, assign roles among the team, film scenes, download images or sounds to add to the film, and edit it all together. This project requires some creativity skills, and communication and collaboration skills are central to the process. The students are not permitted to begin filming until they have created a storyboard. This would usually be done on their large whiteboard. Where possible, there would be an adult mentor on hand to help the team with the filming phase of this project as the students often required encouragement to take part in the filming and to aim beyond the path of least embarrassment.

Learning new technical skills is an important part of the day, and students would often be using multimedia software for the first time. Support from the facilitator and mentor team is important

at this stage to keep all members of the teams engaged and to help them meet their deadline for the day.

Towards the end of the day, each team presents their video to the rest of the group. As a team, they address the whole group and answer some questions from the facilitator. Questions such as "What did each team member do to help complete the project?" or "Would you change anything if you had more time?" encourage each member of the team to speak out but also to think about their role within the team and the quality of their work. For day one, the teams are given these questions in advance and the facilitator structured the presentation by asking the questions.

The day ends with each team completing a team reflection sheet in which they answer questions about how they worked during the day, what went well and where they would like to do better the next day.

Day Two: Multimedia - Future Tech

The second day of the programme begins with at least one team-building activity. Usually, each team has a few minutes to prepare a short "Introduce a team-mate" presentation. Each member of the team introduces one team-mate and tells the group three interesting things about them. This helps the teams get to know more about one another and allows each student to speak out in front of the whole group.

Each team then elects a team leader. The team leaders meet with the facilitator regularly during the day to give updates on their project and to pass information back to their team. The leader remains in position for the rest of the week. The use of team leaders in this way allows the teams to feel increased ownership of their project work and encourages the use of self-direction skills during each team project.

The students are then introduced to open brainstorming using their large whiteboard and every student is given a marker. They are given a topic and encouraged to write down as many ideas as possible in a short period of time. They are encouraged to be creative and told that even a silly idea might inspire someone at the table and become something valuable. Criticism of the ideas is not allowed until after the brainstorming phase is complete, so the focus is on quantity over quality and encouraging everyone to engage with the process. This technique is used as part of the main project for the day but it is usually run once or twice as a warm-up exercise with brainstorm topics such "50 things you could do with an orange" or "50 things you could do with €5 note".

Once each team has come up with a lot of ideas, there is a quick-fire sharing phase where each team in turn gives one idea. Each team continues to take turns until ideas began to become duplicated. During this process, individuals are called out to share one of their team ideas on each turn to ensure everyone takes a chance to speak out publicly.

The main project for the day is to develop a pitch for a future technology product. This begins with each team brainstorming "Inventions for the year 2050". Ideas typically vary from slightly modified versions of existing technology (a mobile phone with a very long-lasting battery) to much more advanced ideas (time travel, teleportation). The challenge for each team is to create a multimedia ad campaign (a TV ad, a radio ad, and a poster) to sell their favourite future invention. This project builds upon the communication, collaboration and creativity skills exercised on day one by requiring each team create several pieces of digital media in a coordinated manner.

The teams are given a Team Role Sheet (Appendix 6 - Team Role Sheet) to help them plan their day and decide which team members would work on which parts of the project. The sheet describes 10-12 roles so each person in the team would sign up to at least two items. This project uses the same software as the first day but there are more tasks to be completed and a higher level of coordination is required among the team. The team leader is encouraged to make sure that each team member understands their role and that each role is covered within the team.

Once again, each team presents their work towards the end of the day. The team are instructed to provide most of the same information as on day one but this time, the facilitator does not lead the presentation by asking questions for the team to answer, meaning that each team must structure their presentation for themselves. The teams complete another team reflection sheet to wrap up the day.

Day Three: Research and Analysis

On the third day of the programme, students undertake a short research project. Each team puts together a survey of their peers under the general heading of "Being a Teenager in Ireland", and analyses the results. This project allows students to increase their use of critical thinking and self-direction skills.

The day begins with a group discussion about different types of questions (open, closed etc.) and which questions are best suited to different scenarios (e.g., to establish facts or to get more information during an interview).

The teams then brainstorm topics that might be included under the theme of the survey. The broad theme allows each team to choose a topic of interest to themselves, and to have a reasonable expectation that their peers could provide meaningful answers to their questions. Typical topics would include: education, social media, health and fitness, music, and relationships. Each team then chooses one topic and creates a one-page survey. This is usually between five and eight closed questions. Students at this level often find writing questions that would yield useful information to be challenging. This is a point where guidance from the mentors is often needed and each team is required to have their questions approved by the facilitator before they proceed to print and administer their survey.

Each team nominates one person to administer the survey to the students in the other teams. In this way, each team could have 20-25 completed surveys. The teams then collate their results, devising their own system to do this. This typically involves making a count of responses to each question using a whiteboard or a spreadsheet. Some teams perform data analysis tasks such as comparing the responses from male or female students. Where appropriate, students are also asked to do some online research on their chosen topic to help them situate and discuss their findings.

The teams present their findings at the end of the day. They put together slides and would often create graphs or charts to show the data they collected. The students are encouraged to critically analyse their data and to present more than just the questions and answers from their surveys. They are encouraged to highlight any unexpected results, any questions that did not yield useful data or any results that lead to further questions. The facilitator asks questions to further challenge each team to think about the questions they used and the data they collected, and sometimes leads group discussions on interesting points that emerge. This team presentation and discussion is a step up from their previous presentations in that they are discussing the quality of their own work and offering, and often defending, their opinions on a range of topics.

Day Four: Presentation and Discussion

The final day of the programme begins with a question and answer session about third level education. An increased understanding of third level education is an intended learning outcome of the Bridge to College programme. Each team writes questions on their whiteboard and the facilitator and mentors answer them based on their own college experience. Education is the main topic for the day, particularly the students' experience of second level education. Each team is

asked to brainstorm “things we like about school” and the facilitator leads a group discussion on this topic. This is followed, often with increased enthusiasm, by another brainstorm and discussion on “things we don’t like about school”.

The task for the day is for each team to prepare a presentation during which they propose changes to the second level education system. Each member of the team proposes one idea and explains why they think it is needed and how it would help. The teams are permitted to create slides to help with the presentation, but the slides should not contain any words. This is to encourage students to focus on what they would say during their presentation rather than preparing detailed slides, and to avoid them copying and pasting blocks of text and simply reading to the group.

During these presentations, the facilitator asks follow-up questions on each idea and invites the rest of the group to ask questions or challenge the speakers. This allows the students to use their communication skills at a level above what was required in their earlier team presentations. The day ends with the students completing questionnaires about their experience during the week. The group then have lunch together in the college dining hall to mark the end of the programme.

3.3.3 Facilitator & Mentors

The Bridge to College programme is led by one facilitator with the help of a team of volunteer mentors. The role of the facilitator is to introduce and scaffold the programme activities, support the students through their project work, and to lead whole group discussions. This model of facilitation is an ongoing feature of the programme and is described in Appendix 4 – Facilitator and Mentors.

In the re-design of the programme, two changes were made to how the mentor team were deployed. More mentors (~3 at a time) were scheduled to take part on the first day of the programme to provide significant support to students as they began the programme. Fewer mentors were needed later in the week and on Return weeks, as students became more confident and comfortable in this setting.

Secondly, former participants of the programme, who had since completed secondary school, were sought to act as mentors on the programme. The direct experience of the programme these mentors possessed proved advantageous, and as some mentors had attended the same schools as the participating students, they were relatable role models.

3.3.4 Third Level Setting / Learning Space

The Bridge to College programme is based in Trinity College Dublin, the University of Dublin. The Bridge to College learning space (Figure 5) includes two adjoining rooms. One room is a flexible learning space with tables and chairs that can be easily reconfigured to allow for teacher-led activities and whole group discussion, or for teams to gather around a table to discuss, plan or reflect together. The second room contains semi-enclosed cubicle spaces, known as pods, where each team can use their computer resources and work on their projects together.

Figure 5: The Bridge to College Learning Space

This space was designed in 2007 when the Bridge to College programme began and was used throughout this study. This space, and the university setting, are ongoing features of the programme and are discussed in more detail in Appendix 5 – Third Level Setting / Learning Space.

3.3.5 Workshop Resources

Away from the high-tech tools, portable whiteboards were introduced as a prominent feature of the re-designed programme. Each team has one large dry-wipe whiteboard, 60cm x 90cm, see Figure 6: Bridge to College Students & Whiteboard below. This allows the team to sit around the board for brainstorming and planning conversations. The boards are also used for storyboarding, creating draft layouts for presentations and infographics, and for artwork as part of daily projects. The use of these boards, rather than pen and paper, allows for quick cleaning or editing. In earlier iterations of the programme, many of these tasks were carried out on A4 sheets of paper, with one team member often doing all the writing. The shared use of the boards, with each team-mate holding a marker, encourages collaboration and helps a team to construct and maintain a shared conception of their work (Roschelle & Teasley, 1995). The ease with which ideas can be removed from the board encourages participation and creativity among the students. This approach is a

helpful scaffold to encourage collaborative learning and avoid the pitfall of unstructured teamwork highlighted in Section 2.4.6.

Figure 6: Bridge to College Students & Whiteboard

There are also pens and pencils, sheets of paper, post-it notes, and some other stationary available to the students as needed throughout the workshops.

3.4 21C Skills

The Bridge to College Core programme is four days in duration. The content for the Core programme, as designed by the author, includes multimedia, research, and communication projects with a focus on developing 21C skills and confidence. Teams undertake a different project each day. In this design of the programme, each project is chosen to include the use of specific 21C skills. These projects are designed to be challenging, with several tasks combining to build towards a shared output or artefact. The initial focus on skills over content means that no specific topics from the second level curriculum are covered during the Core week.

Collaboration skills are used throughout the week and learning with technology is a feature of the main project for each day. The icebreaker activities and video project on day one include a focus on communication skills and team building. The multimedia project on day two builds on this by introducing increased use of creativity and innovation skills. This project includes several deliverables, so an increased level of self-direction skills and planning are required of the teams. The research project on day three builds further upon the skills used earlier in the week and includes a significant focus on critical thinking skills and analysis. The presentation project on day

four requires students to propose, explain and defend an idea of their own. This requires the use of many 21C skills, and this presentation and discussion are the culmination of a gradual build-up in the students' skills and confidence in public speaking. The programme content is outlined in detail in Section 3.3.2 - Core Programme Content.

Each day involves one complete cycle of the Bridge21 activity model. Each stage of the model allows for specific skills to be developed. The use of the activity model throughout the Bridge to College Core programme, and how each stage is used to emphasise specific 21C skills, is described in the next section.

3.4.1 Activity Model / Bridge to College

Setup

On the first morning of Bridge to College, students from several schools come together in an unfamiliar setting, a university campus, and are asked to work together, share ideas, and be creative. It is an exciting and often nervous time. The setup phase of the model involves whole group icebreakers, designed to get students moving around and speaking to one another, and to model and discuss good team behaviour, e.g., listening, sharing, taking turns, and sharing any fears/nerves about the programme ahead of them. This is intended to encourage friendly communication and to prepare the students for effective collaboration once they are assigned to their teams. Once the teams for the week are announced, their first tasks are small and social: learn each other's names, learn something about each other, agree a team name. Helping students to opt in is an important part of the Bridge to College programme. Establishing norms and expectations from the beginning is a crucial step in creating successful teams. Students must be willing and be allowed to offer their opinion (Vuopala, 2010). This encourages students to develop their communication and collaboration skills in an environment that feels safe and supportive. Further team-building activities, focused on aspects of collaboration such as trusting your team-mates, or negotiation and compromise, may take place at the start of days two and three if the facilitator feels the are necessary.

Warmup

Warmup activities on the Bridge to College programme have included open brainstorming exercises, logic puzzles, online games, and mini creative activities, either on computers or with craft materials. Establishing 'active participation' as the accepted norm among a group of

teenagers who do not know one another is not straight-forward and requires careful handling (Roschelle & Teasley, 1995). These warmup activities help establish this and reinforce it at the start of each Bridge to College day. In the programme re-design, the introduction of creativity and innovation skills at this stage added an engaging, collaborative aspect to the day and allowed teams to enjoy quick and early success together. The use of techniques like open brainstorming at this stage was intended to establish an informal but engaged tone, and to introduce them to a technique they would use during their project work later in the day.

Investigate

On the first days of the programme, this may be little more than explaining the project brief to the teams or briefly introducing the software tools that the teams may need to complete their challenge. As the students advance to more challenging projects, establishing content knowledge, or using and building their research or self-direction skills, becomes more important. In the programme re-design, in order to encourage the use of critical thinking and learning with technology skills, the projects introduced on days three and four included a substantial requirement for student-led research in the investigate phase.

Plan

For planning purposes, teams are given a template of team roles (Appendix 6 - Team Role Sheet) for their first projects. This lays out the roles required to complete the project and allows the team to assign names to each task. A shared understanding of the project, and each student's own role within the team, is vital for successful collaboration (Vuopala, 2010). This is a scaffolded introduction to self-direction and teamwork skills. In later projects, the team may be able to generate this task list themselves. The facilitator can offer advice on which tasks to tackle first or leave that to the team to determine themselves. This requires the use of skills including collaboration and critical thinking. Again, more help and support are usually offered at the start of the programme.

Create

The create phase is usually the longest part of the project cycle. The facilitator will monitor each team's progress as they work and intervene as needed or if requested to do so. This will typically involve spending more time with some teams than others but the ability to provide additional support when needed is a strength of this approach. In the programme re-design, in order the

promote self-direction skills and encourage teams to take more ownership of their project work, an increased emphasis was placed on the use of team leader meetings to monitor team progress and to pass information between the facilitator and the students. These meeting take place every 20-30 minutes as the students develop their projects.

Collaboration skills and learning with technology are central to this stage every day. The choice of the main daily project has a significant impact on which other 21C skills may be exercised. Depending on time constraints, the facilitator will help teams review or think critically about their work near the end of this phase and identify improvements or additions. The emphasis is on creating the best project possible in the time available, rather than simply completing the project as quickly as possible. The upcoming presentation is a helpful motivator in this regard.

Present

Before a team presentation, the students are given some time to prepare what they will say. They are given the key points that their presentation must address and allowed a few minutes to decide who will take each point and the order in which they will speak. The facilitator may ask questions to draw further information or insight from the presenting team, or open up a discussion among the wider group, as appropriate. This can be an important intervention to encourage reflective discussion among the students.

In the programme re-design, in order to support the development of students' public speaking skills, these presentations were adapted to gradually increase what was asked of the students on each day and to incrementally reduce the scaffolding provided to them. As the teams work through this process several times, less support is needed as they become more comfortable presenting their project work, reflecting on their role within the team, and sharing their ideas. This allows students to exercise their communication and critical thinking skills.

Reflect

The main focus of the daily reflection exercises is on collaboration skills and how well the teams are working together. The teams discuss and reflect together and complete a "team reflection sheet" (Appendix 7 - Team Reflection Sheet). This requires the use of critical thinking skills and different, more personal communication skills than are needed in the presentation phase. These sheets are reviewed by the lead facilitator each day and this is often followed by a whole group discussion about the day's work and what the students have learned. This serves to highlight and

reinforce the students' learning by encouraging them to think about and articulate their achievements, or the challenges they faced, during the day. These reflection sheets and discussions can also contribute to the final decisions on programme content for the following day. For example, additional time can be spent on team building, on activities to develop certain skills, or to foster trust or inclusion within the teams.

Students will work through this cycle each day, from setup and warmup through to presentation and reflection. There is greater emphasis on certain stages of the model depending on the day of the programme and the content to be covered that day. For example, the setup and warmup phases are given more time and attention in the first days of the programme compared to later in the week as these become less important once the students get to know one another and become comfortable working together.

3.4.2 21C Skills / Programme Design

This Bridge to College programme was designed by the author to allow students to build their 21C skills and confidence in a focused but gradual manner, with reduced levels of scaffolding required as students become more confident and capable (Fullan & Langworthy, 2014; Vuopala, 2010). This section describes how six 21C skills are exercised and developed by students on the redesigned Bridge to College programme. These six skills are not completely unrelated and, in many cases, an activity that helps students to develop one skill will also require the use of other 21C skills in parallel.

Collaboration Skills

Collaboration is fundamental to the Bridge to College programme. Students are assigned to a team and work with that team throughout the week. There are four or five students in each team. Smaller teams may not allow for a range of opinions and abilities within the team and do not allow for any possible absenteeism. Larger teams are harder to establish and to manage in a short time together (Vuopala, 2010). The teams are picked by the facilitator and, as much as possible, they are mixed gender and include a mix of students from different schools (Lawlor et al., 2018).

Teams need to be set up, developed, and encouraged (Katzenbach, 2005). The initial scaffolding on the Bridge to College programme can support the kind of mutual engagement, discussion, and shared decision making described by Roschelle and Teasley (1995). This is then built upon during repeated project cycles. For this reason, Bridge to College teams work together for all four days of

the programme. This gives the students time to get to know one another and work together through several project cycles. The aim is to create the kind of social interdependence described by Slavin (2010), in which students are motivated, at least in part, by the fact that they feel a positive connection with their team and want them all to do well together. They will, to varying degrees, work through the forming, storming, norming, and performing stages of group development (Tuckman & Jensen, 1977).

Each team will appoint one student as team leader. The team leader will act as a coordinator within the team, ensuring each task is covered, and that each team member has a role to play. The degree to which each team and their leader can manage this must be closely monitored, and support is provided, where necessary, by the programme facilitator. Regular team leader meetings are held throughout each day of the programme. These meetings allow information to be passed between the facilitator and the teams, and for certain decisions to be taken together, without interrupting the work of the rest of the group.

The shared use of resources is designed to encourage collaboration with each team. Teams are required to create digital projects together and each team has shared access to two computers and one camera to help them achieve this. The use of large, shared whiteboards (Figure 6 in Section 3.3.5) allows students to collaborate effectively in the create and planning stages of their project work.

Team role sheets (Appendix 6 - Team Role Sheet) provide a useful scaffold that allows to teams assign roles among themselves for each project in a way that ensures each member of the team has a role to play and that nobody is overloaded or excluded. The use of mixed ability teams and the focus on mastery goals (Lawlor et al., 2018) i.e., doing their best rather than being the best, allows students and teams to operate at different levels and to always try to improve or develop a new skill.

As the teams put together their project work, the facilitator can offer feedback on their progress which the team must digest and respond to together. Each day, they prepare a joint presentation of their work.

Team reflection activities encourage students to recognise their use of, and to further develop, their collaboration skills. Teams reflect together at the end of each day. On the first day or two of the programme they complete a team reflection sheet that focuses on the specifics of how they

collaborated during the project, what they did well, and where they would like to improve. This is part of the initial focus on collaboration as a foundational skill.

The approach to teamwork used on the Bridge to College was largely unchanged in the programme re-design. The author observed that the existing model was very effective in helping students develop collaboration skills and that this was an ideal foundation upon which to build the new programme. One change that was introduced was an increase in the frequency of the team leader meetings. These were an existing feature of the programme, intended to encourage teams to take ownership of their work. To further promote the development of self-direction skills, more of the interaction between the facilitator and the teams was carried out through these meetings.

The use of collaboration skills during the Bridge to College Core programme is summarised in Table 7.

Collaboration Skills	
Work in pairs/teams to complete a task together.	All programme activities.
Work with other students to set goals and create a plan for the team.	Planning phase of each project.
Create joint products using contributions from each student.	Daily project work.
Present their group work to the class, teacher, or others.	Team introductions and daily project presentations.
Work as a team to use feedback on group tasks.	Facilitator feedback during create phase.
Give feedback to peers or assess other students' work.	Discussion of other team presentations.

Table 7: Skills Summary - Collaboration

Learning with Technology

On the Bridge to College programme, working and learning with technology takes place every day. Each team has shared access to technology resources. A team of four or five students will have two computers to work with. This is to encourage the collaborative use of the resources, to allow students to share with their team-mates, and learn to from one another (Chih-Cheng et al., 2011). The technology is used as a shared object to think with, allowing students to create digital artefacts to express their ideas (Jonassen et al., 1999).

Each team PC has some standard software for use by the students. Windows Movie Maker and Microsoft Photos are easy to use video editor programmes. Audacity is a sound editor designed for use in education settings. Piktochart is an online tool for creating infographics. Additionally, each team has access to Microsoft Office tools such as Word, Excel, and PowerPoint.

The technology tools chosen for the students are appropriate for the tasks at hand and, usually, allow their basic functionality to be understood quite quickly, while also leaving space for the creation of more advanced or complex artefacts as students develop their expertise. For example, during Bridge to College, students will often use video editing software on day one of the programme. The software should be user-friendly enough to allow each team to put a simple video together on day one, but also allow the teams to explore more advanced features in subsequent projects that contain a video element. In this case, the students do not receive any prior training in the use of the video editing software. For more complex software, a short walk-through or video introduction may be required. The idea is to give students just enough support to get started and to help them explore the possibilities of the application with some 'light touch' guidance (Wu, 2002). In this way, they can develop confidence by working out how to use the software and solve problems without relying on a teacher at every stage.

Following the programme re-design, the use of Google for Education accounts now allows students to use technology to collaborate effectively. Teams can access and create shared documents using Google Docs, Sheets, and Slides, a convenient option if using two computers to complete a project together. Students are also required to use technology to analyse and summarise data and communicate their findings. They use spreadsheets to analyse their data and generate graphs and charts.

In order to encourage the longer-term use of the skills developed on the programme, one design choice was the use of open source, or free to use, software so that students would have the option to continue using those tools, at home or in school, after completing the programme.

The availability of technology allows students to find information or learn for themselves at certain points in the programme. To promote the use learning with technology skills, the new programme includes activities that requires students to find information online, e.g., whether a product idea of theirs already exists or how their research data compares with similar studies carried out elsewhere. This also requires the students to think critically about the online sources they are

using. These changes are learner-centred, and focused on the educational needs of the students rather than the technical capabilities of the computers (Conole et al., 2004).

The use of learning with technology skills during the Bridge to College Core programme is summarised in Table 8.

Learning with Technology	
Select the right technology tools or resources for completing a task.	Research project work – various options for analysis and presentation of findings.
Use technology or the Internet to help students learn things for themselves.	Investigate phase of multimedia (Future Technology), research, and presentation projects.
Use technology to help to share information.	Daily project work – create and presentation.
Use technology to work in a team.	Research and presentation projects – use of shared Docs/Sheets/Slides during investigate and create stages.
Judge how good and useful online resources are.	Investigate phase of multimedia (Future Technology), research, and presentation projects.
Use technology to analyse information.	Research project work – analyse survey findings.

Table 8: Skills Summary – Learning with Technology

Communication Skills

The Bridge to College programme is designed to allow students use their communication skills in various ways throughout each day. The collaborative nature of the programme requires students to work together, to share ideas, to ask questions, to listen to their team-mates, and sometimes to persuade their team-mates to choose a particular idea or strategy. The icebreaker and team-building activities are designed to model good practice in relation to communication skills, requiring students to speak up and to listen to their peers.

In the re-designed Core programme, team presentation and public speaking are a particular focus. This is an area that many students identify as a source of nerves or something they believe they cannot do well. To address this, students make regular presentations throughout the week, within their teams. Student presentations are a feature of good practice in project-based learning (Krajcik & Blumenfeld, 2006; PBLWorks, 2020). The shared presentations reduce the pressure on any one student. One early presentation involves introducing themselves and their team-mates to the rest

of the group. At the end of each day, each team presents their finished project work. On day one, each team stands up together and the facilitator asks each team member one or two questions about their project. The questions are provided in advance and the team are allowed time to prepare their answers.

Typical questions could include:

- What was your role within the team today?
- What did you learn today?
- Would you change anything about your project if you had more time?

On days two and three, the team are instructed to provide most of the same information as on day one but this time, the facilitator does not lead the presentation by asking questions for the team to answer, meaning that each team must structure their presentation for themselves. The facilitator may ask additional follow-up questions, or invite the other students to do so, if appropriate. On the final day of the programme, the team presentation requires students to offer, and sometimes defend, their own opinions and ideas on the topic of the day.

To help students develop a range of digital communication skills, the new programme includes a diverse set of daily projects. Video editing and sound editing were already established Bridge to College activities and remain part of the programme. The creation of infographics and the preparation of presentations slides were introduced to broaden the students' digital communication skills. The use of technology to structure and present data is also required in the students' project work later in the programme. This creative, productive use of technology for learning is widely recommended in literature, see Section 2.4.2.

The use of communication skills during the Bridge to College Core programme is summarised in Table 9.

Communication Skills	
Structure data for use in written products or oral presentations (e.g., creating charts, tables, or graphs).	Research and presentation projects, days three and four.
Communicate your ideas using media other than a written paper (e.g., posters, video, etc.)	Daily project work and presentations.
Prepare and deliver an oral presentation to the teacher or others.	Team introductions and daily project presentations.
Answer questions in front of an audience.	Daily project presentations.
Decide how to present their work.	Daily project presentations.

Table 9: Skills Summary - Communication

Creativity & Innovation Skills

Creativity and innovation skills are exercised regularly during the re-designed Bridge to College programme as students are required to generate and develop ideas and to offer solutions to problems. In the new programme, short activities in the set up and warm up phases are a fun way to use these skills as students are challenged to solve problems together, both in person (e.g., arrange the group by order of birthdays without speaking to one another), or on screen (e.g., help the character navigate the maze).

To develop creativity skills, the use of collaborative, open brainstorming was introduced as part of the re-designed programme. The students use their large whiteboard, and every student is given a marker. A topic is introduced, and students are asked to write down as many ideas as possible in a short period of time. They are encouraged to be creative and are told that even a silly idea might inspire someone at the table and become something valuable. Criticism of the ideas is not allowed until after the brainstorming phase is complete, so the focus is on quantity over quality, and on encouraging everyone to engage with the process. This technique is initially introduced as a fun activity with brainstorm topics such as “50 things you could do with an orange” or “50 things you could do with €5 note”. Once each team has come up with a sizeable number of ideas, there is a quick-fire sharing phase where each team in turn contributes one idea to the whole group. Each team continues to take turns until ideas start to become duplicated. During this process, individuals are called on to share one of their team’s ideas on each turn to ensure everyone takes a chance to speak out publicly. Once teams are familiar with this process, it is used to generate project ideas, to demonstrate prior knowledge on a relevant topic, or to generate questions for research or discussion.

To ensure the use of creativity and innovation skills within the daily project work, the "Future Technology" project is completed on day two and the presentation project in on day four. Both projects allow students to propose new ideas or creative solutions to a problem they have identified. The chance for students to identify a problem to work on, and to generate their own ideas on how to solve it are features of good practice in project-based learning (Fullan & Langworthy, 2014; PBLWorks, 2020).

The use of creativity and innovation skills during the Bridge to College Core programme is summarised in Table 10.

Creativity and Innovation Skills	
Use idea creation techniques such as brainstorming.	Warmup, investigate, and plan stages.
Generate their own ideas about how to solve a problem or answer a question.	Multimedia (Future Technology), research, and presentation project work.
Test out different ideas and work to improve them.	Investigate phase of multimedia (Future Technology), research, and presentation projects.
Invent a solution to a difficult problem.	Multimedia (Future Technology) and presentation project work.
Create something new that can help them express their ideas.	Daily project work.

Table 10: Skills Summary - Creativity & Innovation

Critical Thinking Skills

Bridge to College students are required to exercise their critical thinking skills as they work through their projects, assess the merits of their ideas, make choices about the content and direction of their projects, and reflect on how they worked and what they learned. The planning phase of each project requires students to make decisions that demand critical thinking. The re-design of the programme aimed to create a set of projects that each required the use of these skills. The students choose topics and story ideas for videos, they weigh the pros and cons of their "Future Tech" product ideas, and they must decide which survey questions will generate meaningful responses from their peers.

During the create phase of each project some students will be challenged by the facilitator or mentors to reflect on how their project is going so far. This could happen in a team leader meeting, or while checking in with a team as they work. Identifying and addressing problems, or

opportunities for improvement, can be an area where some encouragement is required. Team and individual reflection activities are another opportunity for students to think critically. Teams are asked to reflect on and discuss their work at the end of each day of the programme. Individual reflection also occurs each day, usually as part of the team presentation. Students are asked to describe the role they played within the team that day, to highlight any new skills they learned or used, and to identify any ways in which they would do things differently if they could repeat the process. Reflection, both during and after a project, is highlighted a feature of best practice in project-based learning, and as a mechanism to encourage critical thinking and reinforce learning among students (Grant, 2002).

In order to focus on critical thinking skills, the research project was included in the new programme design, taking place on day three. Students are typically settled in their teams at this point and can begin to take on more challenging projects. This activity calls for critical thinking as students must try to make meaning from the survey data they have collated and to identify, and possibly explain, any unexpected findings. The presentation project on day four allows students to challenge the ideas proposed by their peers and to discuss the relative merits of competing ideas.

The use of critical thinking skills during the Bridge to College Core programme is summarised in Table 11.

Critical Thinking Skills	
Try to solve problems or answer questions that have no single correct solution or answer.	Research and presentation project work.
Compare information from different sources before completing a task or assignment.	Research project work – compare findings with other sources.
Draw their own ideas based on analysis of numbers, facts, or relevant information.	Research project work – analyse survey findings.
Summarise or create their own interpretation of what they have read or been taught.	Research and presentation projects – create and presentation stages.
Analyse different arguments, perspectives, or solutions to a problem.	Presentation project – presentation and discussion.
Use evidence to develop arguments.	Research and presentation projects – investigate, create and presentation stages.

Table 11: Skills Summary - Critical Thinking

Self-Direction Skills

The Bridge to College programme, relative to their experience in formal education, is an opportunity for students to take ownership of their learning and to make decisions for themselves. The nature of the project work requires students to generate their own ideas, make choices, and create a plan for their work. The style of facilitation, and the support of the mentor team, is intended to help students make these decisions but not to instruct or to provide answers. This was recognised by the author as an ideal approach for the development of 21C skills and built upon in the new programme design.

The team leader system is designed to encourage this student-led approach and to empower teams to plan and discuss their work without relying on instruction from the facilitator at every step. Regular team leader meetings require the leaders to report on and discuss their teams progress with the facilitator and the other team leaders, to share any problems that may have arisen, and to discuss possible solutions. To maximise this impact, the use of team leader meetings was made more frequent in the new programme design.

The investigate phase of each project cycle requires students to find information for themselves to contribute to their projects or to make informed decisions. The plan phase requires students to take responsibility for aspects of their project and to make sure tasks are completed in a timely and organised manner. The shared, and limited, resources require the students to organise their time, schedule which tasks need to be carried out on the computers and, usually, to work in sub-units of two or three students on different elements of the overall project (Lawlor et al., 2018).

The technology tools chosen for the students allow for significant choice in how the students use them. In the new programme design, the tech tools allow their basic functionality to be understood quite quickly, while also leaving space for the creation of more advanced or complex artefacts as students develop their expertise. Students have the opportunity to explore these tools during the create phase of each project and to integrate new techniques or features into their work.

The use of self-direction skills during the Bridge to College Core programme is summarised in Table 12.

Self-Direction Skills	
Take the lead when faced with a difficult problem or question.	Team leaders. Research and presentation projects.
Choose their own topics of learning or questions.	Investigate and plan stages of multimedia (Future Technology), research, and presentation projects.
Plan the steps they will take to accomplish a difficult task.	Daily project work – Plan stage.
Choose for yourself what to study or what to use to help you study.	Research and presentation projects – investigate and plan stages.
Track their own progress and change things if they are not working the way that they should be to complete a task.	Daily project work – Create stage. In-team discussion and/or team leader meetings.
Assess the quality of their work before it is completed.	Daily project work – Create stage.
Use peer, teacher, or expert feedback to change their work.	Daily project work – Create stage, facilitator feedback.

Table 12: Skills Summary – Self-Direction

3.5 Return Weeks

The introduction of Return weeks was a significant feature of programme re-design. In earlier iterations of Bridge to College, various approaches to extending or deepening the students' experience were trialed. This included in-school project days, outdoor activity days, and the use of the learning space as a drop-in centre during school holidays. The new Return weeks followed the same four-day format as the Core week but with new curriculum-based content. These Return weeks were designed to be a step up from the Core programme, on the basis that the students' initial Bridge to College experience had helped them to develop their collaboration and communication skills. As such, this was a chance to undertake the kind of challenging projects recommended by Claxton (2014). Approximately half of the students who had completed the Core programme were invited to take part in a Return week. Each Return week had a different theme, so the programme content changed from week to week. The Return weeks included curriculum content that was new to the students and there was often reduced support from the mentor team when compared with the Core programme. This was an opportunity to reinforce, and build upon, the skills developed on the Core programme, and for students to gain experience of subject areas that may have been of interest to them as options for study in the Senior Cycle of Irish secondary school or in higher education.

The selection of students for Return weeks was initially based on their interest or perceived aptitude for the topic in question. For the computer science weeks, students taking Higher Level Mathematics in school were favoured. Higher level Irish was a requirement for the Irish week and some level of German was needed for the German language programme too. For other weeks, students were asked to express their interest in one Return week or more as part of the Time 2 (end of Core week) questionnaire. Students who had been consistently late, missed days or had serious discipline issues during their Core week would not be invited to take part in another week, although it should be noted that attendance was rarely a problem and discipline issues tended to be very minor. Another significant factor was the students' own availability for a given week. Many students were invited to take part in specific week but were ultimately unable to do so due to conflicting commitments with their transition year programme. This led to any remaining places being offered based on random selection of students who had not yet been offered a Return week.

The content for each Return week focused on one main theme or subject area. Some of the Return weeks were recurring over several years whereas others only took place within a single year of the programme. The choice of topics for Return weeks was often based on the availability of domain experts to assist with the design and delivery of the programme. The CRITE research group played a significant role here. Members of CRITE contributed content to many of the Return weeks and the programme served as a testbed for projects developed within the group. A selection of Return weeks are described in Table 13, below.

Theme	Description
History Week	Students marked the centenary of the 1916 rising in Dublin by reviewing, discussing, and documenting the events of Easter 1916 and the characters involved. Their project work included “live” news broadcasts from key events and the creation of simulated social media posts, from some of the key individuals during the rising.
English / New Literacies	Students explored different styles of language, learned about plot and character, and re-told some of Shakespeare’s works in a modern Dublin setting. A visit to the National Gallery was part of the week and this provided inspiration for some of the students’ storytelling (Kearney, 2018).
Learning Circles	Students discussed and explored different approaches to teaching and learning. Each team was tasked with taking a topic they had not studied before, learning it for themselves, and creating an engaging learning experience on that topic for the rest of the group (Sullivan, Marshall, & Tangney, 2015).
Irish Language	Students spent four days working in, and learning, the Irish language. Project work included videos and podcast recordings in Irish and a live broadcast, by one team, on a local Irish language radio station.
Computer Science	Coding and computing were the focus for these weeks. Students created their first programmes using the Scratch programming language before moving on to text-based coding in Python and working with hardware devices such as Raspberry Pi or Arduino boards. These computer science workshops have developed to become a significant programme of their own, including a female-only stream (CodePlus) and a series of advanced summer tech camps (InvenT) (Byrne et al., 2017; Sullivan, Byrne, Bresnihan, O'Sullivan, & Tangney, 2015; Tangney, Oldham, Conneely, Barrett, & Lawlor, 2009).
German Language	Learning and speaking the German language was the focus for this week. Students created German language media, including podcasts, and created German versions of their favourite TV programmes by adding voiceovers “auf Deutsch”. Each day students could interact, via video chat, with a group of students in Germany who were undertaking similar activities to develop their English language skills (Bauer et al., 2015).
Science Week	Students focused on science experiments, problem solving, and science communication on this programme. Students calculated acceleration due to gravity and created video lab reports, researched antibiotic resistance, created posters on the topic, and prepared “TED talk” presentations on a range of topics.

Table 13: Return Weeks - Themes and Content

3.6 Chapter Summary

This chapter describes the early development of the Bridge to College programme, up to the point where the programme was re-designed to focus on 21C skills. The Bridge21 learning model is introduced and its suitability for use in this study is highlighted, on the basis that it is social constructivist in nature and is a pragmatic choice in allowing students to use and develop their 21C skills in a structured and scaffolded environment. The various elements of the Bridge21 learning model, and the Bridge21 activity model are described, leading to a discussion of the design of the Bridge to College programme. This includes key features such as student selection, the role of the facilitator and supporting mentor team, the third level setting of the programme, and resources used during the programme. Each of these sections clarifies the context in which the programme takes place and provides insight into how the programme is delivered.

The use of the Bridge21 activity model during the programme is outlined, as well as the ways in which each stage of the process is used to promote the use of specific 21C skills by the participating students. Six 21C skills, and how they are integrated into the design of the programme, are discussed in detail. Finally, the Bridge to College Return weeks are described.

The first research goal of this study includes the design of a structured non-formal education programme to promote 21C skills development. The Bridge to College programme, as described in this chapter, is that programme. The collaborative, project-based approach allows students to exercise collaboration and communication skills, to make plans, and to take ownership of their work and their learning, to be creative, and to reflect on where they were successful and where they could do better. It is a practical implementation of social constructivist, 21C learning approaches to help students develop their 21C skills. Chapter 4 contains a description of the research methodology used in this study to determine whether this research goal and the other goals of this study, were met, including details of data collection and analysis.

4 Methodology

The purpose of this chapter is to introduce and explain the methodological approach that was employed in this study. The chapter includes discussion of various methodological considerations relating to how data are interpreted and the epistemological and ontological beliefs and ideas that underpin the research. The selection of an appropriate research paradigm for this study leads into the discussion of research methods (Cohen et al., 2013).

Bassey (1999) defines research as a "systematic, critical and self-critical enquiry which aims to contribute towards the advancement of knowledge and wisdom" (p.38). Research should be ordered and structured. It should be open to scrutiny by others and to reflection and re-evaluation by the researcher. Bassey goes on to state that educational research is "aimed at informing educational judgements and decisions in order to improve educational action." This study meets this description in that it attempts to evaluate and understand the impact of an ongoing education programme.

The Bridge to College programme is an education outreach programme based in the researcher's university. The programme aims to build 21C skills in participating students. A desire to better understand if the programme is effective in developing these skills, how and why this effect is achieved, and whether this impact was sustained over time led to the development of the following hypothesis and research questions:

Hypothesis
The Bridge to College programme is a framework for developing 21C skills that is pragmatic, effective and has a long-lasting impact.

Research Questions	
RQ1: Is the Bridge to College programme effective in developing 21C skills in participating students?	**RQ2:** Are changes in skill levels/attitudes among Bridge to College students sustained over time?
RQ1 (a): Which features of the programme help promote 21C skills development?	

The research methods employed to answer these questions are described in Section 4.2. Research Methods, not to be confused with Research Methodology, is the set of instruments and

techniques used to collect and analyse data. Methodological considerations (Section 4.1) guide and influence the framing of research questions and the choice of methods used to answer them. The data collection (Section 4.3) and data analysis methods (Section 4.4) employed to answer these research questions are also described in this chapter. Ethical considerations, limitations of these methods, and the transferability of findings from this study are also discussed.

4.1 Methodological Rationale

A methodological rationale should underpin the work of a researcher and guide their decision-making throughout a study. This rationale can be based on one or more approaches. Morrison (2007) identifies four broad, and commonly used, approaches in the field of educational research, see Table 14.

Interpretivist	Research is grounded in personal experience. It is acknowledged that the presence of a researcher changes a participant's experience and that their subjective interpretation of events will impact on any findings.
Positivist	Research is seeking objective truths, relying on cause-and-effect relationships and variables that can be controlled.
Critical	The researcher is not a neutral actor within the research but rather their values contribute to actions or interpretations which may lead to some change or development.
Pragmatic	Research focuses on specific situations, actions, and outcomes rather than exploring prior conditions and context. There is a focus on action and finding solutions i.e., "doing whatever works".

Table 14: Research Paradigms - Morrison (2007)

Each of these paradigms has value and is appropriate for use in a range of circumstances. Grogan and Simmons (2007) suggest that a researchers epistemological and ontological beliefs should be reflected in their choice of a research paradigm and related research tools. This will guide decisions such as, for example, whether to use qualitative or quantitative data, or a mixture of both. The positionality and beliefs of the researcher are discussed in the next section.

4.1.1 Positionality

This section describes the positionality of the author, his relevant experience, his beliefs on knowledge and research, and his role within this research. It aims to share the inspiration for this

research, identify any biases that may have influenced it, and connect the researcher's personal beliefs on knowledge and research to the design of this study and the methods chosen to carry it out.

[Note: In section 4.1.1, first person pronouns (I, my) are used.]

Researcher's background

My interest in the topic of this PhD developed as I was, at first, volunteering as a mentor on the Bridge to College programme and then as I took over as lead facilitator. At that point, I had a professional background in software development and an interest in a possible career in education. On a career break from the IT world, I was working as a substitute teacher in primary schools. It was suggested to me that, with my interests in technology and education, I would enjoy volunteering on Bridge to College. And so it proved. This voluntary work led to my taking on the position of lead facilitator.

During these years, the Bridge21 model of collaborative, technology-mediated and project-based learning was developed and codified (Lawlor et al., 2018). As I gained experience in the role, I built on these core ideas and developed the programme structure described in this thesis. It was obvious to me that the participating students enjoyed the programme. They were overwhelmingly positive about the experience. A desire to understand how and why the programme was effective, and what impact, both immediate and long term, participation in the programme had on the students inspired me to undertake this research.

This research, which aimed to evaluate the effectiveness of the approaches used in Bridge to College in terms of skill development, was rooted in an optimistic belief that this programme, and its various elements, would have a positive impact on the participating students. I hypothesised that these approaches were effective in helping students develop 21C skills, at least in the short term. I always aimed to be objective during the research process. However, I must acknowledge that my personal bias may have influenced my approach and/or my interpretation.

Researcher's beliefs on knowledge and research

In defining and describing my assumptions on the nature of reality (and things) and consequently, methods of enquiry, I will use terminology from Burrell and Morgan (1979), as referenced in Cohen et al. (2013).

My beliefs broadly align with subjectivist conceptions of social reality described by Cohen et al (2011, p. 9). On human nature, I take a voluntarism perspective, in which human beings have "free will" and are the "creator" and "controller" of their environment rather than primarily the product of that environment. My view on the nature of reality is a nominalist one, in that thoughts and ideas are "merely words" and there is "no independently accessible thing constituting the meaning of a word" (Cohen et al., 2011, p. 6). This is an anti-positivist view, seeing the social world as "personal and humanly created" and that truth, in the social world, is a subjective concept. The alternative, realist, perspective holds that thoughts and ideas exist independently of "the knower".

My epistemological perspective – my view on how to carry out research on the nature of reality (and things) – also tends towards the subjective but this is not clear-cut. Cohen et al. (2013) state that choosing between the competing views that knowledge is "hard, objective and tangible" or "personal, subjective and unique" will have a profound effect how one carries out research on social behaviour. In this regard, I choose a pragmatic point of view, acknowledging both subjective and objective perspectives, and the need for both qualitative and quantitative measures to gain an understanding of the social world. This is a practical approach and suggests data are collected and analysed as needed to address the research questions in an effective and efficient manner (Cohen et al., 2011, p.23). These beliefs and assumptions impact many stages of the research process, particularly around setting questions, choosing research methods, and drawing conclusions.

My role in the research

Reflexivity is the process through which a researcher considers their position within, and relationship to, their research (Morrison, 2007). This research is situated in an out-of-school education programme which aims to develop student skills and raise their educational aspirations. The ongoing reform of the post-primary education system is a relevant context to consider when positioning this research as is the unequal distribution of university places for social, cultural, and economic reasons. Research such as this is also an inherently personal process with one's own background and point of view always present in each decision and piece of analysis. This is something to be aware of and to manage but it will never be exactly measured or eliminated. A researcher must be self-reflective about the research process for these reasons (Corbin & Strauss, 2008).

As the dissertation details, this research centred on the design and delivery of an education programme for secondary school students. My role was to design the programme and act as lead

facilitator in its delivery. In this role, my aim was for the students to have a positive educational experience and, for this reason, the planning, preparation, recruitment, and delivery of the programme was carried out with this aim in mind. I worked on the basis that I could not guarantee a positive experience for all students but that each decision I took should be a move towards increasing the likelihood of more students experiencing more positive outcomes. In this sense, I had a belief in the value and effectiveness of the programme as it was happening.

This belief in the programme, and enthusiasm as facilitator, had to be set aside as I aimed to be an impartial researcher. This separation was helped by the fact that I was not simultaneously delivering the programme and collecting data. I collected data at the start and end of each programme week and at various points after that, but I did not think I could meaningfully collect data while facilitating the student workshops. While collecting data from students, the importance of honesty and critical feedback was always highlighted and, in analysing the data, measures were put in place to ensure an objective interpretation.

The next section describes the various approaches that were considered for use in this study and explains which approach was chosen, and why.

4.2 Research Methods

The choice of research methods is heavily influenced by the researcher's beliefs on the nature of knowledge and research. Researchers with an interpretivist outlook will typically employ qualitative research methods. They believe that there is no objective reality beyond the meaning brought through human interpretation. Rich detail on the setting for the research must be provided to better understand the social, cultural, and historical context in which the research occurs. Researchers with a positivist outlook will tend to favour quantitative methods. They will focus on what can be counted or measured, and causal relationships (Johnson, Onwuegbuzie, & Turner, 2007).

Researchers who adopt a pragmatic approach often employ mixed methods in their research as it is problem-centred and consequence oriented (Johnson et al., 2007). Mixed methods research refers to studies which include both qualitative and quantitative approaches with the aim of broad understanding and corroboration (Johnson & Onwuegbuzie, 2004; Johnson et al., 2007). One could question how effective a combination of approaches can be when they are based on conflicting epistemological beliefs. However, Hammersley (1992) states that it is generally accepted that

researchers, both qualitative and quantitative, recognise that their findings are constructed and that they do not create this reality themselves. In practice, a carefully designed mixed methods study can allow for different approaches to be favoured in addressing each research aim or research question (Creswell, 2003). Gorard and Taylor (2004) argue that the use of varied methods creates researchers who are better equipped to critically review more kinds of research and, by extension, whose own research is more robust to criticism.

Research methodologies should be chosen to address the specific research goals of the study. As stated previously, the research goals of this study were to:

Research Goals		
RG1: Design a structured non-formal education programme to promote 21C skills development.	**RG2:** Develop a deeper understanding of how and why that programme impacts 21C skills development.	**RG3:** Improve understanding of long-term impact of the non-formal out-of-school education programme developed in RG1.

The overall purpose of this research is to examine the impact of an out-of-school education programme, to explore the design of the programme, and to consider the relationship between the two. The design of Bridge to College is based on the combination of some well-established educational principles and a sense of what is possible or practical with the students who take part in the programme, and with the resources available to deliver the programme. For this reason, the research paradigm utilised in this study is best described as pragmatic (Johnson & Onwuegbuzie, 2004; Morrison, 2007). This pragmatic sense of what is possible rather than what is perfect is reflected in the choices made about data collection in this study including the sources used, the types of data gathered, and the instruments used to collect those data.

The researcher's epistemological perspective in this study was pragmatic and acknowledged the need for both qualitative and quantitative data to build a deep understanding of the complex phenomenon under review, and to address the research goals. This was a practical approach and focused on collecting and analysing data to address the goals of the research as effectively as possible. Quantitative data were used to ascertain whether changes occurred in student confidence and skill levels before and after participation in the programme. Exploring the nature of this change, which elements of the programme contributed to it, and the longer-term impact of

the students' participation required the use of qualitative data, and a more interpretive outlook. For these reasons, this study involved the use of mixed methods.

The research was carried out in what was, in one sense, a controlled or "educational laboratory" setting. Workshops were delivered in a purpose built, out-of-school, learning space. This unique setting is a feature of the programme. The researcher was aware that this context would impact the phenomenon under examination here.

Various methodologies were considered for use in this study. This study involved the examination of a relatively new area, with limited pre-existing data and literature. As discussed in Section 2.4.5, assessment of 21C skills is in its infancy, and Section 2.5.4 highlights a lack of longitudinal research around 21C skills and NFE. For these reasons, several common approaches to educational research could be immediately dismissed. Survey or historical approaches are suitable for examining existing phenomenon but would not be appropriate to address the research aims, or answer the research questions, of this study (Cohen et al., 2013). An *ex post facto* angle was considered. This would have involved comparison between the group of students that took part in the Bridge to College programme and a matched group of students who did not take part. This would have been based on the assumption that these groups began at similar points in terms of background, skill levels, and other experiences, and that any differences present between the groups after the intervention could be attributed to their participation in the programme or some other occurrence (Allen, 2017). The use of a control or comparison group was not in keeping with the epistemological perspective of the author and would not have been feasible due to the likely difficulty in creating, and collecting data from, this matched group.

Having ruled out some common approaches to educational research, three research methodologies were considered as viable options for use in this study. These were:

1. Action Research
2. Design Based Research
3. Case Study

These are described in sections 4.2.1 – 4.2.3.

4.2.1 Action Research

Action Research (AR) aims to understand, improve, and reform practice through an iterative change process. It involves cycles of diagnosis, action, and reflection. The aim is to improve

participants experience and outcomes by bridging the gap between research and practice. There is often a focus on practical issues that have been identified by stakeholders that are both problematic but possible to be changed or addressed (Cohen et al., 2013). Action research can be used to solve problems in a particular setting and then to produce guidelines for best practice in this context (Green, 1999). Some scholars have emphasised different ideas or aspects of action research, including collaboration among practitioners, self-reflective enquiry, and the development of theory (Cohen et al., 2013).

Denscombe (2010) defines the key elements of action research as follows:

- Practical – It develops solutions to specific problems in real-world settings.
- Change – It moves beyond understanding a phenomenon and actively seeks to change it.
- Cyclical – It is iterative. Findings may lead to further changes as part of the process.
- Practitioner – Practitioners are directly involved in the research.

4.2.2 Design-Based Research

Design-Based Research (DBR) is a methodology with several similarities to AR. DBR is designed for educators and aims to increase the impact of educational research and its translation into improved practice. It was first developed in the 1992 and has become popular since 2000 (Anderson & Shattuck, 2012). The idea of a lesson or intervention migrating from an experimental classroom to the mainstream is fundamental to DBR. DBR, like AR, involves an iterative approach to creating lessons. DBR includes collaboration between researchers and practitioners and aims to create design principles that can be applied beyond the specific context in which they were developed (Barab & Squire, 2004).

Anderson and Shattuck (2012) define the key elements of DBR as follows:

- Authentic Context – Set in a real-world context and aiming to solve a problem in that setting, with the possibility of scalability or transfer to other contexts.
- Design and Testing – The design of an intervention is collaborative between researchers and practitioners. It is based on literature and theory but is focused on the local context.
- Mixed Methods – DBR usually involves the use of mixed methods and a range of research techniques, as is deemed appropriate.
- Iterative – There is a process of designing, testing, and refining, and interventions are developed/updated through repeated cycles of implementation and review.

- Collaborative – DBR often involves collaboration between researchers and practitioners, with the researchers typically leading the design process.
- Design Principles – The design of interventions should lead to the development of principles and theories which can be applied elsewhere. These are not necessarily generic solutions for use in all settings but can be utilised where necessary/appropriate.
- Practical Impact - DBR is conducted in a real-world context and generates practical ideas and guidelines.

4.2.3 Case Study

A case study is a practical examination of an identified phenomenon in its real-world context. Case study methodologies are often used to answer "how" or "why" questions about events or activities. It is a useful approach when examining complex situations with many more variables than can be captured in data. The study of a specific instance of a phenomenon often leads to the emergence of more general theories or ideas and help others to understand similar instances elsewhere (Yin, 2014). Mixed methods are often used in case studies, drawing upon multiple lines of evidence. They seek to establish an accurate record of the facts of the situation, draw conclusions and to develop logical explanations of the phenomenon in action (Mills, Durepos, & Wiebe, 2009).

The key elements of a case study are as follows (Bassey, 1999; Creswell, 2003; Yin, 2014):

- Defined – The "case" to be studied is clearly defined.
- Empirical – It is a study of a specific instance of a phenomenon in action, within defined boundaries of time and location.
- Natural Context – The phenomenon is studied in its real-world setting.
- Extensive Data Collection – Data are collected from multiple sources, often both qualitative and quantitative, to allow for a full and reliable description of the case.
- Setting – The study includes a detailed description of the setting of the case.
- Results – Findings are discussed in the context of relevant literature. Conclusions are drawn and general principles extracted and positioned on this basis.

There are many types of case study and many overlapping categories. Stake (1995) distinguishes three categories of case study: intrinsic, instrumental, and collective. In an intrinsic case study, a narrow focus is taken with limited scope for drawing generalisable conclusions afterwards. In an

instrumental case study, a small group of participants may be chosen in order to examine a particular pattern of behaviour. In a collective case study, a wide selection of sources, or multiple cases, are used. This could include different departments, different schools, or a diverse set of individuals. Stake advises that in deciding between intrinsic and instrumental approaches the relative importance of the case or the issue must be considered. If the case is prioritised, an intrinsic approach is appropriate. If the issue is dominant, then it should be an instrumental case study.

Case study designs are frequently described as exploratory, explanatory, descriptive, illustrative, or evaluative (Harrison et al., 2017). An exploratory case study is often a first step. They are used to generate hypotheses, to create and pilot interventions, and to develop research instruments. This is often followed by an explanatory case study. An explanatory case study aims to provide a deeper understanding of the case and to explain how and why certain outcomes occur, or conditions emerge (Yin, 2014). Yin states that case study is a particularly useful approach for programme evaluation. An evaluative case study seeks to evaluate the impact of an intervention or phenomenon. This goes beyond understanding the programme in question and would include, for example, exploring the impact of participating in Bridge to College in contexts beyond the implementation of the intervention. This would also include the judgement of the researcher alongside the findings emerging from the data (Zainal, 2007).

There are advantages and disadvantages to using a case study methodology. The examination of data in their own context is a strength. These data may be more meaningful in their natural setting as opposed to data generated in an artificial/experimental setting. The flexibility offered by intrinsic, instrumental, and collective approaches, and the diversity of data that can be collected using mixed methods mean that case studies can be used effectively in a wide variety of settings. Limitations of case study methodologies include that they can sometimes lack rigour, that it can be difficult to generalise from a single case or a small sample, and that they can be unwieldy in terms of time taken and documentation produced (Tellis, 1997; Zainal, 2007).

4.2.4 Choice of Approach – Evaluative Case Study

There are elements of this study that align well with an action research paradigm, such as the practical approach and practitioner involvement but, in other areas, there is a mismatch. This research does not seek to change the implementation of the Bridge to College programme, and any cyclical process is also absent for this reason. In the early years of Bridge to College, as the

programme was first developed, an action research approach was central to that process (Lawlor, 2016). This research focuses on exploring and evaluating the programme at a stage of relative maturity. For these reasons, an action research approach was not employed in this study.

As with AR, there are elements of this study that align well with DBR. DBR would allow for the use of mixed methods, and for key ideas and principles to be extracted from the design, and successful implementation, of the Bridge to College programme. This study does not, however, include an iterative process or aim to solve a specific problem in a real-world context. It seeks, instead, to evaluate the effectiveness of an existing intervention.

Elements of action research and design-based research aligned well with the aims of the study, particularly the practitioner involvement, the practical nature of the research, and the use of mixed methods. However, in each case, there were clear discrepancies such as the iterative nature of the design process and the intention to change the intervention in question. For these reasons, AR and DBR approaches were ultimately deemed unsuitable. Thus, it is clear that another research method was needed to address the research questions of this study.

An evaluative case study methodology was chosen for this research for both practical and theoretical reasons. This approach, which includes both evaluative and explanatory aspects, allows for a deep description and analysis of the case in question using a variety of data to document the design of the Bridge to College programme, and to explore the students' experience during and after participation. To use Stake's terms, this is an instrumental case study in that it focuses on a group of students experiencing the same phenomenon and seeks to understand the impact of that phenomenon on those students. This methodology allows for the use of both qualitative and quantitative data sources and is a practical choice, in keeping with the pragmatic perspective of the researcher.

The setting for this study allowed the researcher to minimise the typical limitations of case study research mentioned above. The Bridge to College programme is a complex intervention that is best examined in context. There are large numbers of participants each year but their experience is relatively consistent so they can be treated as a single, large case. There is time within the programme structure to collect data as needed, and the opportunity to collect data from students in the years after they complete the programme allows for a longitudinal aspect to the research.

4.2.5 Research Timeline

This research involved the investigation and evaluation of an established educational intervention. The Bridge to College programme had been developed over several years before this research began. From 2007 to 2011, AR and DBR approaches were used by Lawlor (2016) and Conneely (2018) as the design and structure of the programme were developed and the Bridge21 model was codified (Figure 7, below). The author of this study became lead facilitator of the programme in 2009 and contributed to this development process.

In 2011, the programme was re-designed, building on the existing format but with an increased focus on the development of 21C skills. The programme retained a settled structure and team between 2011 and 2018. While this PhD research formally began in 2015, elements of the study were underway from 2011 onwards. Some data collection was carried out throughout this period and research ethics were granted for this work. This study was focused on the Bridge to College programme between the years 2011 and 2018. The status of the programme in this period, and the nature of this research, meant that AR or DBR approaches weren't relevant, and that exploratory-level inquiry was not required.

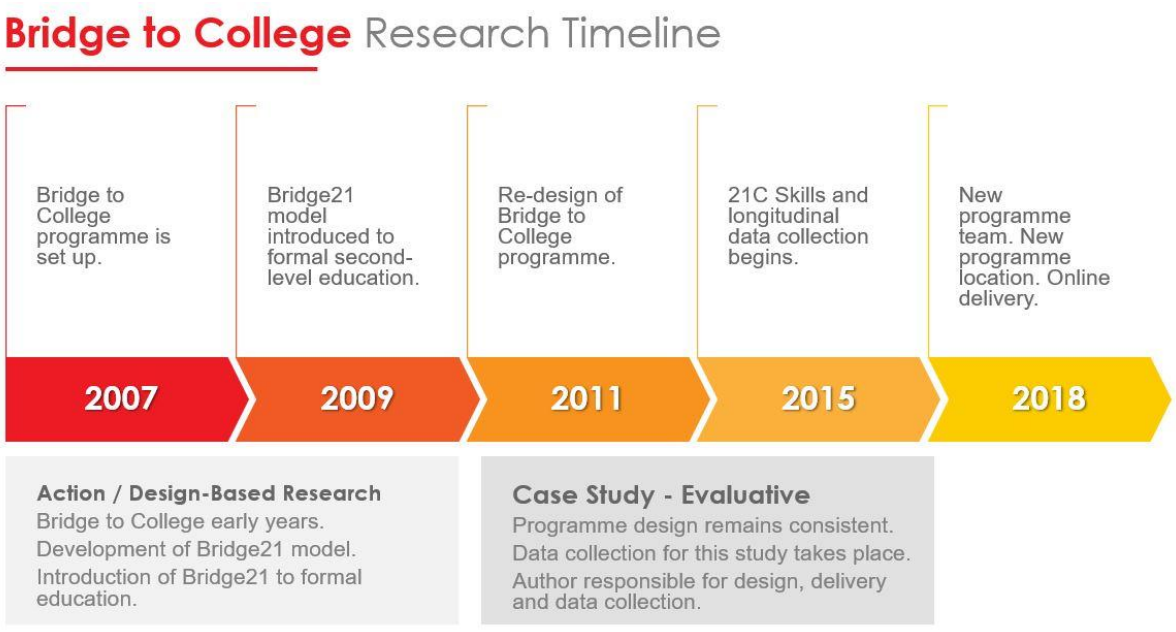


Figure 7: Research Timeline

4.2.6 Research Design

This evaluative case study aimed to understand the impact of the programme on the skill and confidence levels of the participating students, both immediately and longer term, and to examine how the design of the programme produced these outcomes.

The case study is an embedded, single case study. Data were collected during each week of programme delivery across several years, but these data were ultimately treated as one large main unit of analysis (Yin, 2014). The reason for treating these data as a single case is that the collective shared experience of all the participating students is more relevant to this study than the experience of one particular (weekly) programme group, their individual year group, or the experience of students from one particular school or other.

There were occasional changes in the data collected from year to year. There were some survey questions that were asked of every student group, every year, but there were questions that were included in some years but not others. For this reason, some of the data analysed were taken from participating students across all groups but, in other cases, data analysed were taken from smaller representative samples of one, two or three-year groups.

At the beginning of this formal PhD process, there was a data set from previous years of the Bridge to College programme (see Section 1.3.1). These data were collected following the re-design of the programme to focus on 21C skills. Initial analysis of these data suggested that the programme had a positive impact on the 21C skill levels of participating students. This informed the subsequent data collection and analysis that makes up the bulk of this study.

The main Evaluative Case contains three sets of data. These are:

1) Data collected from students during the Bridge to College programme between 2015 and 2018. n = 544.
2) A structured analysis of the design of Bridge to College, with a particular focus on the expected use of various skills during the activities which make up the programme.
3) Data collected from students between one and seven years after their participation in the Bridge to College programme. n = 389.

This is summarised in Figure 8.

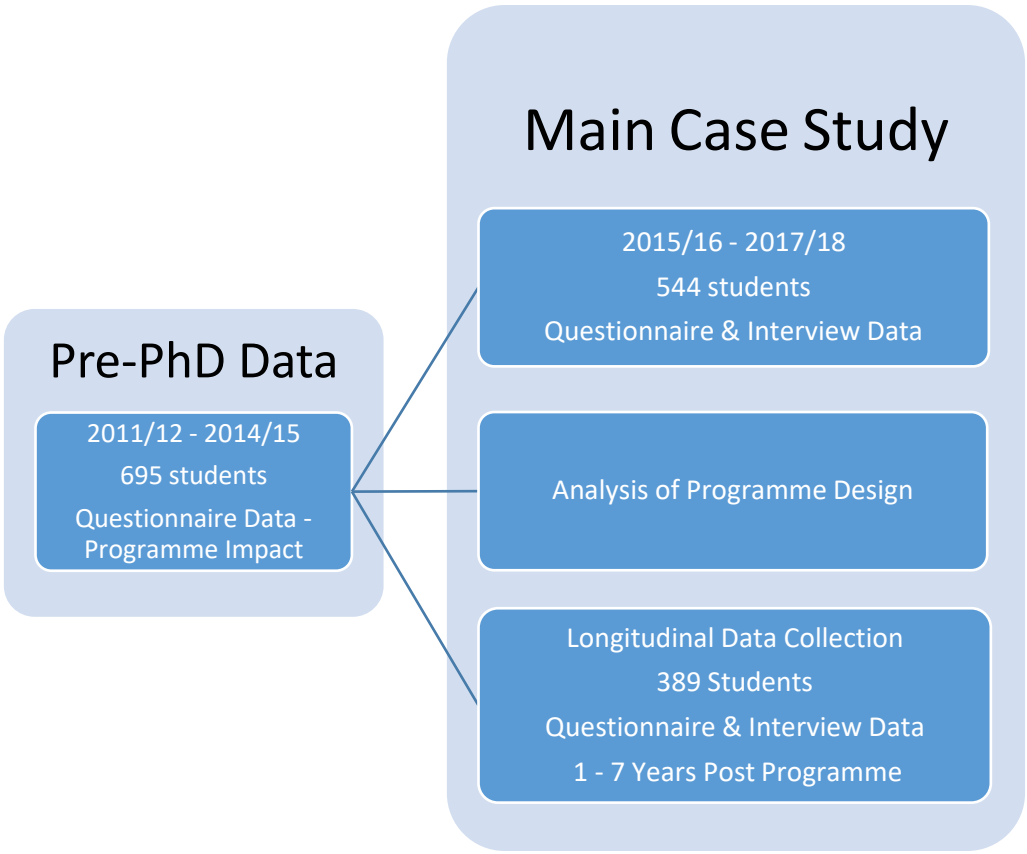


Figure 8: Pre-PhD Data & Main Case Study

The nature of this earlier data set and the data collection that took place as part of the main case study are described in the next section.

4.3 Data Collection

4.3.1 Mixed Methods

In a case study methodology such as this, there is a range of variables to consider and the use of various tools and sources for data collection is a natural choice. A mixed methods approach is consistent with a pragmatic outlook in that it includes narrative and numeric data sets and makes use of qualitative and quantitative methods, as needed to meet the aims of the research and answer the research questions (Cohen et al., 2013). This study uses a parallel mixed design, in that both quantitative and qualitative data are collected simultaneously, to address the research questions (Teddlie & Tashakkori, 2011). In this approach, the various sources of data contextualise, reinforce, and illuminate one another. This process of multiple sources of data converging, or reinforcing one another, leads to a triangulated view of the phenomenon and allows the researcher to have faith in the rigour of this approach (Cohen et al., 2013; Yin, 2014).

The main quantitative tool, the Ravitz key skills framework (Ravitz et al., 2012), aimed to provide a numeric measurement of students' confidence in a range of 21C skill areas at various time points (Section 2.3.1 - Defining 21C Skills). It was chosen as it provided a clear description of various actions or activities that allow for consistent description of six 21C skills. Additional quantitative questions addressed related points about the students' experience on the Bridge to College programme. Qualitative tools, such as open survey questions, were used to collect data at each time point. Analysis of these data sought to confirm or reject, or explain, the outcomes of the quantitative data and explore or suggest any other significant findings.

Both qualitative and quantitative data were collected throughout this study. This happened at various time points during the programme and in the months and years after students had participated. This timeline is explained in the next section.

4.3.2 Data Collection Timeline

Data were collected from students at seven time points, beginning with their first morning on the Bridge to College programme, as shown in Figure 9. Student questionnaires were used at each of the seven time points and student interviews were also used at Times 4 and 7.

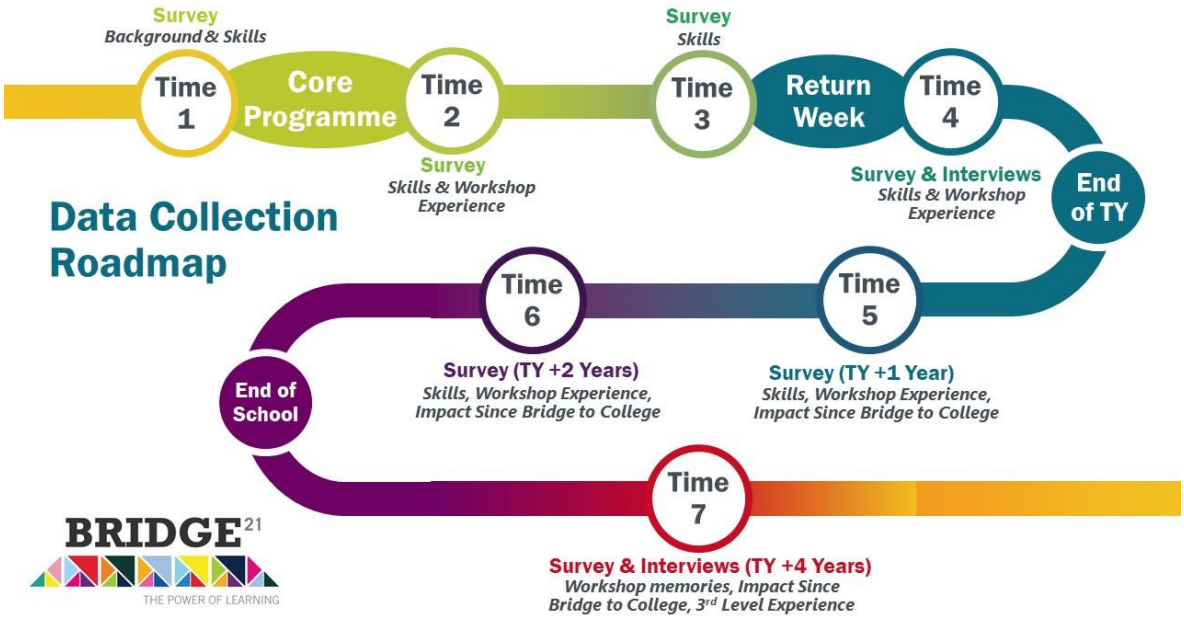


Figure 9: Data Collection Timeline

Data collection at Times 5, 6, and 7 allowed for a longitudinal review of the impact of participation in the Bridge to College programme. This is particularly significant given the lack of longitudinal studies of NFE programmes highlighted in Section 2.5.4.

Table 15, below, shows the topics/instruments included for each of the nine instances of data collection to which a student may have contributed. The grey boxes indicate the presence of a particular topic during the specified instance of data collection.

	Data	Student Background	Confidence / 21C Skills (Ravitz, 2012)	3rd Level Intentions	Workshop Experience	Since Bridge to College…	3rd Level Experience
Time 1 Survey N = 1005	Quant & Qual						
Time 2 Survey N = 1032	Quant & Qual						
Time 3 Survey N = 143	Quant						
Time 4 Survey N = 177	Quant & Qual						
Time 4 Interviews N = 12	Qual						
Time 5 Survey N = 211	Quant & Qual						
Time 6 Survey N = 190	Quant & Qual						
Time 7 Survey N = 60	Quant & Qual						
Time 7 Interviews N = 57	Qual						

Table 15: Data Collection Timeline/Topics

This data collection can be described within three broad phases. These are:

1. Times 1, 2, 3 & 4 – During the Bridge to College programme.
2. Times 5 & 6 – After the programme but the students are still in secondary school.
3. Time 7 – After the programme and after the students have finished secondary school.

The data collection in each of these phases is described next. The questionnaires used are shown in Appendix 11 – Questionnaires.

Times 1, 2, 3 & 4

The programme is divided into two blocks of weeks. The Core weeks, in which every student participates, contain the same content each week. The Return weeks were not available to all students, so a subset of the Core group returned to complete an additional week, with each week focusing on a different topic or theme. The Core weeks usually took place between October and January each year with the Return weeks taking place between February and April. Therefore, the Return weeks typically took place about three months after the students' first week on Bridge to College. Data were collected at four time points during the students' participation in the programme. Times 1 and 3 took place at the start of each programme week, with Times 2 and 4 at the end of those weeks, see Figure 10.

Time 1 data were collected via an online questionnaire. Time 2 data were collected using an online questionnaire and a handwritten questionnaire. The handwritten questionnaire included any open, descriptive questions as we found students were more likely to write an answer on paper than to type one using a keyboard. The same approach was taken on the Return weeks with the Time 3 questionnaire online and the Time 4 questionnaire including online and written components. The Time 4 group interviews were carried out with 12 students from five different schools at the end of their final week on the programme.

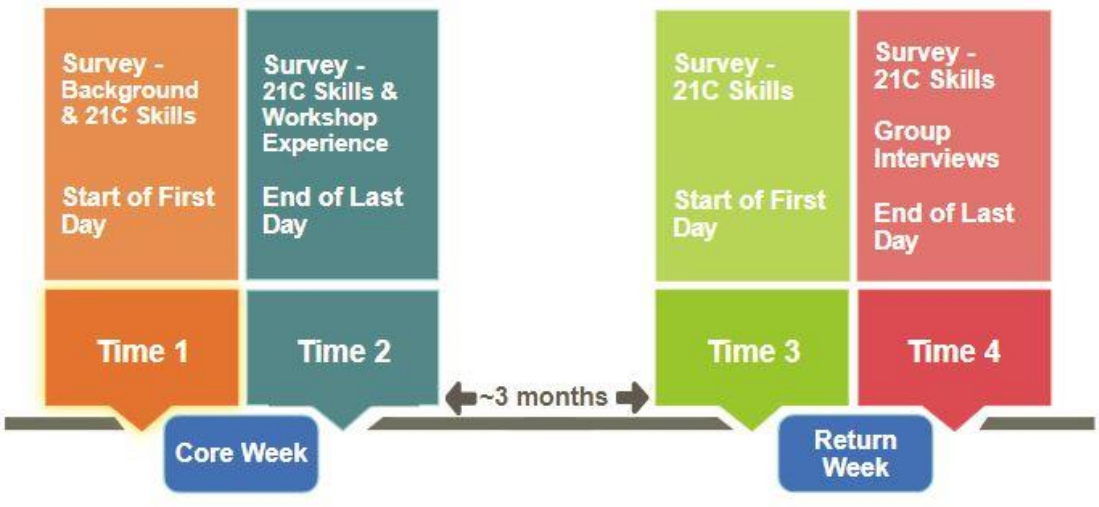


Figure 10: Times 1, 2, 3, & 4

Data were collected at Times 1, 2, 3 & 4 during the 2015/16 and 2016/17 school years. The large numbers shown in Table 15 for the Time 1 and Time 2 surveys include some data that were collected in the years before this study formally began (2011/12 – 2014/15). When survey questions were used across several year groups, the responses were grouped and treated as one larger body of data. For example, the data collected from the 2015/16 and 2016/17 were grouped together for analysis. It was also possible to match the responses from individual students at each time point to track changes in their responses. This included both qualitative and quantitative data sets. The analysis of these data is presented in Chapter 5.

This data collection was not a single, linear process. Time 1 for any individual student took place on the morning of their first day on the Bridge to College programme. For another student in that year group, Time 1 would be another Tuesday morning during that term. Because the programme has been running for several years, multiple new groups of students entered the data collection cycle, by completing the Time 1 survey, each year. During this study, approximately 50% of students took part in a Return week, and therefore completed the surveys at Times 3 and 4. Regardless of whether students participated in a Return week, and the Time 3 and 4 data collection, they may have been asked to contribute to the data collection at Times 5, 6, or 7.

Times 5 & 6

Data were collected at two additional time points after the students had completed the programme but while they were still in secondary school (Figure 9). They were Time 5 (+1 year) and Time 6 (+2 years). Students were welcome to participate in this data collection regardless of whether they had taken part in a Core week and a Return week, or just a Core week.

Time 5 data were collected from the 2015/16 and 2016/17 year groups. This took place, in the students' schools, in March 2017 and March 2018 respectively. A visit was arranged to six of the schools whose students were participating in the programme. Students who had taken part in the programme the previous year were released from class to complete an online survey in a school computer room. It was not possible to visit all of the schools whose students had taken part in the programme, but the schools chosen were those who had sent the largest groups, so this was an efficient way to meet the most students in the fewest visits. During each visit, students were invited to participate but not required to do so.

Time 6 data were collected via a similar process. These data were collected from the Bridge to College groups from 2013/14, 2014/15 and 2015/16. This took place in March 2016, March 2017, and March 2018 respectively, and included the same six schools involved in the Time 5 process. In 2017 and 2018, the data collection for Time 5 and 6 could often be carried out in a single visit to each school.

	March 2016	**March 2017**	**March 2018**
2013/14	Time 6 / n = 81		
2014/15		Time 6 / n = 82	
2015/16		Time 5 / n = 98	Time 6 / n = 17
2016/17			Time 5 / n = 113

Table 16: Times 5 & 6 Timeline

Table 16 shows when the Time 5 or Time 6 data collection took place for four different Bridge to College year groups. Because of the staggered nature of this data collection, there was no overlap between the set of students completing the questionnaire at their Time 5 and those completing it at their Time 6, therefore, no student provided data at both Time 5 and Time 6. One final round of data collection (Time 7) took place after students had left school.

Time 7

To explore the long-term impact of the programme in the years after students had completed secondary school, and possibly progressed to third level education, data were collected from students between four and seven years after their participation. In February 2019, a group of 537 former Bridge to College students were contacted by email and invited to complete an online questionnaire and/or take part in a group interview. These students had provided an email address for this purpose during their participation in the programme, or during the Time 5 and 6 data collection in their schools. 60 students, from ten different schools, completed the online survey. 53 students took part in group interviews, in groups of between three and five at a time. The findings from the analysis of the data collected at Times 5, 6, and 7 are presented in Chapter 6.

In total, close to 1,250 students contributed to this study between October 2011 and February 2019. This included both qualitative and quantitative data. The instruments used to collect these data are described in sections 4.3.3 (Quantitative Data) and 4.3.4 (Qualitative Data).

4.3.3 Quantitative Data

21C Skills – Confidence

To address the research aims of this study, a quantitative metric was used to assess students' 21C skill confidence levels and their frequency of use. A set of Likert scale questions was created to allow students to express their confidence in exercising a set of actions or activities associated with each of the six 21C skills. Likert scales are often used to capture attitudes, or character or personality traits, and to express these aspects as quantitative data (Boone & Boone, 2012). Likert asked respondents to choose from a list of five answers to a given question, ranging from "Strongly Agree" to "Strongly Disagree". Likert combined the responses from sets of questions to generate an attitudinal measurement scale (Likert, 1932). This study uses the same approach for each of the six 21C skills.

Ravitz et al (2012) created a categorised list of activities that relate to various 21C skills, including:

- Collaboration Skills
- Communication Skills
- Creativity and Innovation Skills
- Critical Thinking Skills
- Learning with Technology
- Self-Direction Skills

For example, under Communication Skills, activities such as "Prepare and deliver an oral presentation to the teacher or others", and "Answer questions in front of an audience", are included. The subskills provide clear examples of each skill in practice and allow for a reliable count of how often a skill is used. The Ravitz framework was first designed as a tool to assess how frequently teachers were encouraging the use of 21C skills in their lesson planning. A version of the scale used here has recently been independently validated for use in measuring students' confidence with 21C skills (Bray et al., 2020). This validation work was carried out by colleagues of the author from the CRITE research group using data provided by the author. Students were asked to rate their confidence with each subskill on a five-point scale from "Very Confident" to "Not Confident at All". This Ravitz framework includes the skills most frequently included in the various descriptions and definitions of 21C skills, and provides a clear definition of each skill set by including the various actions or activities that make up each one. In order to gather quantitative

data, students were asked to rate their confidence with each of the 37 activities that map to the six skill categories listed above.

In assessing student skill levels, this study used a pre-experimental design including a pre-test and a post-test. Students were asked to rate their confidence to complete each activity/action on a five-point scale ranging from "Very Confident" to "Not Confident at All". This pre-test was included in the Time 1 questionnaires and the post-test was included at Time 2 to identify any changes. The same instrument was included at Times 3 and 4 in order to track changes between the two programme weeks and during the Return week. This design does not include a control group to compare with the experimental group, but this approach was deemed suitable for this study as the creation of a meaningful control group would be challenging for reasons including feasibility and access (Creswell, 2003). A direct measurement of students' skill levels was not possible so their confidence to undertake or complete each activity is used as a proxy (Sullivan, Bray, & Tangney, 2020).

Confidence as a Proxy Measurement for Skills

In this study, student confidence in certain activities is used as a proxy for assessing student skill levels. "Confidence" is a widely used and understood concept but not one that is clear and easy to define. Maclellan (2014), carried out a literature review on confidence in education and suggests that, in an education context, confidence usually reflects an individual's belief of how they will fair in a range of performance indicators and is related to their impression of their competence in a specified context or domain. This is closely aligned with Bandura's (1977) theory of self-efficacy. Bandura identifies four principal sources that influence one's self-efficacy. These are:

- Performance Accomplishments – one's previous perceived successes and failures.
- Vicarious Experience – observing others perform tasks (successfully or not) and comparing oneself with them.
- Verbal Persuasion – Verbal communication (positive or negative) from others, e.g., peers, teachers etc.
- Physiological States – Awareness of one's emotional reaction (e.g., anxiety) to certain inputs.

When describing confidence, Kroner and Biermann (2007) build on Bandura's definition of self-efficacy by adding a fifth source, self-concept, which is the perceived knowledge of one's current capabilities. Maclellan describes self-efficacy as a "situationally specific manifestation of

confidence" (p. 62). It is arguable that in asking students to rate their confidence to complete certain tasks that we are, in fact, asking them to rate their self-efficacy, in that the action/activity descriptions are often context specific, e.g., "Present their group work to the class, teacher, or others".

However, the survey questions used in this study ask about "confidence" rather than "self-efficacy". This is because the similarities between the two concepts are large and the differences are small. In practical terms, the phrase "confidence" will be meaningful and accessible to the students completing the questionnaire in a way that "self-efficacy" is less likely to be (Kearney, 2018). Also, among those students who are familiar with both phrases, it is likely that most would think of them as largely interchangeable. The author is satisfied that, whether students were conceptualising confidence or self-efficacy as they completed the questionnaire, their responses represented a meaningful reflection of their abilities in the 21C skill areas listed.

To address RQ1, data on student skill levels were needed. The Ravitz framework was well suited to gathering data for this purpose in that it allowed students to rate their confidence in each set of 21C skills. The Ravitz framework was also used during this research as a tool to analyse how frequently the listed skills were exercised during the programme, and thus to address RQ1 (a). It was used to directly count the expected frequency of use of each skill within the design of programme.

21C Skills - Frequency of Use

An understanding of how frequently each of the six 21C skills is used throughout the Bridge to College programme, and when specific skills are emphasised during the programme, is necessary to help understand how and why the programme helps students develop those skills. To generate these data, a mapping exercise was carried out to identify which 21C skills were required to undertake each of the programme activities, and thus to assess how frequently each of the six 21C skills featured in this study are used by Bridge to College students throughout each of the four days of the programme. This analysis is explained, and the results are presented, in Section 5.1.3.

Impact Questions

In addition to the 21C skills scale, a set of Likert scale questions were used to gather additional quantitative data about the students experience on Bridge to College and their self-perception of the impact of their participation in the programme. Students were asked to express a level of

agreement with a series of statements. One set of statements focused on the students self-perceived impact of their participation in the programme. This included statements such as:

- Increased my confidence using technology
- Made me feel I would learn better in school as part of a team

These questions were asked at Times 2 and 4, at the end of each programme week, and in the longitudinal questionnaires at Times 5, 6 and 7.

Additional questions on the longitudinal survey focused on whether students had used any of the skills they learned during Bridge to College (teamwork, technology, etc.) since completing the programme. These were straight "Yes" or "No" questions for each named skill.

In addition to these quantitative data sources, qualitative data were collected via open questions on student questionnaires and group interviews. This data collection is discussed in the next section.

4.3.4 Qualitative Data

Qualitative data were collected from two sources. Student questionnaires, used at all seven time points, contained open questions on topics including the students' programme experience and their use of certain skills during or after the Bridge to College programme. Student interviews were also carried out with some students at Time 4 and a larger cohort at Time 7.

Student questionnaires included some open, paragraph-style questions and were a source of qualitative data. Yin (2014) describes such data as "corroboratory" and suggests that a key strength of this approach is that it can provide a record of events or experiences that were not observed or measured elsewhere. He cautions, however, that it typically includes a degree of bias, especially when written with a particular audience in mind. These questions allow students to explain and qualify their answers, in their own words, and avoid the limitations of closed questions with pre-set responses. In writing the open questions, the author was careful to avoid what Cohen called the pitfalls of question writing (Cohen et al., 2013). These included leading questions, needlessly complex language, vague or ambiguous questions, or the inclusion of so many questions that the questionnaire becomes too demanding a task for the students.

Interviews are often an important source of data in a case study. Yin (2014) described them as guided conversations, allowing for a stream of questions but within a focussed line of enquiry.

Carey (1994) described a focus group as an informal, semi-structured interview, moderated by a group leader, with the purpose of gathering information on a specified topic. Focus group interviews can be used to validate the findings of quantitative research or as part of triangulation with other mixed sources of data (Morgan, 1996).

There are many types of focus groups. Calder (1977) describes exploratory, pre-scientific, quasi-scientific, and phenomenological approaches to focus groups. The phenomenological approach allows participants to discuss their experience and their understanding of events and their impact, both immediate and longer term. This includes their attitudes, opinions, and beliefs. It is a chance to express their understanding of the events in question. This was the desired output from these interviews, so a phenomenological approach was taken in this study.

Prior to group interviews, some decisions and steps must be taken. Participants should be contacted in advance and informed of the topics to be discussed. A set of questions should be determined. These should be open-ended, qualitative, and should be sequenced in a way that is natural (Dilshad & Latif, 2013). The composition of each group is important. Some authors suggest that groups of six to twelve work best, allowing for synergy and preventing one or two voices from dominating proceedings (Anderson & Arsenault, 2005; Dilshad & Latif, 2013; Morgan, 1996). Others found that smaller groups are easier to manage and allow for topics to be explored in greater depth (Wilkinson, 1998). Wilkinson also highlighted that homogenous groups were most effective as the participants' shared background or experience allowed them to speak more freely. In this study, smaller groups were favoured to allow each student to contribute throughout the discussion and each group was made up of students from the same programme week (Time 4) or year group (Time 7).

Webb and Kevern (2001) warn that group interviews prevent the gathering of uncontaminated data and Morgan (1996) points out that participation in a focus group may boost morale among participants in that they feel included or "listened to" and this may impact their responses. Stewart et al (1990) caution about the reliability of interview data as people are aware that the interviewer, or their peers, may expect them to respond in a certain way. Individual interviews can partly address this and may also be used to provide uncontaminated data. Wilkinson states that direct observation of the participants in action is more effective than a focus group for gaining an understanding of phenomena in context and that individual interviews can provide a richer

understanding of a participant's knowledge and experience but that focus groups can address both goals effectively, at once (Wilkinson, 1998).

The qualitative data instruments used in this study are described in the following sections.

Questionnaires

Student questionnaires from Times 2 to 7 included some open, paragraph-style questions. These questions were included to explore the research aims of this study, in part based on the pre-existing instruments used on the Bridge to College programme (Lawlor, 2016), and also to compliment the ideas addressed by the quantitative questions. Additional questions were included in the Time 5, 6, and 7 questionnaires following initial analysis of data collected earlier in the research process. The open questions were included to prompt responses that would provide insights which would enrich (and reinforce, or not) the quantitative data. The open questions included on the questionnaires at Times 2, 4, 5, 6 and 7 are presented in Appendix 10 – Qualitative Questions.

Time 4 Interviews

Group interviews were carried out with students at Time 4, at the end of a Return week. 12 students participated in the interviews, in groups of four. This was an opportunistic sample of students participating in a Return week towards the end of the school year. The Time 4 interviews aimed to gather data that could triangulate, and enrich, the data gathered in the questionnaires. The interview questions were prepared by the author but, to minimise bias, and to encourage the students to speak freely, the interviews were carried out by a colleague not directly involved in the research.

Interview questions included:

1. Did participating in the Bridge to College Programme have an impact on you?
2. Has anything you did/learned on Bridge to College been useful since, in or out of school?

A full list of questions is presented in Appendix 12 – Time 4 Interview Questions.

These interviews were an opportunity for students to reflect on their experience on the programme, and to discuss what they liked or disliked, and what, if anything, they learned from the experience.

The interviews at Time 7 were the final piece of data collection for this study. Analysis of much of the data from Times 1 to 6 had taken place before these interviews were arranged and helped inform the choice of interview questions.

Time 7 Interview Design

One goal of this research, RG3, is to:

Explore the long-term impact of student participation in the non-formal education intervention described in RG1 (The Bridge to College programme).

The Time 7 student interviews are a significant part of this study and are used to meet this research goal and answer RQ2:

RQ2	**Are changes in skill levels/attitudes among Bridge to College students sustained over time?**

At the Time 7 interviews, the author had a strong sense of the students' opinions on their experience with Bridge to College at the time of the programme and relatively soon afterwards. For that reason, these interviews aimed to explore whether those opinions held true several years later (e.g., What did you learn?), and to uncover new data about the relevance of the students' Bridge to College experience to their lives after completing the programme (e.g., Has anything you learned been useful since?). This allowed the author to further explore and better understand the findings from the various Bridge to College student surveys (Times 1 – 6).

Group interviews are an appropriate method to achieve this. Group sizes were kept small (3 - 5 students) and where possible, each interview group came from the same year group. This allows for greater shared experience and richer discussion. Assembling an interview group that is representative of a larger diverse cohort is challenging and, as a result, participants may be disproportionately biased or skewed in terms of age, occupation, or disposition to the topic of the interviews (Gibbs, 1997). In February 2019, a group of 537 former Bridge to College students were contacted by email and invited to complete an online questionnaire and/or take part in a group interview. A series of social media posts were also used to invite former Bridge to College students to take part. This meant the participating students were a self-selecting group and likely to have had a positive experience on the Bridge to College programme. This must be acknowledged as a limitation of the research.

Interviews took place with 12 groups over four evenings within a two-week period. Each year group was assigned an evening and then three smaller groups were formed each evening. These interviews were recorded using a handheld audio recorder (with a backup copy recorded on the researcher's mobile phone). Four separate individual interviews were used to provide uncontaminated data alongside the group interviews. These interviews were carried out by the author himself. There may have been benefits to having the interviews carried out independently but this was not an option due to the timing of the interviews and, as highlighted by Anderson and Shattuck (2012), the author's familiarity with the programme can be seen an advantage in this setting. An individual student survey completed at the same time as the focus group interviews (Time 7), as described above, also served this purpose.

The interview schedule was designed in such a way as to first remind the students of their experience on Bridge to College and then to explore their beliefs about the purpose of the programme. It then explored the impact of the programme in relation to their perceived acquisition of 21C skills, and their intentions to attend third level education. Some of the questions were included as they complemented the questions asked in the various questionnaires used at Times 2 through to 6. With other questions, a theoretical sampling approach was taken as interview questions were included to build upon findings and analysis from earlier data collection (Draucker, Martsolf, Ross, & Rusk, 2007). The semi-structured nature of the process provided ample opportunity for the participants to describe their experience on and since the programme, in detail, and to contribute ideas beyond those directly addressed in the interview questions. The full set of interview questions, and brief discussion of why each was included, is presented in Appendix 13 – Time 7 Interview Questions.

4.3.5 Data Collection Summary

This section has described the data that were collected from ~1,250 students through 2,805 questionnaires and 65 interviews. This data collection took place between November 2011 and February 2019 and included qualitative and quantitative data sources. Due to the large volume of these data, not all data were analysed for use in this study. The approaches used to analyse data are described in the next section.

4.4 Data Analysis Methods

4.4.1 Quantitative Data Analysis

Likert scale questions were used in this study to collect quantitative data. The participant responses were converted to numeric values. This allowed for mean values to be calculated for each set of responses. The analysis carried out here included comparison of these mean values between different groups, or for the same groups at different times. For any statistical test to be carried out reliably, certain assumptions about the data set must be met, for example parametric tests assume that data are normally distributed. A Shapiro Wilk test is used to check whether a dataset is normally distributed (Laerd, 2013). The results of this test help us determine which other tests are best suited to identify statistical changes in a group. If the data are normally distributed, a parametric test (paired samples t-test) can be used to identify differences between two groups or in data collected from a matched group at more than one point in time. If the data are not normally distributed, a non-parametric test (Wilcoxon Signed-Rank test) can be used. These tests allow us to determine if a statistically significant difference exists between the group at two time points.

Beyond confirming the existence of a statistically significant difference, the magnitude of that difference must also be considered. Cohen's d is a classification used as a guide for reporting effect sizes. The effect size (d) is calculated by dividing the difference between the two means (e.g., Time 1 and Time 2), by the standard deviation. Cohen classifies effects as small (d >= 0.2), medium (d >= 0.5), or large (d >= 0.8). These standards are widely used but it should be noted that the context of the measurements is important, as this classification doesn't account for the accuracy of the assessment instruments used or the diversity of the group being studied (Sullivan & Feinn, 2012). In educational interventions, Cohen's d is often in the range of small effect sizes (Hill, Bloom, Black, & Lipsey, 2008). Small effect sizes can be very valuable, particularly if the intervention or change in practice is inexpensive, easy to introduce, and can be widely used, thus having a wide impact (Coe, 2002; Litschge, Vaughn, & McCrea, 2010). By extension, a positive change with a large effect size, that can be achieved in a short time, but which has a sustained impact, is a very valuable outcome.

Where data are collected at more than two time points, a repeated measures ANOVA test can be used. This is an extension of the paired samples t-test but is used when investigating whether there are changes over three or more points in time (Laerd, 2013). This test is more efficient than

carrying out t-tests with each combination of time points. It is also suitable for use with smaller groups, although that is not an issue in this study. This is a widely used statistical test and the main drawbacks noted about it focus on the practical issues around gathering data at various time points. These include a possible regression to the mean as individuals are tested several times and the fact that, over time, factors beyond the scope of the study may influence responses or outcomes (Miller Jr, 1997; Tabachnick & Fidell, 2007).

Time 1 V Time 2

The Time 1 and Time 2 surveys from two year-groups (2015/16 and 2016/17) included the 37 21C skills questions from the Ravitz scale. Following a Shapiro Wilk test, to check that the data were normally distributed, a paired sample t-test (n = 286) was used to compare the students' confidence in each skill category at Time 1 and Time 2. A paired sample t-test is robust and appropriate for use with data of this type and groups of this size (De Winter & Dodou, 2010). Cohen's d was calculated for each set of 21C skill data. These data are presented in Section 5.1.1 - Quantitative Data.

Time 1, Time 2, Time 3 & Time 4

107 students completed the 21C skills questionnaire at each of Times 1, 2, 3, and 4. This set of data was analysed separately from those that just completed the questionnaire at Times 1 and 2. A repeated measures ANOVA test was used with these data. These results are presented in Section 5.1.1 - Quantitative Data.

This quantitative analysis was facilitated by software such as Microsoft Excel and SPSS. Some additional discussion on the use of this software is presented in Appendix 14 - Use of Software in Data Analysis. In the next section, we will look at qualitative data and how it was analysed.

4.4.2 Qualitative Data Analysis

Qualitative data analysis involves interpreting and making sense of the participants meaning and understanding of the situation and identifying patterns and themes. These data must be synthesised and findings extracted and communicated (Cohen et al., 2013).

Qualitative data are, by nature, subjective and potentially subject to misinterpretation due to the researcher's bias, agenda, or background. This misinterpretation may not be intentional but human nature could lead to the over-emphasis of results the researcher may agree with or see as

positive. Whyte (2012) recommends clarity and honesty from the researcher about their aims, their role within the research and their theoretical perspectives (Section 4.1.1).

To minimise this potential bias, parts of the data collection were carried out by people other than author. The student interviews at Time 4 were carried out by a colleague not directly involved with the programme. This was done to help the students feel free to speak honestly about their experience on the programme and to be critical, if appropriate, without having to speak directly to the lead facilitator on the programme. The overall validity of this study, and the steps taken to provide rigour and minimise bias, are discussed in Section 4.6 - Methodological Validity and Limitations.

Content Analysis

Analysis of qualitative data typically involves interpreting the content of text by systematically extracting codes and identifying themes or patterns. This is more than just counting words and requires a close examination of the text to classify large amounts of data into a manageable set of categories or themes (Hsieh & Shannon, 2005). This approach is suitable for data collected in open questionnaires or interview responses and is consistent with the overall mixed methods approach used in this research (Cohen et al., 2013). Two approaches to qualitative content analysis, that are frequently used in educational research studies, are described here:

1) Conventional content analysis

This approach is essentially an open coding process (Cohen et al., 2013). It is commonly used when existing research/analysis is limited and relies on the data set itself to provide codes and themes. It involves immersion in the data, noting, sorting, and categorising codes, and forming meaningful, representative themes (Hsieh & Shannon, 2005). Ezzy (2002) provides a step by step procedure for carrying out conventional content analysis.

2) Directed content analysis

Directed content analysis is a more structured, guided approach and aims to build on existing theory or data. The researcher begins by creating a set of coding categories using relevant theory or research findings. The data are then analysed using this framework. It is not intended to exclude new findings however and any passages of text that do not fit well with the existing codes are assigned a new one (Hsieh & Shannon, 2005; Moretti et al., 2011).

Both of these approaches were used in this study, at different points, and the rationale is given for the choice of approach in each case.

Coding Comparison

To reduce bias in data analysis, student responses to open survey questions for two years of the programme were coded by two colleagues of the author to verify that the coding the author had done himself was fair and accurate. The manner in which this analysis took place did not allow for a direct coding comparison or the calculation of a score for inter-rater reliability, as the specific codes applied to each individual student response were not recorded. Instead, a running count was maintained for each code and these totals showed clear similarities between the analysis of the author and his colleagues.

The vast majority of the data collection and analysis in this study was carried out solely by the author. It was not possible to have any more of the data coded externally in this way. However, this one instance, and the similarity of the results produced by both the author and his colleagues, does provide a degree of rigour and confidence that the findings of the analysis of these data, and in the study in general, are presented in a manner that is representative of the beliefs of the students that contributed to the study.

Survey Data

Analysis of survey data took place at various points throughout the study and was often the first data analysed on a given topic. There were no pre-existing code lists so an approach, led by the data, which allowed codes and themes to emerge through repeated reviews of the data was required. For this reason, analysis of some survey data was carried out using conventional content analysis.

This was in line with the procedure described by Ezzy (2002).

1) A sample of text was identified - This was the set of responses to a single question, as provided by one or more year-groups. The responses were added to one column in an Excel spreadsheet.
2) Define the units of analysis - Each student response was treated as a unit.
3) Define the categories - Each response was reviewed, and a count was added to any relevant codes identified in the text, or a new code was created. Each code was recorded on the spreadsheet with the text.

4) Review the texts to code them and place them in categories – Steps 3 & 4 happened in parallel when conventional content analysis was used.
5) Count and log occurrences of codes and categories – Codes were reviewed and grouped to form broader categories.

To generate a coding scheme, the author carried out this conventional content analysis process on a set of data (from the 2013/14 and 2014/15 academic years). That coding scheme (Appendix 15 – Qualitative Codes and Themes) was then used to carry out directed content analysis of another set of data. This analysis was carried out by two colleagues of the author from outside this project to minimise researcher bias. At this point, statistical analysis could be applied. For this study, counting the frequency of each theme was usually sufficient to indicate their relative importance/significance. Data from the 2015/16 and 2016/17 academic years were analysed for this study and are presented in Section 5.1.2.

The frequency with which each code was identified by the author in the "pilot" analysis of the 2013-15 year groups and the main analysis of the 2015-17 year groups is presented in Appendix 16 – Qualitative Data: Peer Analysis – Myself and How I Learn Codes. The same ideas appear most frequently, and least frequently, within each data set. This allows for a good degree of confidence in the data presented and the process used to generate it. This process also contributed to the creation of a framework of themes that could be used for directed content analysis of interview responses.

Interview Data

Group interviews can be used to investigate a topic when user opinions are unknown. These can be exploratory in nature or can be used to provide corroboration, triangulation, or further depth to data already collected (Stewart et al., 1990).

In analysing data collected in interviews, transcription of recordings is a necessary first step according to Anderson (2005). Stewart, Shamdasani and Rook (1990) suggest that transcription is often useful but not always necessary. Time and cost may be factors in this decision. In analysing these data, Anderson (2005) suggests an initial review of "big ideas" and then considering the strength of feeling and context around these ideas. Stewart et al (1990) suggest that it is seldom practical or useful to analyse an entire interview. One can examine statements on a specific theme or responses to a given question. Unitising involves defining appropriate units of analysis. Answers

to a specific question can be treated as sampling units. Each individual answer to that question is a separate recording unit.

Student interviews were carried out at Times 4 and 7. To allow for analysis of these data, and to get a sense of the "big ideas" within, each interview was initially transcribed into a separate Google Doc. To create meaningful bodies of text to analyse, transcribed responses to each interview question were grouped into a single document, as suggested by Stewart et al (1990). An initial review revealed that the main ideas discussed were in line with those found in other qualitative data sets. For this reason, a process of directed content analysis was carried out on each set of answers, using a pre-defined set of codes, based on the output of the analysis of the various other data sets. To identify which ideas were most frequently mentioned, a count was made of the instances of each code and the frequency of codes for each theme was totaled and recorded. The code sheet used for this analysis is shown in Appendix 15 – Qualitative Codes and Themes.

Reporting of interview data falls into two main categories: summarising the participants' responses and reporting them verbatim. Anderson (2005) favours a combined approach with selected quotes used to illustrate emergent thoughts and feelings among the group. In reporting on this analysis, the frequency of themes in response to certain questions is presented and, in other cases, representative quotes are shared to reflect themes that emerged across several questions, as suggested by Anderson (2005). This is presented in Section 5.1.2 (Time 4 – Group Interviews) and Section 6.2.2 (Time 7 - Interviews).

4.5 Ethical Considerations

Research ethics in education aims to ensure fair and appropriate treatment of all people. An increased recognition of the importance of research ethics can be seen in the presence of regulatory codes and ethics committees in research institutions (Cohen et al., 2013). This case study involved working with people, both in the delivery of the Bridge to College programme and in the collection, analysis, and presentation of data. For this reason, a research approach was devised that was in line with the ethics standards required by the School of Computer Science and Statistics (SCSS), Trinity College Dublin, where this research was based.

At the beginning of study, approval for research on the overarching Bridge21 project had previously been granted by the School of Computer Science and Statistics Ethics Committee, including the Bridge to College programme. In order to gain approval for this study, an Ethical Application Form was submitted, including an outline of the purpose of the study, and of the research methods and instruments to be used.

The participating students were under 18 years of age so informed consent was required from their parents or guardians. All programme participants were invited to be part of the study but had the choice to opt out of the study at any point without penalty. The students were free to take a full part in the programme without contributing to the questionnaires or interviews. Parents and students each received an information letter and related consent form prior to starting the programme. A sample student information letter and consent form are shown in Appendix 8 - Consent Forms / Information Letters. The students provided their names and school details for matching purposes but, once this process was complete, the data sets were anonymised before any analysis was carried out. All information was stored in accordance with the Data Protection Act at Trinity College Dublin.

4.6 Methodological Validity and Limitations

There are limitations to what can be achieved or confirmed with any methodology or set of research methods. Case study research can only demonstrate the findings from the particular case(s) studied and cannot make firm predictions for how a programme or activity might work in another context. While acknowledging this limitation, with careful consideration, case study results can help educators judge the likely impact of an intervention in a similar context.

To help achieve this, Yin proposed four 'features of quality' for case study research (Yin, 2014). They are:

1) Construct validity – This involves the use of data collection methods that are appropriate for the concepts under examination.
2) Internal validity – This seeks to identify causal relationships between elements, conditions, and outcomes. This can typically be tested for during the data analysis phase.
3) External validity – This relates to generalisability or transferability. If the results of the study are to be considered applicable in different settings, its external validity must be addressed.
4) Reliability – This is about whether the procedures and methods used in a study can be repeated. This does not mean that another case study will produce the same outcomes as this one, but that the procedures and methods used in this study could be replicated accurately.

Creswell presents eight approaches to ensuring validity. These are: triangulation, peer-validation, rich description, clarification of researcher bias, presentation of negative findings, prolonged time in the field, peer debriefing, and the use of an external auditor (Creswell, 2003).

Triangulation is the most powerful tool in this endeavour. Denzin (2017) describes four types of triangulation.

1) Methodological triangulation involves the use of various methods of data collection and a range of data types.
2) Data triangulation involves the collection of data from various sources, different groups, or at different points in time.
3) Investigator triangulation involves additional researchers taking part in the collection or analysis of data in a study.
4) Theory triangulation involves the use of more than one theoretical framework.

This study included several approaches to ensuring validity, including significant use of triangulation techniques. These are discussed in the next section, and other limitations of this study are acknowledged.

4.6.1 Validity and Limitations of this Study

This study employed a case study methodology to explore the impact of the Bridge to College programme on students' skill and confidence levels. Steps were taken to ensure that all four of Yin's features of quality were present in this study:

1) Construct validity – In this research, multiple sources of data are used for triangulation purposes and to ensure construct validity.
2) Internal validity – This research explores data on both the programme design and programme outcomes and seeks to identify and explore causal links between the two.
3) External validity – This research takes place in one setting and does not seek to generate a broad, formal theory. There are elements of the study that are transferable, e.g., features of the programme design linked to certain aspects of the student experience or student outcomes.
4) Reliability – In this study, the tools used, and the procedures followed have been documented. The collection and analysis of questionnaire and interview data have been codified and described. In addition, a coding comparison process was carried out on a subset of the data involving two colleagues from outside the project.

Of Creswell's eight approaches to ensuring research validity, five play a significant role in this study. Triangulation, peer-validation, presentation of negative findings, prolonged time in the field and clarification of researcher bias all play in a role in ensuring the validity of this study.

Triangulation is the primary factor in this endeavor. Three forms of triangulation, as identified by Denzin (Denzin, 2017), are utilised in this study. Methodological triangulation is present in the use of both qualitative and quantitative data, and the use of different methods of data collection, including questionnaires and interviews. Data triangulation is achieved through the analysis of data from various programme weeks, different year groups, and from many students at several points in time. Investigator triangulation also features through the use of external coding in part of the data analysis, but this was not used in most areas of analysis due to limits on time or available colleagues.

Peer-validation was used in the coding and analysis of qualitative questionnaire data. Presentation of negative findings can be seen in the Analysis and Findings chapters, with examples including students reporting lower confidence with certain skills following participation in the programme,

or students reporting no impact on their intentions toward third level education. Prolonged time in the field is a clear factor in this research as the author was lead facilitator on the Bridge to College programme for several years before, and during, this research. This ensures a level of insight into the workings and context of the programme but also requires a strong clarification of bias for this study. In attempting to clarify, and minimise, researcher bias, the position of the researcher relative to this study, and the programme under review, is presented in Section 4.1.1. However, complete objectivity, particularly in qualitative research, has been described as a myth (Corbin & Strauss, 2008).

Researcher bias cannot be eliminated completely from this study. However, Miles and Huberman (2002) describe useful strategies to minimise its impact. It must be acknowledged that the beliefs, values, and personal history that the researcher carried into their role have had an impact on the results of the study. The author was directly involved in the design and delivery of this intervention so a belief in, or expectation of, positive outcomes from the programme was fundamental to that process. The reduction of bias can be difficult to achieve in insider research due to closeness to the project setting, and to the programme team and participants (Greene, 2014). Anderson and Shattuck (2012) point out that researchers themselves, despite their biases, are often the best research tool and their involvement adds as much through their unique perspective and insight as their bias may detract from the research validity. An acknowledgement and awareness of this bias from the beginning of the research process was an important first step. Triangulation, peer-validation, the consideration of rival explanations, the inclusion and exploration of data that were outside the general trend, and careful documentation of the procedures followed, are all steps that were taken to minimise researcher bias in this study.

This study relies heavily on self-reported data. Programme participants were asked to self-report on their skill and confidence levels and on the potential impact they felt, or observed, in themselves, following their time on the programme. A person cannot objectively measure these things about themselves but self-reported feedback following an educational intervention is quite common in social or educational research. It is imperfect, but in keeping with the pragmatic perspective adopted for this study, it is what was possible in attempting to assess the impact of the programme (Cohen et al., 2013). This research aimed to assess aspects of the participant and their experience that could not be independently measured or assessed, such as how confident

they felt at a given time. For these reasons, the inherent limitations of self-reported data are accepted by the researcher.

A final limitation to consider is the degree to which the findings of this study can be generalised or transferred to other contexts. This is discussed in the next section.

4.6.2 Transferability of Findings

The transferability of findings, from a particular instance of research, is the extent to which they can be generalised or transferred to other instances or contexts (Lincoln & Guba, 1985). Yin (2014) identifies two ways in which research findings are generalised. These are:

1. Statistical generalisation – Inferences are drawn about a population based on data gathered from a representative sample of that population.
2. Analytic generalisation – Findings reinforce, alter, reject, or develop, theories or concepts, or propose new ideas as a result of the case study.

Case study research can be used to shed light on theoretical concepts or principles. If a case study yields empirical results that reinforce an existing theory or the findings from another study, this can be viewed as replication, and lead to analytic generalisation.

Bassey (1999) describes a third option:

3. Fuzzy generalization – Identifies what is possible or likely given a set of circumstances similar to those in the case study.

Bassey argues that this should be a central aim of any educational case study.

This study sought to derive analytic generalisations based on the results and findings that contributed to determining if, and to what degree, participation in the Bridge to College programme impacts students' skills and confidence (RQ1). The significant data sets gathered and analysed ensure that sufficient information was available to present an in-depth picture of the intervention and the students' perception of its impact on them. This allows a degree of confidence to make inferences about the effectiveness of the programme and the applicability of the findings in other educational settings. In analysing which elements of the programme design led to these effects, and in determining the long-term impact of participation in the Bridge to College programme (RQ1(a) and RQ2), the model of fuzzy generalisation is applicable. This does not seek to propose a formal theory that applies equally in all circumstances but rather suggests a

substantive theory, elements of which can transfer to contexts similar to those in this case (Corbin & Strauss, 2008).

4.7 Chapter Summary

This chapter began by clarifying the aims of this research and identifying the key phenomena under investigation in the case study, i.e., student confidence and skills, and the participants' self-perception of the impact on them as a result of their participation in the Bridge to College programme. A pragmatic methodological rationale was chosen, in keeping with the nature of the study and researchers ontological and epistemological beliefs. These beliefs, in turn, impact the choice of methods used to ensure the validity and reliability of the study.

This is a pragmatic research study using an evaluative case study design. This involves a mixed methods approach to data collection, including both qualitative and quantitative data collected at the time of the programme and in the years afterwards. Analysis of these data informs discussion on the students' experience of the programme and the impact they believe their participation had on them, both at the time of the programme and in the long term. Data generated from analysis of the design of the programme are also used to help clarify how and why this impact occurs. The combination of qualitative and quantitative data, collected at different times points, using different methods, allows for corroboration and triangulation.

The combination of these data is used to explore the hypothesis that the Bridge to College programme is an effective and pragmatic approach to helping students develop 21C skills, that the specific features of the programme contribute directly to this effect, and that the impact is sustained years after students completed the programme. These findings are presented in detail in Chapters 5 and 6. Chapter 5 contains findings based on data collected from students during and immediately after their participation in the programme, and a detailed analysis of the programme design. Longitudinal data are presented in Chapter 6.

5 Analysis & Findings 1 – Workshop Data

This chapter focuses on data collected from students immediately before and after participating in the Bridge to College programme. It contains three sources of data: survey data provided by students at the start and end of the programme, student interview data recorded immediately after the programme, and data describing the structure and content of the programme.

These data are presented to address Research Question 1.

RQ1	**Is the Bridge to College programme effective in developing 21C skills in participating students?**
RQ1(a)	**Which features of the programme help promote 21C skills development?**

Section 5.1 describes data on the development of 21C skills among students participating in the programme. This includes quantitative data collected via the survey instrument designed to measure student confidence in six key skill areas (See Section 4.3.3) and qualitative data collected via open questions in student surveys, and in group interviews. These data were collected before, and immediately after, the Bridge to College Core programme week and, for those students who completed a Return week, before and after that programme – see Figure 9: Data Collection Timeline. These data are used to answer RQ1.

Another set of data presented here provides a detailed breakdown of the design of the Core programme and maps six 21C skills onto the activities that constitute each day. This allows for an analysis of the frequency of use, and timing within the programme, of each of the skills listed. This speaks to RQ1 (a).

Finally, two sets of data are presented that are related to the Bridge to College programme but outside the scope of this study. The first is a brief exploration of differences in sub-groups within the main cohort of students, e.g., male v female students. This was initially examined but ultimately it was decided that it be excluded from the main study. The second additional data set focuses on students' attitudes and aspirations to third level education. Raised aspirations in this area is an aim of the Bridge to College programme and these data were collected for programme evaluation purposes. They are presented here as there are some interesting initial findings and this is an area that may be worth further study in the future.

5.1 Skills Development

This section focuses on the development of 21C skills among students participating in the Bridge to College programme. The findings on the immediate impact of the workshops have been published (Sullivan et al., 2020). The data from that paper are presented in this section.

The Time 1 student survey (n = 286) and the Time 2 student survey (n = 329) included a full set of 21C skills questions based on the Ravitz instrument. Some students did not complete the Time 1 survey due to late arrival or technical issues accessing the online questionnaire. The Time 2 survey also included open questions about the students' experiences on the programme. The open questions provide qualitative data which were analysed to allow an element of data triangulation.

The students that took part in a Return week were surveyed again, both at the start (Time 3) and again at the end of the week (Time 4). These surveys (n = 107) also contained the 21C skills questions. At the end of one Return week (Time 4), a random selection of students were invited to participate in group interviews to discuss their experiences.

5.1.1 Quantitative Data

To compare students' confidence levels at Times 1 and 2, a paired-sample t-test (n = 286) was carried out in all six skill categories. For those students (n = 107) who had completed the survey at all of Times 1, 2 ,3 and 4, repeated measures ANOVAs were carried out on the same questions.

Time 1 V Time 2

A Shapiro Wilk test was used to check that these data were normally distributed (Laerd, 2013), see Section 4.4.1. The results of this test are shown in Table 17, below.

	Statistic	df	Significance	Skew	Kurtosis
Collaboration Skills Time 1	0.981	286	0.001	-0.151	0.191
Collaboration Skills Time 2	0.938	286	0.000	-0.680	0.069
Communication Skills Time 1	0.985	286	0.005	-0.042	-0.235
Communication Skills Time 2	0.946	286	0.000	-0.757	0.653
Creativity & Innovation Time 1	0.967	286	0.000	-0.218	0.602
Creativity & Innovation Time 2	0.949	286	0.000	-0.370	-0.627
Critical Thinking Skills Time 1	0.974	286	0.000	-0.213	0.815
Critical Thinking Skills Time 2	0.945	286	0.000	-0.690	0.010
Learning with Technology Time 1	0.981	286	0.001	-0.204	0.499
Learning with Technology Time 2	0.932	286	0.000	-0.780	0.154
Self-Direction Skills Time 1	0.975	286	0.000	-0.252	0.902
Self-Direction Skills Time 2	0.956	286	0.000	-0.538	-0.081

Table 17: Shapiro Wilk Test for Normality (21C Skills Data)

The primary output of the Shapiro Wilk test did not indicate that these data were normally distributed. For each category, a significance level of <.05 was found, which means that the data deviate from the normal distribution by a significant degree (Laerd, 2013). However, additional descriptive statistics compiled using SPSS software showed that the skew and kurtosis levels for each category were sufficiently normal for the purposes of conducting a t-test i.e., skew <|2.0| and kurtosis < |9.0| (Schmider, Ziegler, Danay, Beyer, & Bühner, 2010). A parametric, paired samples t-test was carried out on these data.

The t-test showed that the increase in student confidence from Time 1 to Time 2 was statistically significant in all six skill categories. Cohen's d (1992) was estimated, and a large effect size was found for each skill category. These data are presented in Table 18.

N = 286	Mean Time 1	Time 1 SD	Mean Time 2	Time 2 SD	Mean difference	t	p-Value	Cohen's d	Effect Size
Collaboration	3.66	0.67	4.28	0.56	0.62	16.18	<.001	0.96	Large
Communication	3.39	0.78	4.12	0.63	0.73	17.92	<.001	1.06	Large
Creativity & Innovation	3.58	0.70	4.10	0.66	0.52	13.53	<.001	0.80	Large
Critical Thinking	3.65	0.64	4.15	0.62	0.50	14.91	<.001	0.88	Large
Learning with Technology	3.73	0.65	4.27	0.58	0.54	14.95	<.001	0.89	Large
Self-Direction	3.64	0.62	4.16	0.60	0.52	15.63	<.001	0.93	Large

Table 18: 21C Skills Times 1 & 2

Communication skills and collaboration skills are the two areas in which we see the greatest gains in confidence. These large changes are reflected in the qualitative data, with collaboration identified as fundamental to the students' experience of the programme. Meeting new people, working in small teams, and making group presentations were identified as highlights of the experience so increased confidence levels in these areas are consistent with those findings. Communication skills had the lowest confidence rating at Time 1, allowing greater scope for improvement. The other four skill categories also show large increases but by slightly smaller amounts. Factors that contribute to this pattern may include higher confidence levels at Time 1 (e.g., learning with technology) or those skills being exercised less frequently during the programme (e.g., critical thinking). The gains in confidence in all six skill areas are substantial. This is a very significant outcome from a short-term educational intervention.

Reduced Confidence

Despite the overwhelmingly positive trend, not every student reported increased confidence in every skill area. To explore this, a count was made of the number of students reporting reduced confidence levels in any skill at Time 2. It was found that, in each skill category, between 10% and 16% of students reported lower confidence at Time 2. These data are presented in Table 19.

n = 286	Reduced Confidence	% Reduced
Collaboration	31	11%
Communication	28	10%
Creativity & Innovation	46	16%
Critical Thinking	34	12%
Learning with Technology	43	15%
Self-Direction	39	14%

Table 19: 21C Skills - Reduced Confidence

119 students reported reduced confidence in at least one of the six skill areas. This does not take away from the overall increases in confidence reported for each skill by this group. It shows that, as students were reporting how confident they felt at each point in time, some fluctuation is likely to occur. The mean confidence across the group was significantly higher at Time 2 in each skill area. The mean confidence across the six skill areas was higher for each individual student at Time 2 than it was at Time 1. Any student that reported lower confidence in one skill area, also reported increased confidence in more of the other five skills.

In the next section, student responses to the 21C skills questions at Times 1, 2, 3, and 4 are explored to look at changes over time and the impact of a second Bridge to College programme experience.

Time 1, Time 2, Time 3 & Time 4

ANOVA with repeated measures was used to identify significant differences at the four time points, see Section 4.4.1. Among the 107 students who completed all four surveys, a clear pattern emerged. The students reported a statistically significant increase in confidence from Time 1 to Time 2, similar to that seen in the overall group. At Time 3, confidence levels were lower than at Time 2 but remained above those reported at Time 1. At Time 4, confidence levels returned to the high levels reported at Time 2. This pattern was consistent across all six skill categories (Figure 11).

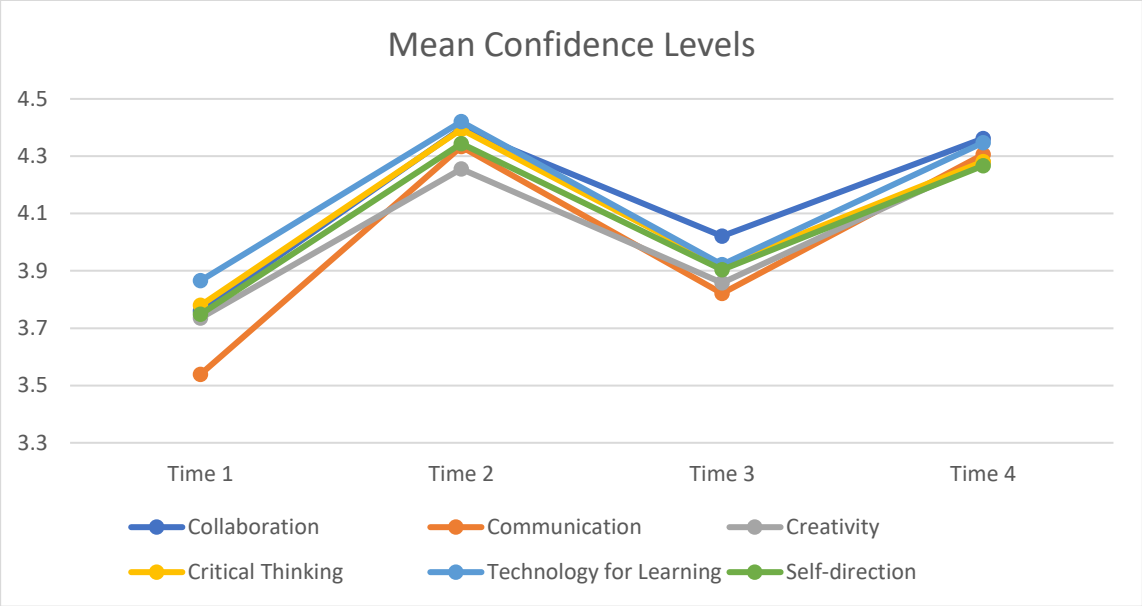


Figure 11: 21C Skills - Times 1, 2, 3, and 4

Bonferroni post-hoc tests were conducted in order to determine which differences between time points were statistically significant. At Time 3, student confidence was reported as lower than at Time 2 but higher than at Time 1. Despite the reduction after Time 2, the increases from Time 1 to Time 3 were statistically significant in three categories: collaboration, communication, and self-direction (Table 20).

Time period	**Significant differences**
T1 – T2	All significant => positive
T1 – T3	Collaboration, Communication, Self-direction significant => positive
T1 – T4	All significant => positive
T2 – T3	All significant => negative
T2 – T4	No significant differences
T3 – T4	All significant => positive

Table 20: Significance of Changes in 21C Skills Times 1, 2, 3, and 4

These data clearly suggest that students develop increased confidence in 21C skills during their time on the Bridge to College programme. In surveys (Time 1) and interviews (Time 4) students report very little use of 21C skills in their formal education. The drop in reported confidence from Time 2 to Time 3 suggests that confidence levels in these skills fluctuate over time based on whether, or how often, the students are exercising their skills. Frequency of use has been shown to be a significant contributing factor to confidence in the use of various skills (Aydogdu, 2015; Kuhlemeier & Hemker, 2007). There may be a "use it or lose it" aspect to confidence in these skills, and that is reflected in the data presented here.

These data suggest that the confidence and skills developed during Bridge to College may endure once the programme has ended. A feel-good factor on the Friday afternoon at the end of the programme must be acknowledged but significant increases over a three-month period suggest real gains in students' skills and confidence.

This idea is further explored through analysis of the qualitative student data.

5.1.2 Qualitative Results

Qualitative data were collected via open questions in student surveys at Time 2 and Time 4 and via student interviews at Time 4.

Time 2 – Open Response Survey Items

The Time 2 survey included an open question about what the students had learned about themselves, and how they like to learn, during the programme. Between 2015 and 2017, 329 students answered this question. A process of directed content analysis was carried out on their responses with each answer assigned one or more of 42 different codes. This gave a total of 1241 coded data points. These data were then grouped into nine broader logical themes. Figure 12, below, shows the themes that emerged from the data and the percentage of the respondents who mentioned them.

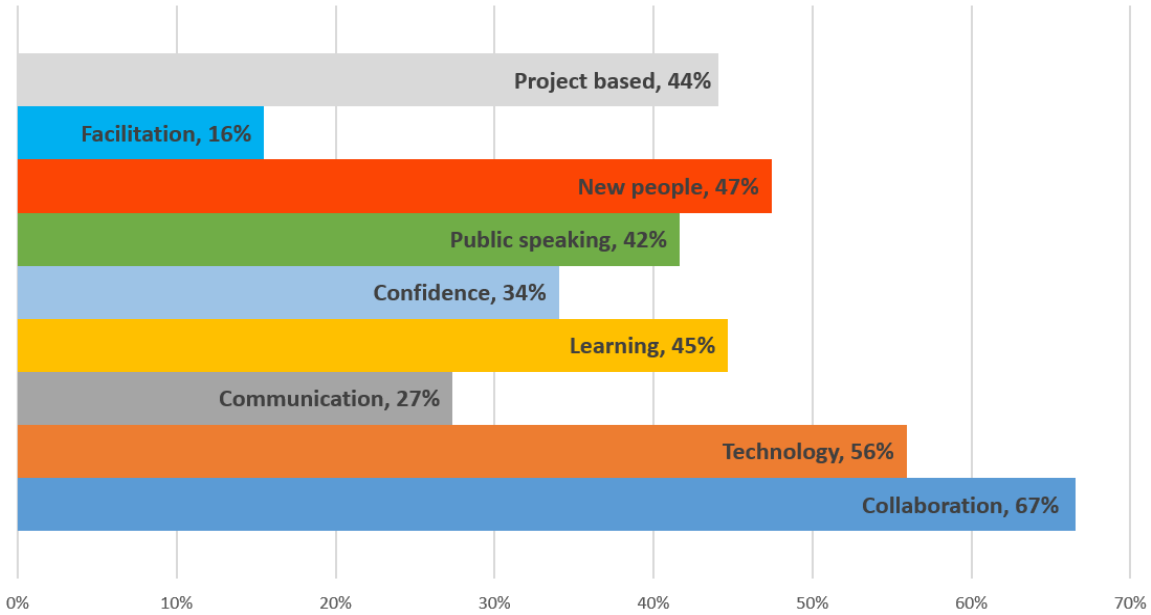


Figure 12: Themes emerging from open survey items (2015-17)

The coding scheme used for this analysis is presented in Appendix 15 – Qualitative Codes and Themes. One such theme was 'Technology', which included the following codes:

'Can do technology skills'	82
'Improved technology skills'	46
'Like using technology skills'	27
'Want improved technology skills'	9
Total:	184

Table 21: 'Technology' codes 2015-17

For example, the following statement was coded under 'Like Collaboration', 'Can do technology skills', and 'Can do public speaking'.

> *"I liked working in a team. I was able to work with the computers. Standing up and talking was a big thing for me and I was able to do it here."*

Collaboration was the most frequently referenced theme with 219 students (67%) mentioning it. The programme is designed to ensure that the students collaborate with their peers throughout the week and this feedback is reflective of that structure. Many students reported little or no prior experience of working in teams, so this was a new approach for them and one that, based on the data presented, had a significantly positive impact. Technology (184 mentions) is very prominent among these data, reflecting the integral role played by various technologies on the programme. Increased confidence, particularly in relation to meeting new people or public speaking, is also notable among these responses. Communication (within their team) was mentioned frequently, and self-direction and creativity were identified within the context of project-based learning.

In the various reflection activities students complete each week, collaboration skills and learning with technology are highlighted more often than other skills. The team reflection sheets include questions about how the team have been working together, and tech skills are usually highlighted after each completed project. This may help students identify those skills in particular, and contribute to their frequent mentions in these data. Reflection activities that focus on a broader skill set may help students recognise their progress in those areas.

When describing their experience with Bridge to College, many students directly identified the same skills described in the 21C skills survey questions. One possible concern here was that the questionnaire may act as a prompt for students to reference those skills in their qualitative responses. In the years where the Ravitz framework questions were included on the

questionnaire, the qualitative data collected were rich in describing the change in the students' skill levels and attitudes. However, they were very similar to the responses given in the years when the Ravitz framework questions were not included, so we can be confident that the students were describing a change that felt significant to them.

The data presented in this section reinforce the findings on skills development from the quantitative data. Further qualitative data were collected through student interviews at Time 4.

Time 4 – Group Interviews

Structured group interviews were carried out with students at Time 4. 12 students participated in the interviews, in groups of four. These students had completed two weeks with Bridge to College. This was an opportunistic sample of students participating in a Return week towards the end of the school year.

Interview questions included:

> *'Did participating in the Bridge to College Programme have an impact on you?'*
>
> *'Has anything you did/learned on Bridge to College been useful since, in or out of school?*

A full list of questions is presented in Appendix 12 – Time 4 Interview Questions.

The interviews were transcribed and a process of directed content analysis (Elo & Kyngäs, 2008) was undertaken, using the coding scheme in Appendix 15 – Qualitative Codes and Themes. Students mentioned many of the skills they had developed during their time on the programme and how those skills had been used since.

Several students described improved confidence, in general, and in relation to meeting new people and speaking in public:

> *'I feel like I'm more confident talking to new people. I'm not as shy. Before I was scared. Now I don't stop talking.'*

Students mentioned that the technical skills they picked up were useful both in and out of formal education:

> *'Lots of little tech things. It was good for projects and stuff in school.'*

Many participants mentioned increased collaboration skills and an improved attitude to teamwork. They credited this to the fact that collaboration was the default mode during this programme and that this was in direct contrast to their experience in school:

'In school, if you talk, they're like "No!", but here it's like "Help each other", and that's good.'

Students also mentioned leadership, decision-making, and self-direction as skills they had opportunities to exercise and develop during the programme.

'In school, you're told what to do. The mentors here, they just help you pick a path.'

These qualitative data are very much in line with the quantitative data described previously. Communication skills, collaboration skills, self-direction skills and technology skills for education have been very prominent in all of the data analysis.

In the next section, the design of the programme is analysed to identify where, and how often, these skills are exercised the during the programme.

5.1.3 Analysis of Programme Design

The Core programme structure and content remained largely unchanged between 2011 and 2018. The four-day programme is described in detail in Section 3.3.2 - Core Programme Content.

The aim of this analysis was to identify the presence, and investigate the frequency of use, of 21C skills in the design of the programme. This was done by matching each of the activities that make up the programme with any relevant key skills from the Ravitz framework (Section 2.3.1). The full set of activities for the week were listed in separate columns (across the top row) of a spreadsheet. The 37 skill elements from the Ravitz framework were listed in separate rows (down the left side). Each cell of the spreadsheet represented a programme activity and a particular skill. If that activity involved the use of the skill, a '1' was recorded in that cell. This allowed for a count of how frequently each skill was used. These were then grouped to give a count of skill use for each of the four days of the programme.

Table 22 shows a sample breakdown for the collaboration skillset and its use in the activities on day one of the programme. The table records 21 instances of students using these skills.

Collaboration is a constant throughout the day and all six skills are exercised by the students during the various activities.

	Setup	Warm-up	Investigate	Planning	Create	Present	Reflect
Collaboration skills	Bridge Game, Pole Game, Fears activity	Team formation	What do we know about movies?	Storyboard	Filming, Editing	Prepare presentation, present video	Team reflection
Work in pairs/teams	1	1	1	1	1	1	1
Work with others - set goals and plan				1	1		
Create joint products				1	1		
Present your group work		1				1	
Use feedback on group tasks	1			1	1	1	
Give feedback to peers	1			1	1	1	

Table 22: Skills Frequency - Day One, Collaboration Skills

This process was repeated with each skill set for each day of the programme. This amounted to 28 student activities or projects over four days. Table 23 shows the frequency with which each skill set is exercised over the four days. The 21 instances of collaboration skills identified on day one of the Bridge to College programme, shown in Table 22 above, are reflected in the highlighted cell in Table 23 below.

	Day One	Day Two	Day Three	Day Four	Total
Collaboration Skills	**21**	22	20	4	67
Communication Skills	11	16	12	10	49
Creativity & Innovation	8	15	11	11	45
Critical Thinking	8	9	19	8	44
Learning with Technology	8	7	13	4	32
Self-Direction Skills	13	19	20	7	59

Table 23: 21C Skills Frequency

The focus on teamwork throughout the week is reflected in the high numbers for collaboration skills. Self-direction skills are required in each project as the students must make plans and organise themselves to meet their goals. Many students report that this is in contrast with their predominantly teacher-led experience in school. Communication skills and creativity and innovation skills are used consistently across all four days.

Students receive significant support and guidance from adult mentors on day one of the programme. The level of scaffolding or support is reduced over the subsequent days as the students become more comfortable planning projects and making decisions for themselves. Critical thinking skills become more prominent on days three and four as the challenges presented to the students become more complex. The specific skills exercised by students during the Return weeks depend on the theme for that week but the same collaborative, project-based approach is used, and lower levels of adult support are provided second time around.

Learning with technology is the skillset with the lowest numbers in this table. There is significant use of technology during the programme but usually for one main task per day. This analysis doesn't capture the complexity or duration of each task and, for this reason, the role of technology in the programme may be under-represented.

This analysis focuses on the intended use of 21C skills during the programme. It is not a measure of the frequency with which any individual student used these skills. It seems very clear that these six skills are integrated into the design of this programme and that participating students have an opportunity to practice and develop their confidence in these areas.

It is clear from this analysis that the skills development described above can be linked to the use of those skills during the Bridge to College programme. The full set of these data is presented in Appendix 17 - Skills Tables: Day by Day. In the next section, we present data on two additional topics that were explored during early stages of this research.

5.2 Tangential Data

During the course of this study, several avenues of research were explored but, ultimately, it was decided they should be excluded from the research aims of this dissertation. That said, some of these data may provide useful guidance for future research. This section includes brief findings from two of these tangential explorations.

The first set of data explored possible differences between different groups within the overall student cohort. These data are presented in Section 5.2.1. The second set of data look at students' attitudes and aspirations to third level education. One aim of the Bridge to College programme is to raise participating students' aspirations to third level education and help them make informed choices in this area. Data were collected on this topic as part of same questionnaires completed at Times 1, 2, 3, and 4. These data are presented in Section 5.2.2.

5.2.1 Student Subgroups

Using the data for one year-group (2015/16, n = 139), the students were split into different categories to allow for comparisons between the sub-groups. These divisions included: whether or not they attended a school with DEIS (disadvantaged) status, gender and, those students who would complete a Return week versus those who completed the Core programme only. A brief summary of these comparisons is provided here.

For each of the three sub-divisions examined, independent samples t-tests were used to identify statistically significant differences between the responses from each sub-group of students. In each case, the distributions were sufficiently normal for the purposes of conducting a t-test, i.e., skew <|2.0| and kurtosis < |9.0| (Schmider et al., 2010). Additionally, the assumption of homogeneity of variances was confirmed via Levene's F tests.

DEIS V Non-DEIS

Students who attended DEIS schools reported slightly lower confidence levels in each skill category at Times 1 and 2. This difference was statistically significant at Time 1 in one category only: communication skills. At Time 2, both groups reported significant increases in confidence, with the Non-DEIS group maintaining a slightly higher level of confidence. These changes meant that the gap in communication skills was no longer statistically significant at Time 2, but the differences in learning with technology and critical thinking skills were.

However, in most categories, there was not a statistically significant difference between the confidence levels of both groups at Times 1 and 2. The mean confidence levels of the DEIS students were slightly lower than those of the Non-DEIS students and this small difference was maintained, even as both groups enjoyed significant increases.

Male v Female

At Time 1, across all six categories, the boys rated their confidence more highly than the girls. This is typical of self-reporting in male students versus females (Campbell, 1992; Lundeberg, Fox, & Punćcohaŕ, 1994). However, by Time 2, the gap has reduced. Both groups made substantial gains in reported confidence, but the girls reported a greater increase than the boys.

Independent sample t-tests on these data showed a significant difference between the Male and Female cohorts in five of the six categories at Time 1. Only self-direction skills showed no significant difference. At Time 2, significant differences remained in three of the five categories. For both collaboration skills and creativity & innovation skills, the gap reduced between Time 1 and Time 2 so that no significant difference remained. In both cases, the boys showed increased confidence, but the girls reported even greater increases.

Core Only Group V Return Group

To explore possible biases in the selection of students to take part in a Return week, the Time 1 and Time 2 confidence rating of the students who were invited to return were compared with those students who would not get the same opportunity.

At Time 1, no statistically significant difference was found between the two groups in any category. At Time 2, three of the six categories show significant differences. Communication skills, critical thinking skills and self-direction skills were significantly higher among those students who would be asked to return for further workshops.

The students who are deemed to be more engaged, enthusiastic, and willing to learn during the workshops are, where possible, given priority when return places are available. The selection process for Return weeks is discussed in more detail in Section 3.5 - Return Weeks. It seems that these students, despite showing no significant difference in confidence prior to the programme, have built up more confidence than with their peers. Confidence levels increased for both groups, but the “Return” group made noticeably larger gains between Time 1 and Time 2. This suggests that the Transition Year cliché about “getting out of the year what you put into it” may hold true for the Bridge to College programme.

Potential differences between different sub-groups of students in their experience of the Bridge to College programme may be an area worth exploring further but following this initial work, it was

decided that this aspect would remain outside the focus of this research. Suggested areas of future work in this area are discussed in more detail in Section 7.5.

5.2.2 Third Level Education

One aim of the Bridge to College programme was to raise the educational aspirations of the participating students, particularly in terms of their progression to third level education. To help assess the impact of the programme in this area, three questions on the student surveys asked about the students' attitudes to third level education. These questions were asked each time the surveys were completed. The questions were:

1) Do you hope to go to third level when you finish school?
2) How important is that you go to third level when you finish school?
3) How likely is it that you will go to third level when you finish school?

In the 2015/16 and 2016/17 academic years, 286 students answered these questions at both Times 1 and 2. Their answers are presented below.

Time 1 V Time 2

Do you hope to hope to go to third level?

286 students answered this question at Times 1 and 2. Their answers are summarised in Table 24.

n = 286	**Time 1**	**Time 2**
Yes	88%	94%
Undecided	10%	5%
No	1%	0%

Table 24: Do you hope to go to 3rd level? Time 1 & 2

Most students (88%) say they do hope to go to third level at Time 1 and this increased to 94% at Time 2.

Table 25 shows these responses grouped according to their choice at Time 1.

n = 286	Time 1	Time 2	
Yes	253	Yes:	252
		Undecided:	1
		No:	0
Undecided	30	Yes:	16
		Undecided:	14
		No:	0
No	3	Yes:	1
		Undecided:	2
		No:	0

Table 25: Do you hope to go to 3rd level? Changes from Times 1 to 2

It is clear from Table 25 where the changes occurred between Times 1 and 2. The students who answered "Yes" at Time 1 almost all give the same answer at Time 2. Of the 33 students that answered "No" or "I don't know" at Time 1, 19 gave a more positive response at Time 2. Participation in the Bridge to College programme has a significant impact on students who are undecided about going to third level education. This pattern is present in subsequent data sources too.

How important is that you go to third level?

286 students answered this question at Times 1 and 2. Their answers are shown in Table 26. The students chose from a 5-point scale ranging from "Not Important at All" up to "Very Important". Their answers were converted to numbers and a mean for the group was calculated for Time 1 and Time 2.

n = 286	**Time 1**	**Time 2**
n=133	5	4.88
n=89	4	4.38
n=48	3	3.62
n=13	2	2.82
n=3	1	1.67
Mean:	**4.19**	**4.38**

Table 26: Importance of 3rd level - Time 1 & 2

The mean at Time 1 was 4.19 which rose to 4.38 at Time 2. A paired sample t-test was carried out and this change was found to be statistically significant. It is clear that, overall, the students believed that third level education was important at Time 1 and that this increased at Time 2.

When the students' responses at Time 2 are grouped based on their Time 1 response, it is seen that 133 (47%) of the students gave the highest possible answer at Time 1 and there is minimal change in their responses at Time 2. The students who answered that third level education was "Important", "Moderately Important", or "Slightly Important" at Time 1, all showed a clear increase by Time 2. The mean response for this subset increases from 3.51 at Time 1 to 4.00 at Time 2. This suggests that the programme had a very positive impact on the undecided students in the group.

How likely is it that you will go to third level?

The students chose answers from a five-point scale ranging from Very Unlikely to Very Likely. Their responses were converted to numbers (1 to 5) and means were calculated. These data are presented in Table 27.

n = 274	**Time 1**	**Time 2**
n = 121	5	4.83
n = 103	4	4.33
n = 25	3	3.36
n = 10	2	2.98
n = 15	1	3.73
Mean:	**4.00**	**4.33**

Table 27: 3rd Level - Likelihood - Time 1 & 2

Overall, there is an increase from 4.00 at Time 1 to 4.33 at Time 2. This increase is statistically significant but, as with the question on the importance of third level education, the change occurs among the undecided students. Those students who answered "Very Likely" at Time 1 showed minimal change at Time 2. Clear increases are seen among the other students.

The mean figures for the importance of third level are higher than those for the likelihood that each student will go on to do so. This may reflect a situation for some students whereby they recognise the potential value of a third level education but are not sure if they will be able to go to college themselves.

Many of this cohort believe third level education is valuable, and it is something they definitely plan to pursue. Among the students where there is less certainty, their participation in the Bridge to College programme led to a clear increase in their beliefs regarding the importance of third level education and the likelihood that they will go on to study beyond secondary school.

Times 1, 2, 3 & 4

106 students answered the same questions again, before and after a second week with Bridge to College. The mean responses to two questions are shown in Table 28.

n = 106	**Time 1**	**Time 2**	**Time 3**	**Time 4**
Importance of third level	4.23	4.47	4.45	4.57
Likelihood of third level	3.97	4.38	4.08	4.35

Table 28: Third Level - Times 1, 2, 3 and 4

After a clear increase from Time 1 to Time 2, the importance of third level stays steady during the three months before Time 3 and then makes a further increase at Time 4.

For the question of the likelihood that they will attend third level, there is an increase from Time 1 to Time 2 but, by Time 3, the value has dropped back down. Time 4 sees another increase, similar to that found between Times 1 and 2. This pattern is shown clearly in Figure 13.

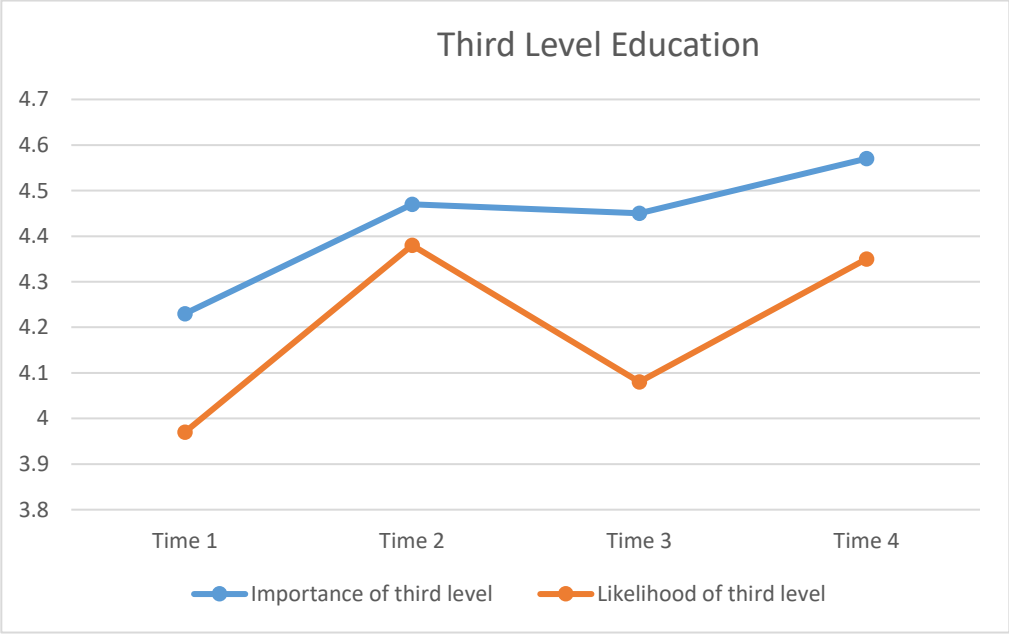


Figure 13: Third Level - Times 1, 2, 3 & 4

It appears that there are sustainable increases in the students' opinions on the importance of third level education but their belief in an increased likelihood they will actually go to third level fades over the three-month period between workshops. The question of likelihood may be more personal and more related to self-doubt or circumstances than the question about the importance of third level.

Time 4 – Programme Impact

The Time 4 survey contained four questions about the impact of the Bridge to College programme on the students' intentions regarding third level education. The students rated their level of agreement with a series of statements using a five-point Likert scale. The scale ranged from Strongly Agree to Strongly Disagree. For analysis purposes these choices were converted to numbers with 5 representing Strongly Agree down to 1 representing Strongly Disagree. These data are presented in Table 29.

n = 125	**Mean**	**Agree %**	**Disagree %**
Made me **more likely** to go to college	4.13	84%	8%
Made me **less likely** to go to college	1.25	1%	97%
Helped me decide **what to study**	3.3	43%	19%
Helped me decide **what not to study**	3.3	40%	17%

Table 29: Programme Impact - Third Level Intention

It is clear from these data that the students believe that their participation in the programme made them more likely to go to third level education. The pre-existing high levels of interest in third level education described above suggest that, for many students, this experience served to reinforce an existing desire for further or higher education. For many students the programme also helped them rule certain courses in or out of their thinking.

Student Subgroups

The student responses to these questions on third level education were further analysed by sub-dividing them into the same categories as was done for the skills questions. These were: male or female, DEIS (disadvantaged schools) or Non-DEIS, and students who would complete a Return week or those who would take part in the Core week only. Shapiro-Wilk tests were used to confirm that each data set was normally distributed and independent samples t-tests were used to identify statistically significant differences between each subset of student responses.

In each category, there were no statistically significant differences between these subsets of students at Time 1 or Time 2.

Both sets of tangential data offer interesting insights and are worthy of further study in their own right. However, it was decided they were beyond the scope of this dissertation and no further analysis will be presented on them at this time.

5.3 Summary

The data presented in this chapter included student surveys and interviews which took place at the start or end of each Bridge to College programme week. It represents a snapshot of the students' attitudes and opinions before, and immediately after, taking part in the programme. These data are relevant to Research Question 1.

RQ1	**Is the Bridge to College programme effective in developing 21C skills in participating students?**
RQ1(a)	**Which features of the programme help promote skills development?**

Findings suggest that the Bridge to College programme is very effective in promoting the development of 21C skills in participating students, and that several features of the programme contribute to this effect. These include the structured nature of the Bridge21 approach, the initial focus on collaboration and communication skills before building up the use of other 21C skills, the varying levels of scaffolding provided as students became more capable and less reliant on the facilitator and mentor team, and the use of technology in a creative, productive manner. These findings are discussed in detail in Chapter 7 - Discussion & Conclusion.

The next chapter presents student data collected in the years after the students completed the programme. This includes student surveys completed one and two years after the programme (Times 5 and 6) and a student survey, and set of interviews, completed after students have finished secondary school (Time 7). This allows us to explore the degree to which the skills and attitudes developed during the programme are sustained in the longer term and to look at what impact they have on the students ongoing education at both secondary and third level.

6 Analysis & Findings 2 – Longitudinal Data

This chapter focuses on data collected from students in the years following their completion of the Bridge to College programme. As discussed in Section 2.5.4, longitudinal research into the impact of NFE programmes is rare. Due to short-term funding, staff turn-over, and changing programme content or objectives, most research into NFE programmes is immediate or short-term, and usually involves quantitative data only. There is a need for longitudinal studies, and research which makes use of mixed methods to capture the depth and breadth of the participants' experience both during and after their NFE programme experience. The chapter includes both qualitative and quantitative data collected between one year and seven years after participation in the Bridge to College programme. It contains three sources of data: survey data provided by students during their fifth and sixth years in secondary school (Times 5 and 6), survey data collected from students who had finished secondary school (Time 7) and had, in most cases, gone on to third level education, and student interview data collected at least one year after they finished secondary school (Time 7) – see Figure 9: Data Collection Timeline.

These data are presented to address Research Question 2:

RQ2	**Are changes in skill levels/attitudes among Bridge to College students sustained over time?**

Section 6.1 describes the survey data from Times 5 and 6, collected one or two years after completing the programme, while the students were in their final two years of secondary school. This includes data on the impact of the programme on the students, their experience since completing the programme, and their use of the skills they developed. These surveys contain both qualitative and quantitative data.

Section 6.2 contains data recorded after the students had finished school, between four and seven years after participating in the Bridge to College programme (Time 7). This included an online survey in which students were asked about their experience of the programme and the impact they believe it had on them, in terms of skills, confidence, and their experience since participation. The final set of data presented is a set of group interviews carried out at Time 7. These discussions covered the students' memories of the programme, their perceptions of the impact of participating in the programme, and their experience since completing the programme, particularly in moving from secondary school to third level education.

Finally, as in Chapter 5, an additional set of data is presented that focuses on students' attitudes and aspirations to third level education. Raised aspirations in this area is an aim of the Bridge to College programme and these data were collected for programme evaluation purposes. This includes survey data from Times 5, 6, and 7, and interview data from Time 7. The data presented here are complementary to the main study and this is an area that may be worth further study in the future.

6.1 Times 5 & 6

Between 2016 and 2018, students in fifth and sixth year, that had taken part in the Bridge to College programme during their Transition Year, completed an online survey. 110 students from the TY groups of 2015/16 and 2016/17 completed the Time 5 survey. 229 students from the 2013/14, 2014/15, and 2015/16 TY groups completed the Time 6 survey (see Section 4.3.2 - Data Collection Timeline - Times 5 & 6). The survey (see Appendix 11 – Questionnaires) included questions about the students' experience during the programme, what impact they feel their participation had on them, and whether the skills they learned on Bridge to College had been useful since, either in or out of school.

This was not a survey of the same students at two points in time. There were no students surveyed at both Times 5 and 6. This is explained in more detail in Section 4.3.2 - Times 5 & 6. The two groups gave similar responses to most questions on this survey. For this reason, the responses from both groups are presented together for each section of this questionnaire.

6.1.1 Programme Impact

This survey included the same set of questions about the impact on the students of the programme as had appeared on the original post-workshop questionnaire. Students were asked to comment on a series of statement using a five-point Likert scale ranging from Strongly Disagree to Strongly Agree. Table 30 shows these data for the Time 5 group. Numeric values were assigned to each answer, with a 1 representing "Strongly Disagree" and a 5 representing "Strongly Agree".

n = 110	Time 2	Time 5	Time 5 Agree %
Improved my attitude to working as part of a team	4.37	4.34	95%
Improved my attitude to education	4.19	3.73	68%
Increased my confidence using technology	4.48	4.27	83%
Made me feel I would learn better in school as part of a team	4.25	3.90	74%
Allowed me to make new friends	4.62	4.40	84%
Improved my communication and presentation skills	4.60	4.45	95%
Increased my independence	4.48	4.08	78%
Increased my confidence around new people	-	4.41	92%

Table 30: Student Impact Data 15-17 – Time 5

It is clear that, even one year later, students were very positive about the impact of the programme.

Over 90% of the students agreed with the statements about confidence around new people, communication and presentation skills and teamwork. The scales relating to making new friends and confidence with technology also saw high levels of agreement. The statements about attitude to education and believing that they would learn better in school as part of a team receive quite positive feedback but at a lower level than the other scales. This may suggest that some of the students see their experience with Bridge to College as separate or different from their formal education. The results for the Time 6 group are shown in Table 31 and show a very similar pattern.

n = 201	Time 2	Time 6	Time 6 Agree %
Improved my attitude to working as part of a team	4.44	4.31	95%
Improved my attitude to education	4.03	3.67	70%
Increased my confidence using technology	4.43	4.14	92%
Made me feel I would learn better in school as part of a team	4.29	3.92	67%
Allowed me to make new friends	4.67	4.43	94%
Improved my communication and presentation skills	4.53	4.38	95%
Increased my independence	4.40	4.15	84%
Increased my confidence around new people	-	4.40	93%

Table 31: Student Impact Data 13-16 – Time 6

Two years after the programme, students reported strongly positive opinions on the impact of Bridge to College on them. Overall, the results at Times 5 and 6 were a little lower than those

reported at Time 2 by the same students but remain overwhelmingly positive. There is some consistency in which scales found the highest and lowest levels of agreement at Times 2, 5, and 6.

6.1.2 Since Bridge to College

A series of questions on this survey asked about the students experience since they completed the programme. These included questions about teamwork, technology, using any of the skills they learned during Bridge to College, and whether they were still in contact with friends they made during the programme.

Teamwork

The first question in this section asked: "Since Bridge to College, have you taken part in any activities where you worked as part of a team?". 108 students answered this question at Time 5 with 83% responding "Yes". This was mirrored among the Time 6 cohort.

Since Bridge to College, have you taken part in any activities where you worked as part of a team?		
Time	**n =**	**Yes %**
Time 5	108	83%
Time 6	229	83%

Table 32: Since Bridge to College - Teamwork

The students were asked to give details if they answered "Yes". These answers were analysed via a process of conventional content analysis. 7 codes were identified with a total of 113 statements noted at Time 5 and 234 statements at Time 6. These are shown in Table 33.

	Sport	**Extra-curricular (In School)**	**Informal Education**	**3rd level outreach**	**Schoolwork**	**Work Experience**	**Part-time Job**
Time 5	24%	27%	12%	7%	34%	2%	5%
Time 6	16%	24%	24%	3%	27%	1%	8%

Table 33: Since Bridge to College – Teamwork details

Extra-curricular activities and sport offer many students the chance to work with others. 70% of students across both groups reported doing no teamwork within mainstream classes in the time since they worked with Bridge to College.

The one notable difference between the two groups is that informal education was mentioned more frequently by the Time 6 group. It was mentioned by 54 students, or 24% of the respondents. This difference is largely due to the fact that several of these students were involved

with ECO-UNESCO, a youth organisation that offers programmes for transition year students and various out-of-school activities for older students.

Technical Skills (ICT)

Another question asked if the students had taken part in any activities during which they used the technology skills they had learned in Bridge to College or where they learned new tech skills. The responses to this question are shown in Table 34.

Since Bridge to College, have you taken part in any activities where you used, or learned new, technical skills?		
Time	**n =**	**Yes %**
Time 5	108	55%
Time 6	229	51%

Table 34: Since Bridge to College - Tech Skills

The students that answered "Yes" were asked for more details. In analysing the students' responses about the use of technical skills since Bridge to College, two passes through their explanations were carried out. First, to pick out where and why they were using or learning these skills (Table 35), and secondly to determine which ICT elements they were working with (Table 36).

The question of Where/Why students used ICT, broke down into five main categories with 152 instances mentioned across the two groups. Only 21% of students reported using ICT in their formal schoolwork. This limited use of ICT, and the low number of students reporting the use of collaborative learning in school, suggests that these approaches remain largely absent from the formal classroom at Senior Cycle. The low rates of ICT use may also point to a "digital divide", in which ICT resources are less available to students in certain socio-economic groups.

Where/Why?	**Schoolwork**	**Extra-Curricular (In School)**	**Informal Education (Out of School)**	**Personal**	**Part-time Job**
Time 5	21%	7%	6%	8%	5%
Time 6	21%	8%	9%	4%	2%

Table 35: Since Bridge to College – Tech Skills Details: Where/Why?

When describing what they used their ICT skills for, five main codes emerged. Multimedia work and creating presentation slides made up the bulk of these responses. Programming and shared use of Google Docs/Sheets were also mentioned. Table 36 presents a breakdown of the responses provided, not the overall usage of each technology.

What?	Video	Audio	Docs/Sheets	Presentation	Programming
Time 5	32%	15%	11%	21%	21%
Time 6	33%	16%	4%	32%	15%

Table 36: Since Bridge to College – Tech Skills Details: What?

Use any Skills you Learned?

The students were asked if there was anything they had learned in Bridge to College that had been useful since, in or out of school.

Has anything you learned in Bridge to College been useful since, in or out of school?		
Time	**n =**	**Yes %**
Time 5	108	80%
Time 6	229	90%

Table 37: Since Bridge to College - Useful Skills

Once again, these students were asked to explain their choice. Six codes emerged with 388 individual instances counted across the two groups. These are shown in Table 38.

	Collaboration	Communication	Tech	New People / Social	Confidence	Leadership
Time 5	13%	23%	34%	14%	14%	1%
Time 6	24%	30%	31%	17%	16%	4%

Table 38: Since Bridge to College – Useful Skills

In both groups, technical skills were the most popular response but communication, team skills, and increased confidence, particularly around new people were all mentioned frequently. It seems the students have largely put the skills they learned in Bridge to College to good use, although perhaps not too often in formal educational settings.

Still in Touch with Friends?

Finally, the students were asked how often they are in contact with the friends they made in Bridge to College. Their responses are shown in Table 39.

How often are you in contact with friends you made in Bridge to College?		
	Sometimes/Often	**Seldom/Never**
Time 5 (n = 107)	59%	41%
Time 6 (n = 216)	51%	49%

Table 39: Since Bridge to College - Still Friends?

More students are still in touch with their friends from Bridge to College at Time 5 than at Time 6, but the difference is relatively small. Around half of the students are still in touch with friends from other schools two years after completing the programme.

The data collected at Times 5 and 6 suggest that up to two years after the programme, students remain very positive about the impact of their participation in Bridge to College in areas such as skills development, confidence, and ability to socialise. Many students describe these developments as having an ongoing impact on their lives, albeit often outside the formal classroom.

The next section describes data collected at Time 7, four to seven years after completing the programme.

6.2 Time 7 – After School

This section presents data collected from students at Time 7 - between four and seven years after they completed the Bridge to College Programme. This was an opportunity to explore the long-term impact of participation in the programme, to determine if the effects reported immediately after the programme are long-lasting, and to potentially uncover other long-term outcomes. These students had completed secondary school and, in many cases, were in third level education at the time of this data collection.

In February 2019, a group of 537 former Bridge to College students were contacted by email and invited to take part in a survey and/or a group interview. These students had provided an email address for this purpose during their participation in the programme, or during the Time 5 and 6 data collection in their schools.

6.2.1 Time 7 - Survey

60 students completed the online survey. These students had taken part in the programme between 2012 and 2016 and had all completed secondary school. Most of these students were in, or had experience of, third level education. This survey included some questions from the Time 5 and Time 6 surveys and some new questions, see Appendix 11 – Questionnaires.

What is Bridge to College?

The students were asked how they would describe the Bridge to College programme to a friend. The student responses were analysed using a process of open coding. Codes were noted and

recurring codes counted. For example, the following answer was coded against Learning, Collaboration, Technology, Fun, and New Friends.

"It's an alternative learning experience that focuses primarily on group work and using technology. Not only is it a fun new perspective on learning, but it's also a great way to make new friends."

164 data points were coded, and these were grouped into 12 overall themes. These themes are shown in Table 40.

Learning	**Fun**	**Confidence**	**New People**	**Trinity/College**	**Atmosphere**
60%	25%	12%	25%	12%	3%
Skills	**Team**	**Technology**	**Creativity**	**Communication**	**Self-Direction**
22%	43%	40%	10%	15%	7%

Table 40: "What is Bridge to College?" Themes

The most popular theme was "Learning", mentioned by 60% of students. "Teamwork" and "Technology" were the next most popular with "Creativity", "Communication Skills" and "Self-Direction" also receiving several mentions. More general statements about "Skills" and "Confidence" were also common. Students also mentioned "Fun", working with "New People", a relaxed "Atmosphere" and that the programme is a taste of third level education.

Programme Impact

This questionnaire also included the set of "Student Impact" questions that was used in the previous surveys. 57 students answered this question, and the results are shown in the Table 41.

n = 57	**Time 7**	**Time 7 Agree %**
Improved my attitude to working as part of a team	4.51	96%
Improved my attitude to education	4.19	84%
Increased my confidence using technology	4.39	91%
Made me feel I would learn better in school as part of a team	3.98	79%
Allowed me to make new friends	4.51	93%
Improved my communication and presentation skills	4.61	98%
Increased my independence	4.53	93%
Increased my confidence around new people	4.61	93%

Table 41: Student Impact Data – Time 7

The levels of positivity at Time 7 are higher than those reported at Times 5 and 6, particularly in the two fields associated with the students experience in formal education. This may be due to

their varied educational experience since leaving school and to the fact that this was a self-selecting group.

6.2.2 Time 7 - Interviews

In March 2019, a series of structured group interviews were carried out with students that had taken part in the Bridge to College programme between the 2011/12 and the 2014/15 academic years. This was between four and seven years after they had taken part in their final workshops on the programme. 53 students participated in the interviews, in groups of between three and five. The recruitment of these students is described in Section 4.3.2 - Time 7.

The topics covered included:

1) Memories from their first visit to Bridge to College (first impressions, team names etc.)
2) What is Bridge to College? (How would you describe the programme to a friend?)
3) Whether or not the programme made a difference to each participant? And if so, how?
4) Did the students learn anything that proved useful afterwards?
5) What was their favourite part of the programme?
6) Transition to third level and their experience in college.

A full set of interview questions, and the rationale for each, is presented in Appendix 13 – Time 7 Interview Questions.

The interviews began by asking students about their memories of their first visit to Bridge to College. The students described initial feelings of awkwardness or nervousness but mostly had happy memories of their time on the programme. Students mentioned friends they first met in Bridge to College and a growing confidence throughout the week as they completed various tasks and got to know their team-mates. Many students remembered the names of the teams they had been part of in Bridge to College and most students remembered which pod their team had worked in on their first visit.

What is Bridge to College?

When asked how they would describe Bridge to College to a friend, the most frequent responses were on the theme of learning, usually the idea that the programme involved a different style of learning to that which they experienced in secondary school.

"It's very focused on peer learning. Instead of a teacher, it's more we got given a task and it was facilitated rather than taught. It was doing things like presentations, things that you don't normally do in school which was nice."

Technical skills, collaboration skills, and communication skills were also mentioned frequently.

"I would say it's a week where you get challenged, like something creative, modelling in groups, creating scratch code, you know, making a video, drafting up a concept, creating a project. Basically, do that while developing loads of soft skills necessary to complete the project, which TYs may not have or be getting elsewhere."

Impact/What did I Learn?

When discussing what impact the programme had on them or what they learned, a number of ideas came up repeatedly. A process of open coding was carried out and the frequency with which each idea was mentioned was recorded. These included increased confidence, particularly around meeting new people, a more positive attitude to teamwork, increased confidence in public speaking, and improved technical skills.

These data are presented in Table 42.

Theme	Mentions
Tech Skills	47%
Self-Direction Skills	32%
Collaboration Skills	49%
Communication / Presentation	43%
Social Skills / New People	40%
Confidence	28%
Creativity	11%

Table 42: Interviews: Impact / What did I learn? - Time 7

In both surveys and interviews, when asked to describe what the Bridge to College programme is, the responses tended towards describing what students do during the programme, i.e., work in teams and use technology. When asked what they learned, skills development was mentioned much more frequently. This suggests that while the students recognise that skills development is an outcome of participation in the programme, they may not see this as the point of the exercise. This may suggest an underlying belief, perhaps created by the students experience or formal

education, that education means acquiring new information rather than developing new skills or attitudes.

Confidence: New People / Social Skills

Many students mentioned increased confidence having completed the Bridge to College programme. Some gave no more specific detail but feeling more comfortable or confident around new people was mentioned frequently:

> *"I used to have no self-confidence at all, very self-conscious. I mean the first day I came in I think I sat down I didn't say two words to anyone … but by the end of that week I could literally talk to anyone."*

> *"As I said my job is very people orientated. I wouldn't have had any sort of ability to start or conduct a conversation, probably wouldn't have even got an interview the way I was. I could barely say hello to me ma never mind like some randomer."*

> *"I didn't think I was gonna cope well in college because I was kind always afraid of being in large groups. But I dunno this kind of showed me that you know you don't have to be afraid of people. If you have an opinion you can voice it."*

Meeting and working with new people is a feature of the Bridge to College programme that was emphasised in the programme re-design (Section 3.3.1 - Student Background). It appears that this experience has long-lasting benefits for the students.

Collaboration Skills

Students said that the experience of working closely with their peers was valuable in that it helped prepare them for working with others in future study or professional scenarios. This included learning to trust their team-mates, a willingness to offer ideas within the team, and learning to listen to other ideas.

> *"I think that this has definitely helped with people skills"*

> *"I used to like hate working as a team, I was one of those people that were like 'Ah I work better on my own, ugh I can't work as a team, I just, it's too hard, yous don't know it.' So there's that. So I became less of an A-hole." (laughter)*

"I'm not afraid to say like oh, I think we should do it that way."

"How to explain yourself or expand on a point you might have. How to operate within a group of people and not feel like you have to be the one that is talking all of the time. How to listen and understanding that you don't have to know everything all of the time and you can learn from other people."

"Practicing in Bridge made doing group work easier in 6th year."

The model of teamwork employed during the programme, and the level of scaffolding provided, seems to be well-judged for these students. This allowed them to enjoy positive experiences of working in a team, and to develop the skills and confidence to collaborate more effectively in other settings.

Communication / Presentation Skills

In addition to communicating effectively within a team, public speaking was another popular theme. This is a source of anxiety, nervousness, and worry for many young people. The Bridge to College programme includes a gradual build up in this area, from just introducing yourself or your team-mates, through to describing your project work at the end of the day, to proposing and discussing your own ideas.

"I used to be so nervous talking in front of a lot of people … And then when I came here I was just like 'Hey everyone's in the same boat as me.' Even like the little things we had to do, stand up and say like our name and our favourite colour and then you gradually built us up from there."

"It was a big advantage, because we got to shake all the nerves here, because we had to present in front of people that we didn't know and it was kind of the same experience when it translated to college, so that helped in a big, big way."

"I had something to say and they were interested and that was awesome. That was like such a confidence boost and then I was just like 'I can talk in front of anybody now.'"

Public speaking was a particular focus of the programme re-design (See Section 3.4.2 - Communication Skills) and it appears that the approach used is effective in helping these students become more confident and capable public speakers.

Technology Skills

Students described how the technical skills they learned in Bridge to College were useful for them in their personal lives and in their studies.

> *"Before Bridge I would have never gone near anything technology-based, making videos etc. I found I did like it and even thought about doing it in college. I even started doing it for myself at home."*

> *"I'd two group projects in the start of the first semester in second year and I, eh it's just, we were just given a topic and we had to present it in some art form … but, eh, we ended up making a video presentation of the topic so we used like Movie Maker and Audacity and all that. We'd have people, like, talking over, like, stop motion animations and all that of the topic we had, like, at hand."*

Learning with technology is prominent throughout the programme design and the tech resources are used so as to allow beginners or more advanced students to develop their skills.

Favourite Part of the Programme

When asked what their favourite memory from Bridge to College was, some students described specific projects they had worked on. The most frequent answers were about the end of day presentations.

> *"Seeing what people came out with was always, like, the highlight of everything. You'd be like, 'ooh, we get to see now!' but at the same time just pray to God that they weren't better than yours." (laughter)*

> *"Making the projects and seeing them at the end was great."*

Some students described the atmosphere as less strict than school and feeling more trust and responsibility.

"We didn't have people standing over our shoulders. We were allowed to do our own thing."

"I felt like I was older, in college or something."

Students enjoyed seeing, and sharing, the tangible outputs of their project work. They also liked the style of facilitation and the feeling of freedom, relative to their school experience. These are features of the Bridge to College that are not typical of a content-heavy, exam-focused formal classroom.

Others mentioned the people they met and the friends they made, many of whom are still in touch years after completing the programme.

"I'd just say the people though. Like, you know for like, everything that was good about it but it comes down to the people you were with that would've been the best part. The friends and everything that you make from it."

Transition to 3rd Level

The final area discussed was attending third level education and how the students' experience in Bridge to College affected that transition. The students were very positive on this point. They were almost unanimous in saying that going to college was easier if you had taken part in the Bridge to College programme. The students' responses on this topic were analysed via an open coding process. Themes were noted and a count was made of any recurring topics.

These themes are presented in Table 43.

Theme	Mentioned by
Tech Skills	13%
Social Skills / New People	30%
Confidence	11%
Collaboration Skills	32%
Self-direction / Leadership	13%
Communication / Presentation	11%
College / Campus Experience	8%

Table 43: Interviews: 3rd Level Transition – Time 7

The students mentioned not being so nervous around new people, confidence in speaking up or asking a question in class, experience with group work or project work, technical skills, and experience leading a team as factors that made third level education easier. They credited Bridge to College with helping them develop that confidence and those skills.

In their own words…

Social Skills / New People / Confidence:

> *"… showing up on the first day [of college] and you're like 'I don't know anyone and no one knows me,' but it was kind of like, I actually remember thinking back to this and going 'Oh I've done this before, it's not going to be that bad.'"*

Self-Direction / Leadership / Confidence:

> *"I think it made me more into kind of a leader like, when you are in a group or something in college and eh you find that everyone is kind of eh, shy and not putting their foot forward to do things and then you're kinda there and you have the experience from Bridge where you're able to kind of say, 'Alright', you know.' I'll take control here, I'll give ideas, I'll get people talking,' or whatever so then it gives you that advantage."*

> *"… that confidence carries through and you're able to participate more in groups and become a leader which is kind of what I'm doing now in college."*

Technology Skills:

> *"… like, we made videos and stuff like that for presentations and it's really handy cause like, it was all fun here and you didn't realise how much you were actually learning cause then when you sat down to do it you were, like, I know how to do all this, like."*

Collaboration / Project Work:

> *"I'm in college now and especially in third year we are getting loads of project work and you've to work together, and I just feel like it's much easier to organise cause I've experience here."*

6.3 Tangential Data - Third Level Education

As in Chapter 5, we will present some findings that emerged during this study and that, though outside the immediate scope of the research questions, may be of interest or suggest avenues for future study.

The Time 5 and 6 surveys included questions on the students' plans regarding third level education and the factors which contributed to their decisions. These are presented in Section 6.3.1. Survey and interview data on the same topic from Time 7 are presented in Section 6.3.2.

6.3.1 Times 5 & 6

How important is it that you go to third level?

The question "How important is it that you go to 3rd level after school?" was answered by 109 students at Time 5 and 228 students at Time 6. For each group, those same students' responses from Times 1 and 2 were collated for comparison purposes. These are presented in Table 44 (Time 5) and Table 45 (Time 6). Each table contains a summary of these data with a 1 representing "Not Important at All" and a 5 representing "Very Important". Responses are grouped according to their response at Time 1 to allow us track changes in responses across different time points.

n = 109	**Time 1**	**Time 2**	**Time 5**
n = 60	5	4.87	4.90
n = 26	4	4.39	4.42
n = 16	3	3.81	3.81
n = 7	2	3.00	3.57
Mean:	4.27	4.47	4.54

Table 44: Importance of Third Level - Time 5

The results at Time 5 are very similar to those reported by these students at Time 2. This suggests that the increases shown between Times 1 and 2 are sustained up to one year after completing the programme. This is similar to the data collected at Time 3 (Section 5.2.2 - Times 1, 2, 3 & 4).

n = 228	**Time 1**	**Time 2**	**Time 6**
n = 130	5	4.88	4.65
n = 68	4	4.28	3.88
n = 11	3	3.8	4
n = 19	2	3.37	3.37
Mean:	4.35	4.52	4.28

Table 45: Importance of Third Level - Time 6

The results at Time 6 show a different pattern than at Time 5. The average "importance" ratings are down a little from those reported by these students at Time 2. This reduction is mostly visible among students who had previously rated going to college as "Important" or "Very Important". Interestingly, the increases made among the 30 students at the lower end of the scale are largely sustained from Time 2 to Time 6.

The different patterns at Times 5 and 6 may be partly explained by the fact that, at Time 6, students are very near the end of their time in secondary school and probably have a clearer idea of whether they will achieve the grades required to attend the university, or the course, they want. At this point, academic attainment may be overtaking aspiration at the primary factor in the students' responses here.

Third Level – Programme Impact

Two questions on this survey asked if the students' participation in the Bridge to College programme impacted their plans for third level education, either in whether to go to third level or not (Table 46), or in what course they would choose to study (Table 47).

	Time 5 (n = 108)	**Time 6** (n = 228)
Yes	48%	30%
Unsure	19%	23%
No	33%	46%

Table 46: Third Level Impact – College or not?

Across the two groups, 36% of the students surveyed said the programme made a difference in their plans to go to college or not. The Time 5 group were significantly more positive on this point than the Time 6 group. Factors which may explain this include: the extra year that has passed since the students took part in the programme, increased access to information and advice on third level education in sixth year, and students having a clearer idea of whether they will achieve the grades to qualify for their preferred courses.

	Time 5 (n = 108)	**Time 6** (n = 228)
Yes	24%	27%
Unsure	24%	20%
No	52%	53%

Table 47: Third Level Impact – What to study?

One in four of the students surveyed said the programme contributed to their decision on what to study. This is consistent at both Times 5 and 6.

For each question, the students were asked to explain their answer. In each case, an open coding exercise was carried out and recurring themes were counted and grouped.

For the question of whether the programme influenced the decision to go to college or not, 10 codes were identified with a total 108 instances noted among the Time 6 cohort. The most common answers related to having gained an insight into college life (mentioned by 24 students) and having enjoyed meeting new people during Bridge to College and wanting to repeat that experience in college (mentioned by 21 students). A positive attitude to teamwork, enjoying learning with technology, a better knowledge of course choices and a sense that college will be fun were also frequently mentioned by students. It seems that getting to experience life on campus for themselves is an important factor in second level students' desire to attend third level, with both social and pedagogical factors being noted by the students. The answers given by the Time 5 group were very similar.

For the question of what to study, two passes through the data were carried out. One was to note any reference to why or how Bridge to College influenced their decision. The second pass was to note which areas of study the students mentioned.

When discussing why or how Bridge to College influenced their decision, 76 instances of 5 codes were found. When discussing which areas of study they were influenced towards by Bridge to College, 66 instances of 6 different codes were noted. There were very similar responses from the Time 5 and Time 6 groups. A breakdown of their combined responses is presented in Table 48.

Why? / How?					
Discovered X	Confirmed I like X	Ruled out X	Confidence	Sharing ideas/stories	
47%	26%	11%	8%	8%	
What?					
Computer Science	Media/ Communications	Education	Social Care	Management/ Business	Drama/ Art
30%	36%	17%	6%	6%	5%

Table 48: College choices - How? What? Times 5 & 6

It appears that discovering an interesting topic or area of study is the most common way in which Bridge to College can influence course choices for students. The course choices here reflect the content of programme with Media and Communications prominent on the Core programme, and there were Return weeks focused on both Computer Science and Education.

Two years after the programme, students continue to report that third level education is important to them and that Bridge to College helped them identify this path, although the links to Bridge to College identified at Time 6 are not as strong as those reported at Time 5.

6.3.2 Time 7

Survey data

The Time 7 survey included the same two questions on third level education that appeared on the Time 5 and 6 surveys:

1) Did your participation in the Bridge to College programme influence your decision to go to college or not?
2) Did your participation in the Bridge to College programme influence your decision on what to study in college?

Table 49 contains a summary of the responses.

n = 57	**College or not?**	**What to study?**
Yes	40%	28%
Unsure	30%	19%
No	30%	53%

Table 49: Third Level Impact – Time 7

The 40% who answered "Yes" to the "College or not" question falls between the responses from Time 5 (48%) and Time 6 (30%). The 28% who answered "Yes" to the "What to study" question is close to the responses at Time 5 and 6: 24% and 27% respectively.

When asked to explain their answers, these students gave similar responses to those surveyed previously. On the question of whether to go to college or not, the most popular responses were getting a taste of/insight into college life or reinforcing an existing desire to attend third level. On the question of what to study, discovering (or confirming) an interest in a particular area was the main reason given with media, communications, and computer science courses mentioned most frequently.

Interview data

In the Time 7 interviews, the same two questions about third level education were discussed.

College or not

Many students felt that they would have progressed to third level with or without their Bridge to College experience.

"I already knew I was going to college."

Some said that the programme reinforced their desire to go to college or that it helped them understand what third level education might really be like.

"I was always the same. It was the next logical step for me, but I didn't really know what that meant."

"I think it was because my parents wanted me to go to college. And I would have done what they said, but it wasn't until Bridge that I knew I actually wanted to go, not just for my parents, but for myself as well."

Some students did highlight the programme, or the increased confidence they gained from it, as an important factor in their progression to third level:

"It definitely gave me the confidence to go to college. If I didn't come here, I'm not really sure if I actually would've went to college"

What to study

On the topic of course choices, most students said it did not have a major impact, either because they knew what they wanted to study from a young age or because, even after completing Transition Year, they still had not decided what they wanted to do:

"I still had no idea."

"Not really, work experience influenced me more."

Some students mentioned that their time with Bridge to College made them feel more confident in terms of pursuing the course they wanted:

"It kind of pushed me as well to kind of say 'I could do veterinary.' So it did push my confidence and my eagerness to do that, what I wanted to do."

Others pointed to specific topics they covered in Bridge to College, e.g., digital media, that led them to pursue further study in these areas.

"It affected my CAO choices. I ended up putting film first on my CAO."

"It made me want to go to Trinity."

"I'm doing teaching now because I kind of figured out here that I wanted to do teaching. And actually you said to me on my first week afterwards I had a bit of trouble with people on my team and you were like 'You should like, you dealt with that so well, you should do teaching, really consider teaching,' And I remember that."

Further exploration of attitudes to third level education among different year groups in secondary school or an examination of the impact of outreach programmes, like Bridge to College, could be of great interest. However, no further analysis will be presented of the data shared in Section 6.3.

6.4 Summary

This chapter presents data collected in the years after students participated in the Bridge to College programme, both in school (Times 5 and 6), and after school or during college (Time 7). These data are relevant to Research Question 2.

RQ2	**Are changes in skill levels/attitudes among Bridge to College students sustained over time?**

The data presented here build upon and reinforce those presented in Chapter 5. At Times 5 and 6, students continue to report a belief that their participation in the programme led to improved skills and increased confidence. They describe the use of these skills in their education, both formal and informal, and their personal lives. This suggests that the gains made by the students during the programme have a long-term impact.

The data collected at Time 7 build on this further. Again, the students continue to report on the positive impact they believe their participation in the programme had on them, describing skills they developed, increased confidence, and how this experience helped them to make the transition from second level to third level education. This suggests that the personal development gained from participating in the programme, as described in Chapter 5, including increased skills and confidence can translate into a more positive experience for the students that do go on to college. They are more confident as they enter this new environment, they are less nervous around new people, they have the collaboration and project skills to participate in group

assignments, and they have the confidence and communication skills to offer an opinion or ask a question. These findings are discussed in detail in the Chapter 7.

7 Discussion & Conclusion

This dissertation describes a non-formal education programme, Bridge to College, that is designed to help students develop 21C skills and confidence. It involves the use of a particular model of social constructivist 21C learning, Bridge21, deployed in the specific setting of an out-of-school education programme based on a university campus.

There is a substantial body of literature highlighting the increasing relevance of 21C learning in modern life, and in education settings in particular, and there have been a range of efforts to develop and integrate social constructivist ideas into education systems, both formal and informal, with varying degrees of success. Problem Statement 1 (PS1) relates to the need for practical and effective approaches to the development of 21C skills. The Bridge to College programme is presented as an example of an effective and practical solution to this problem. Problem Statement 2 (PS2) relates to the fact that most research on the effectiveness of non-formal education tends to be focused on immediate or short-term outputs and outcomes. Based on these problem statements, the following research goals were identified.

RG1: Design a structured non-formal education programme to effectively promote the development of 21C skills. (PS1)

RG2: Develop a deeper understanding of the effectiveness of that programme in developing 21C skills, including an assessment of skills development among participating students, and an exploration of the programme structure to identify key features which support those skills. (PS1)

RG3: Explore the long-term impact of student participation in the non-formal education intervention described in RG1. (PS2)

Chapter 2 contains a detailed literature review focusing on 21C skills, 21C learning, and non-formal education. Chapter 3 presents the author's design of the Bridge to College programme, including the use of the Bridge21 pedagogical model. Chapter 4 describes the research methodology employed in this study, including research methods, data collection and analysis, and considerations around validity and limitations of the research. Chapters 5 and 6 present the findings of this study, both at the time of the programme and in the years after students had participated.

This chapter discusses the findings presented in Chapters 5 and 6 in the context of the literature reviewed in Chapter 2 and, on that basis, seeks to address the aims of this study and answer the following research questions.

RQ1	**Is the Bridge to College programme effective in developing 21C skills in participating students?**
RQ1(a)	**Which features of the programme help promote 21C skills development?**
RQ2	**Are changes in skill levels/attitudes among Bridge to College students sustained over time?**

The literature review highlighted a growing recognition that education systems must adapt to meet the changing needs in modern society, and to help prepare students to thrive in a data-rich, connected world. Non-formal education programmes were identified as an area that can play an important role in both the development and delivery of innovative approaches to teaching and learning.

As discussed in Section 2.3, there is a broad recognition that 21C skills have an increased relevance in modern society and a general consensus about which skills fall under this banner. There are many overlapping definitions of 21C skills, but some key ideas appear consistently. The Ravitz key skills framework includes most of the ideas mentioned in the various 21C skill models reviewed previously but is set apart by the inclusion of a detailed breakdown of the actions and activities that make up each skill category. This level of detail means that the Ravitz framework can be, and was, used to determine the frequency with which each skill was exercised in the course of the programme, and to help determine the students' confidence and skill levels.

Formal education systems have responded to the increased recognition of the need to develop 21C skills with moves to integrate 21C learning approaches into their practice, typically based on social constructivist ideas. As discussed in Section 2.4.4, these systems have had varying degrees of success in this effort. Many countries have been restricted in their progress by factors including crowded curricula, content-focused assessment, and limited training for pre-service or practicing teachers. It has also been reported that social constructivist 21C learning approaches can be ineffective if implemented poorly or if under-scaffolded. For these reasons, there remains a need for practical approaches to social constructivist 21C learning that can be used to support the development of 21C skills while working through challenging content.

The literature review (Section 2.5) considers non-formal education programmes as a possible testing ground and complementary system to formal education. Non-formal education programmes are organised and instructor-led but sit outside the mainstream school system. These programmes are typically more agile than those in the formal system and so can react quickly to emerging needs and deliver relevant programmes for their target learners. NFE programmes have been used to promote 21C skills development, and despite limited academic documentation, there is some evidence of their effectiveness in this area (Knopf et al., 2015). These programmes can complement and support the development of formal education systems.

The Bridge to College programme was re-designed by the author to focus specifically on the development of 21C skills among participating students. The programme structure was adapted, and new content was introduced, to ensure the use of six 21C skills during the four day Core week. There was an increased focus on communication skills and public speaking, new resources were introduced to support creativity and collaboration, and project work was chosen to encourage the use of critical thinking and self-direction skills. All of this was built upon an initial focus on collaboration and communication skills, and on helping students to work together effectively before moving on to challenging project work later in the Core week and in the curriculum-themed Return weeks. The first goal of this research was to design a structured non-formal education programme to effectively promote the development of 21C skills. Bridge to College, as described in Chapter 3, is that programme.

Accordingly, the author hypothesised that the Bridge to College programme, with its particular use of the Bridge21 pedagogical model, could be an effective approach in helping students develop 21C skills and confidence. In addition, a detailed exploration of why the programme was effective was embarked upon, an exploration that also considered which elements of the programme design contributed to the observed/reported effects on participating students. This is the focus of RQ1 and RQ1(a). Related findings are discussed in Section 7.1.

The assessment of NFE programmes is typically immediate or short-term and, as discussed in Section 2.5.4, there is a clear shortage of literature around assessing the longer-term impact of programmes such as Bridge to College. This longitudinal impact is the focus of RQ2, and these findings are discussed in Section 7.2.

7.1 Workshop Data

The findings on the immediate impact of the workshops presented in Chapter 5 have been published (Sullivan et al., 2020). The key points from that paper, with additional discussion, are included in Section 7.1. This includes data related to the development of 21C skills during the Bridge to College programme, analysis of the programme design and its impact on 21C skills development, and answers to the first two research questions, RQ1 and RQ1 (a). The data discussed here were collected at Times 1 and 2, at the start and end of the Bridge to College Core programme, and at Times 3 and 4, at the start and end of Bridge to College Return weeks, typically held about three months after the Core programme.

7.1.1 Skills Development

The findings presented in Chapter 5 show that student confidence in the six key skill areas measured is significantly higher after taking part in the Bridge to College programme, and that these increases remain visible up to three months after participating in the programme. Collaboration and communication skills show the greatest gains among those assessed. As shown in Section 5.1.1, there is some reduction in confidence between Time 2 and Time 3, in the months after completing the Core programme, but following the completion of a second Bridge to College week, student confidence returned to the high levels shown at Time 2. These findings are based on a large number of responses to the quantitative survey questions based on the Ravitz framework, (n = 286) and are backed up by a significant qualitative data set. Analysis of open survey questions and group interview audio reinforces these findings as students described increased confidence, increased skill levels, and becoming more comfortable meeting new people and working in new environments. When Cohen's d is calculated to assess the size of the reported impact of an educational intervention, small effect sizes are typically identified (Hill et al., 2008). In this study, a large effect size was identified in each of the six skill areas. It is perhaps unsurprising that Bridge to College had an effect in this area, given the central role 21C skills play in the programme (see Sections 3.4 and 5.1.3), but the magnitude of this impact is significant. This suggests that the design of the Bridge to College programme is well judged for this student cohort and extremely effective in helping these students to develop a broad set of 21C skills.

Students reported that working and learning with their team was a fundamental part of the Bridge to College experience. Collaboration skills are prominent in the literature on 21C learning and skills development. The programme represents an opportunity for students to learn how to work as

part of a team (Galton et al., 2009; Johnson & Johnson, 1990) with collaboration skills showing a large increase from Time 1 to Time 2. As discussed in Section 5.1.2, qualitative data from both surveys and interviews found that students reported increased confidence in collaboration skills, positive experiences in relation to working with their team, and a positive change in their opinions on whether teamwork is enjoyable, effective, or something they can do well. Many students reported that their positive experience of teamwork with Bridge to College contrasted with their previous experience of teamwork, in school or other settings.

"I never liked teamwork before and now I actually do."

The data suggest that the structured nature of the Bridge to College programme and the initial focus on collaborating to complete creative, engaging tasks before moving on to more challenging, curriculum-based material, created an environment in which the students were able to learn to work well in a team.

Learning with technology is a frequently cited 21C skill and a central element to most models of 21C learning (Fullan & Langworthy, 2014; P21, 2018). In Section 5.1, Bridge to College students reported that learning with technology during the programme was valuable and worthwhile, and reported large increases in confidence and tech skills from Time 1 to Time 2. Qualitative data sources also included frequent mentions of tech skills and learning with technology.

'I used to be really bad with computers but now I can do a lot of things.'

Students reported improved technical skills, a sense of enjoyment in working and learning with technology, and a wish to see more technology used in their everyday education in school. Most students learned to use one or more new pieces of software during the programme, typically multimedia software such as Audacity (a sound editor) or Windows Movie Maker (a video editor). Students were engaging with technology in a way that was active and productive. They were creating digital artefacts rather than using technology to consume content. The nature of the project work on the programme meant that technology was used as a shared object to think with, to work with, and to create with. In creating digital artefacts to express their ideas and demonstrate their understanding, students were engaged in knowledge construction rather than content consumption (Jonassen et al., 1999; Papert, 1993). This is an example of good practice in learning with technology as described by Conole et al (2004).

Shared computer resources are a key element of the Bridge to College programme. The students worked in teams of four or five, sharing two devices, so the Vygotskian idea of a 'more able other' was key to their learning as they worked together and helped each other to complete their project work. This encouraged students to work together and to maintain a shared understanding of their work throughout the project cycle. The development of both collaboration skills and technology skills are aims of this programme so the shared access to these resources was a pragmatic choice and a good example of deploying technology in a social constructivist, learner-centred manner, designed to meet these aims (Mayer, 2010; Roschelle & Teasley, 1995).

Despite the overwhelmingly positive shift in confidence recorded using the 21C skills questionnaire, as reported in Section 5.1.1, not every student reported increased confidence in every skill area. Some variation is to be expected and this suggests that students felt free to report how they felt at each time point without direct reference to their perception of the impact of their participation in the programme, or comparison to the answers they provided at previous time points. This does not detract from the statistically significant, large increases in confidence reported by most students in most skill areas. If asked to directly rate their own improvement or development in an NFE setting, students will often over-estimate their gains (Souto-Otero et al., 2013). The fact that students were asked to rate their confidence at a point in time, rather than asked if they believed their confidence had increased or decreased, is a more reliable indicator of their true beliefs. The clarity of language provided by the Ravitz scale was another strength of this approach, in that it allowed for a consistent understanding of the skills under consideration and helped avoid a scenario in which we use familiar terms to describe slightly different ideas of skills.

The importance of a positive start and the need to create an environment in which students feel comfortable and want to engage with their teams, and with the workshop activities in general, cannot be overstated. This has been highlighted in literature (Blatchford et al., 2005; Eshach, 2007; Johnson & Johnson, 1990; Vuopala, 2010) and is reinforced by the findings in this study. Students need to feel comfortable in a new environment, or with new people, they need to feel safe and confident to speak up and share ideas, they need to learn how to work in a team, to find roles for themselves and to trust their team-mates. The Bridge to College programme in general, the setup and warmup activities on day one, and the choice of projects to initially focus on collaboration and communication skills, are designed to meet these needs. The icebreaker activities and team-building games help students get to know one another, and they encourage students to behave in

a way that is effective within a team (Blatchford et al., 2005; Katzenbach, 2005). Brief whole group discussions are used to highlight the key lessons of each activity. Open brainstorming activities, as described in Section 3.4, are a key feature of this programme design. They help encourage students to share opinions and exercise creativity skills in a non-judgmental, low-risk manner.

The non-formal setting of Bridge to College allowed for the development and implementation of this programme away from some of the restrictions of the formal education system. Social elements of the experience, such as mixing with students from other schools, or not wearing a uniform, created a sense that Bridge to College was something new and outside of the students' experience in school. As described in Section 3.3.1, the programme re-design included a greater mix of students from different schools. This social experience was significant for many of the participating students. The students' first impressions of one another, their initial willingness to engage with the workshop activities, and the creation of a new shared "normality" all occur within the first hour or two of the programme. This has a big impact on the rest of the week, as it is much easier to build on a good start than to recover from a bad one. For this reason, the facilitator and mentors must encourage the students to be open and friendly, must help them to feel comfortable in this unfamiliar setting, and must make it as easy as possible for the students to trust the people around them and to positively engage with the programme. Team selection is carried out to separate students from the same school. Many students mentioned feeling less nervous about meeting new people after completing the programme. Working closely with students from other schools was an exciting and sometimes nerve-wracking opportunity for the participants though. Despite these nerves, working with new people allowed the students a fresh start, to try something new, to take on a different role in a newly formed group, and to leave behind some of the social structures from their day-to-day life in school. This was a chance to be a leader, to be creative, to be funny, to make new friends, and to maybe succeed in an education setting in a different way. These opportunities contributed to the students' positive experience on the programme and allowed Bridge to College to act as a boost to their skills and confidence in a way that was complementary to their experience in school.

An "informal group learning" approach (Slavin, 2010) is used, aiming to create a social interdependence whereby, despite the lack of high stakes assessment or individual rewards, students value their team and their place within it and work to contribute to a successful project. The daily project work is designed and facilitated to encourage participation from each member of

the team. Part of the facilitator's role is to be on hand to help teams discuss issues, make decisions, and manage their project work in a fair and inclusive way.

Grant (2002) considers reflection to be an important aspect of "superior" approaches to project based learning. Each Bridge to College project cycle ends with a reflection activity. This encourages students to think about and articulate their experience of working together and completing their project. During the Core week, the reflection template (Appendix 7 - Team Reflection Sheet) focuses more on collaboration and teamwork than the other skills. This is based on the belief that effective collaboration among the students is the most important element of their experience on the programme and an area where, if students recognised their success in a team setting, they may be more willing to engage in future collaborations and to thrive in those settings.

Some of this comfort in collaborative settings is evident when students return for their second week on the programme. They typically require less help and support to chat, mix, and work with their new team-mates second time around. At Time 3, students reported increased levels of confidence in their collaboration and communication skills.

'Before I would have been shy. Very shy person. I love it now though.'

These Return weeks allowed the students to put the skills they developed on their first Bridge to College experience to good use. They undertook what Claxton called "challenging projects" in various curriculum areas but did so using the 21C skills they had exercised during their Core week (Claxton, 2014).

As discussed in Section 5.1.2, public speaking was frequently mentioned by students as a significant fear at the beginning of the programme but was also mentioned as a key area where students felt they had developed or improved. Communication skills had the lowest confidence levels at Time 1 of the six skills assessed using the 21C skills questionnaire, with the specific scale relating to "presenting their work" ranked lowest within communication skills.

'Before I would have been, like shaking, and forgetting what I'd say.'

This suggests that the management of students' use of communication skills, a significant feature of the new programme design (see Section 3.4.2 - Communication Skills) is well judged. Communication skills are particularly prominent throughout the Core programme, but the level of

scaffolding provided, and the level of input required of students, varies as the students gained experience and confidence with each passing day.

It is clear from this section that the Bridge to College programme was very effective in helping the surveyed students develop a range of 21C skills. This was achieved by allowing the students to exercise those skills in a structured and scaffolded manner, in an environment where they felt comfortable moving beyond their initial comfort zone. A detailed analysis was carried out of how students' use of various 21C skills was structured and organised during Bridge to College. This is discussed in the next section.

7.1.2 Analysis of Programme Design

The research presented in Section 5.1.3 establishes a clear link between the design of the Bridge to College programme, which encourages and supports frequent use of these skills, and the positive outcomes for the participating students. The analysis of the programme design shows that the six key skills measured in the survey were exercised by students throughout each Core week and highlighted the intentional emphasis on certain skills at different times within the programme. Students reported large increases in confidence in all six skill areas assessed.

Communication skills were shown to be used frequently throughout each day of the Core programme. Team presentations happened every day, ranging from introducing themselves and answering questions at the beginning of the week through to proposing, discussing, and defending their own ideas at the end of the week. With each passing day, the presentations required more input from the students, with less support or scaffolding from the facilitator. This process was intended to prevent students becoming overwhelmed while still pushing each person to speak out with their team during each presentation.

The design of the Bridge to College programme, and the use of the social constructivist Bridge21 model, allows for different levels of scaffolding to be provided for students as needed throughout the week. This also allows for increased focus on the use of specific skills on different projects or at certain times of the week (Lawlor et al., 2016). This managed change in scaffolding as students work through the programme allows them to build confidence and develop their skills without pushing them too far too soon. If 21C learning activities are under-scaffolded or "unguided", this can lead to an unsatisfying or ineffective learning experience (Fullan & Langworthy, 2014; Kirschner et al., 2006). The student feedback on their experience with Bridge to College was

overwhelmingly positive, which suggests that the managed reduction in scaffolding during the programme was well-judged for students at this level.

When students took part in Return weeks, they usually required less help with teamwork or technology issues. On these weeks, there was more emphasis on supporting students to take on challenging, curriculum-based projects (Claxton, 2014). This shift in focus from skills to content is a key element of the programme design and a key step in implementing social constructivist ideas in a practical, effective manner. It allows students who are inexperienced with collaborative, technology-mediated, or project-based learning to build up their skills and then apply them to productive, curriculum-focused projects.

7.1.3 Research Questions

RQ1	**Is the Bridge to College programme effective in developing 21C skills in participating students?**

As discussed in the literature review, there is a growing recognition of the value of 21C skills in modern society and, by extension, within education systems. The development of effective approaches to 21C learning has been an increasing priority in both formal and informal education settings. As discussed in Section 2.4, effective approaches to 21C learning must address a range of considerations including initial introductions and team formation, use of technology and resources to support collaboration, creativity, and knowledge construction, and appropriate scaffolding to allow student-led project work to succeed (Johnson & Johnson, 1990; Vygotsky, 1980). The design of the physical space and the use of resources appropriate for the intended style of learning, the emphasis on student presentations of their work, and the use of student reflection instruments are all features that can contribute to positive developments of 21C skills (Condliffe, 2017; Grant, 2002). The structure of the programme must allow students to use, and develop, these skills without becoming overwhelmed (Fullan & Langworthy, 2014). Non-formal education settings possess many of the features conducive to successful implementation of 21C learning but there is a lack of academic study of the implementation, or the effectiveness, of 21C learning in NFE.

This study has shown that the Bridge to College programme is very effective in building students' confidence in all six 21C skills areas covered. Student feedback, both qualitative and quantitative, gathered through questionnaire and interviews, provided strong evidence that participation in Bridge to College led to increased confidence in the use of their 21C skills. It is a pragmatic and

effective implementation of social constructivist ideas and, by extension, can be considered an example of 21C learning done well.

RQ1(a)	Which features of the programme help promote skills development?

Analysis of the design of the Bridge to College Core week has shown that many of the features of the programme encourage students to exercise their 21C skills throughout the four days. The structured nature of the Bridge21 model provides a regular pattern to each day and helps students to find a role within their team. Each new project builds on this experience. The higher level of scaffolding provided at the beginning of the programme allows students to collaborate effectively and make decisions together but the gradual reduction in support encourages them to think critically more often and to take more ownership of their project work. The setup and warm-up phases of the Bridge21 activity model, which include team-building activities and whole group icebreakers, help students to feel comfortable together and to collaborate and communicate effectively. They also provide an opportunity to exercise and discuss good habits of working together. The strong focus on collaboration skills and communication skills in the early days of the programme and the gradual increase in emphasis on other skills before moving on to challenging, curriculum-based material allows the students to move from the medium to the high level on Fullan and Langworthy's (2014) continuum of effective pedagogies. The selection of each project for the four days encourages the use of specific skills, from the early focus on communication and collaboration skills, to the introduction of increased self-direction and creativity on day two, through to the inclusion of critical thinking and analysis on days three and four. The curriculum themed Return weeks further build on this process. Throughout the programme, technology is used in a productive, creative manner, which helps students to develop their technology skills, but also to use the computers as tools for learning, allowing them to access and create digital content. The project-based approach to learning, the "guide on the side" facilitation, the shared access to technology and other resources, the open brainstorming activities, and the regular team presentations are features of the programme which promote the use of specific 21C skills. These approaches to social constructivist ideas are pragmatic in nature, with a focus on sensible implementation within the context of the Bridge to College programme.

The discussion in this section is based on the design of the programme, as described in Chapter 3, and data collected at the time the Bridge to College programme was delivered. The next section

includes discussion of data collected in the years after students had participated in the programme.

7.2 Longitudinal Data

The previous section shows that the Bridge to College programme is effective in helping students develop their 21C skills and confidence. It also demonstrates how the design of the programme, and the structured nature of the Bridge21 learning model, contribute directly to this effect. As discussed in Section 2.5.4, there is a lack of, and a need for, formal research into the long-term impact of NFE programmes on students' skill development. This study directly addresses that need. The data discussed in this section were collected at Times 5, 6, and 7, between one and seven years after students participated in Bridge to College (Figure 14).

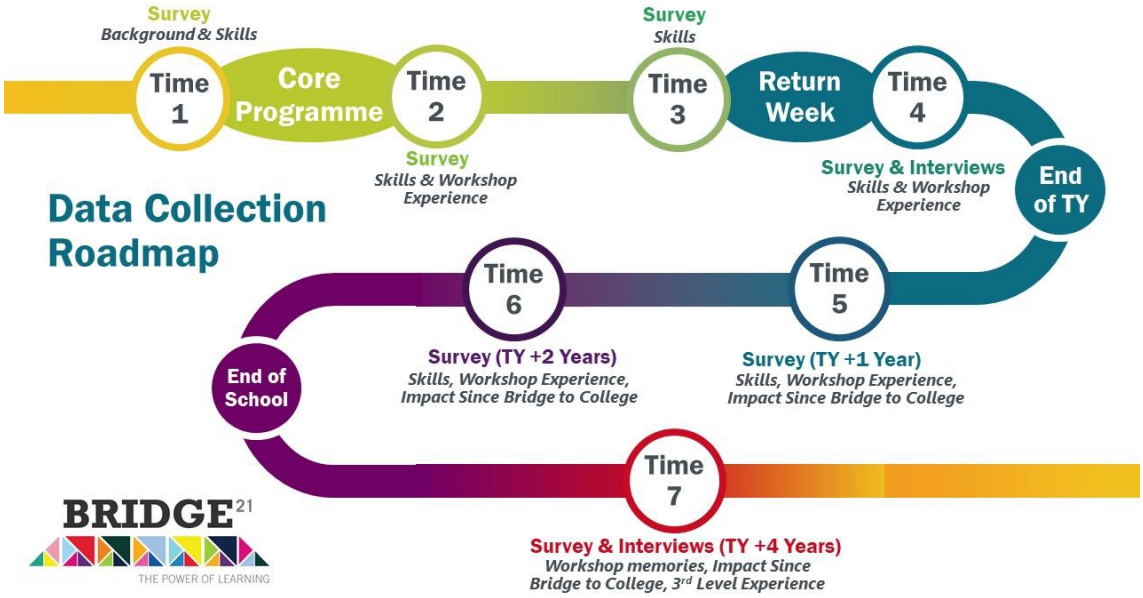


Figure 14: Data Collection Timeline

The findings presented in Chapter 6 show that, in the years after participating in Bridge to College, the surveyed students used and relied upon the skills and confidence they had developed during the programme. The students remained very positive about their experience, describing what they had learned, and sustained changes in their attitudes to meeting new people, collaborative learning, and public speaking. The students frequently referred to the skills they developed on the programme and the impact it had on their lives in school, in college, and in their personal lives, in the years since they took part.

7.2.1 Long Term Impact

The Likert scale questions at Times 5, 6, and 7, which focused on the impact of participation in the programme, elicited overwhelmingly positive responses from the surveyed students (Section 6.1.1). They believed that their participation in Bridge to College had very positive outcomes for them. The scales related to improved attitudes to teamwork, increased confidence with technology, improved communication and presentation skills, and increased confidence in meeting new people all received over 90% agreement at Times 5, 6, and 7. This represents a very strong statement about the sustained impact of the programme, but also serves as a significant set of data to triangulate and reinforce the 21C skills findings discussed in the previous section. These data suggest that the developments in skills and confidence are not only large and statistically significant but are also long lasting.

The general level of agreement across the full set of "programme impact" scales was similar at Times 5 and 6. This was a combined group of over 300 students who were surveyed in school and, while participation in the survey was optional, this was a large sample of the overall Bridge to College cohort. The responses showed a slight drop from the very high agreement levels given at Time 2 by the same students but represent a strong statement about the perceived impact of the programme in the two years after participation.

All of the scales showed high levels of agreement. There were, however, two scales which stood out as generally lower ranked than the others. When asked if their participation in the Bridge to College programme had "improved my attitude to education" or "made me feel I would learn better in school as part of a team", a significant majority of students agreed with these statements, but this was typically in the 70%-80% range rather than the almost unanimous position adopted on the 21C skill scales. It would be of interest to know more about why some students felt doubts around these statements. It may be that some students saw Bridge to College and school as separate experiences and did not foresee an easy or obvious transfer of ideas from one setting to the other. The timing of reform of second level education in Ireland may be a factor in this. Most of these students completed their Junior Certificate education before, or very early in, the phased introduction of the reformed Junior Cycle. As discussed in Section 2.4.4, the new Junior Cycle includes an increased focus on 21C skills development and should encourage increased use of 21C learning pedagogies. However, when asked about their experience in school

during their Senior Cycle, it appears that ideas such as collaborative learning or learning with technology were often absent.

Since Bridge to College

In the Time 5 and 6 surveys, the students were asked about their engagement in collaborative learning or technology-mediated learning activities since their participation in Bridge to College. Only 30% of students reported engaging in teamwork activities in their formal education since completing the programme. Only 21% of students reported the use of ICT in their senior cycle classrooms. This suggests a classroom experience that is individualised, teacher-led, and content-focused. A process of senior cycle reform has begun in Ireland, albeit too late for this cohort. The OECD have described the current Senior Cycle, Leaving Certificate, as rigid, narrow, and not 'preparing students for the future beyond sitting the Leaving Cert' (OECD, 2020). This context may explain why fewer Bridge to College students felt the programme impacted their attitude to education or that collaborative learning could play a significant, positive role in their formal education. The low rates of ICT may be related to the socio-economic profile of the schools whose students participate in the programme, and a possible 'digital divide' or lack of ICT resources in these schools.

The surveyed students did describe significant engagement in collaboration or learning with technology in extra-curricular or non-formal education settings, such as after-school clubs, youth organisations such as ECO-UNESCO, or sports clubs. When asked to describe which ICT tools they had worked with since Bridge to College, presentation software (PowerPoint, Google Slides) or video editing software (Windows Movie Maker, iMovie) were mentioned most often. These are tools that are flexible, widely available, can be used in a wide variety of projects, and they were and are frequently used during the Bridge to College programme. Increased confidence and experience with creating and presenting videos is an outcome of the participation on the Bridge to College programme. Continued use of these skills, outside of the formal classroom, suggests that students enjoyed and valued the experience of developing these skills and sought for this to continue.

> *"Before Bridge I would have never gone near anything technology based, making videos etc. I found I did like it and … even started doing it for myself at home."*

As discussed in Sections 6.1 and 6.2, qualitative data, collected through surveys at Times 5, 6, and 7, further reinforces the idea that these students believe that the Bridge to College programme had a positive, long-term impact on their 21C skills and confidence. When the students were asked at Times 5 and 6 (Section 6.1), if they had learned anything useful during Bridge to College, their response was very positive and the detail they provided gave a strong indication that the development of 21C skills was central to their experience. Technology skills were the most frequently cited "useful" skills, closely followed by collaboration and communication skills.

When students were asked at Time 7 (Section 6.2.1), how they would describe the Bridge to College programme to a friend, many students made statements about learning, including how they learn or new ways of learning.

"It's an introduction to non-formal education."

"It's learning through a range of different methodologies."

"I didn't think it felt like learning, it was enjoyable."

References to teamwork and learning with technology, were also frequent, and there were statements about skills and confidence in general.

"It's a way of learning about technology."

"It's very focused on peer learning."

It is clear from these longitudinal survey data that, in the years after completing Bridge to College, the students' beliefs about the long-term impact of their participation in the programme align well with intended aims and outcomes of the programme design. The out-of-school context may have limited the students' beliefs in how their experience on Bridge to College was relevant to their secondary school education, but it was a key factor in creating the conditions that allowed them to engage with the full breadth of experiences, social, technical, and personal, provided by the programme. These ideas were further explored in group interviews at Time 7. As discussed in Section 4.3.4, students were invited, by email or via social media posts, to take part in interviews between four and seven years after completing the programme.

After School – Time 7 Interviews

The data collected in student interviews at Time 7 further reinforce and build on the findings presented previously. The group of students surveyed or interviewed at Time 7 were unique among the overall data set for this study in that they had finished secondary school and had, in most cases, gone on to third level education.

In describing what they believed the programme to be, students spoke about new ways of learning, working in teams and using technology. When asked about the impact the programme had on them, their answers were largely focused on specific 21C skills, improved social skills, or feeling more comfortable around new people and general statements about increased confidence. This offers further evidence that the development of 21C skills is a significant outcome of participation in the Bridge to College programme and that this effect is a long-lasting one.

Meeting and working with students from other schools was an important part of the Bridge to College experience for all participants. Becoming comfortable, or feeling less nervous, around new people was mentioned as a positive outcome at each time point and was also present at Time 7. Students referred to feeling more confident going into situations where they would meet, collaborate with, or speak to new people. They also referred to the lasting friendships they had formed. Just over half of the students surveyed at Times 5 and 6 said they were still in touch with friends from Bridge to College sometimes or often. It seems that many Bridge to College friendships had remained active and stable, up to seven years after completing the programme.

"Socially now all my friends are those I met in Bridge."

The friendships made during the programme were often mentioned as a favourite aspect of the whole experience. The belief that new people can become new friends was cited as a source of increased confidence when entering new situations, such as starting a new job or going to college.

When asked about college life, in the context of their experience with Bridge to College, the students reported very strongly that many of the skills they had gained on the programme directly contributed to a smoother transition to third level education. The students referenced meeting new people on their first day of Bridge to College as a helpful memory as they began their courses at third level. Several students stated that the group work they undertook at third level was easier because they had learned to work as part of a team, and that they often took on leadership roles for this reason. Improved, or more relevant, technical skills were also mentioned as a direct

benefit that gave them an advantage at third level. These are relevant and valuable skills and experiences that help prepare students to positively engage and succeed in higher education and beyond. Raising the educational aspirations of the participating students was one of the founding aims of the Bridge to College programme. This feedback indicates that the re-designed programme goes beyond this by helping students to succeed in a third level environment. This suggests that the impact of participating in Bridge to College is substantial in the long term and has a strongly positive impact on students' ongoing experience of formal education.

This finding on the transition to third level education and the relevance of Bridge to College in that context is a good example of the benefit of a mixed methods research approach. This topic emerged organically in the first group interviews and became part of the interview plan for later conversations. It was not originally considered as an aim of the programme or as a topic for this study but it as a clear, practical benefit of the skills developed and experience gained for the students surveyed. The combination of the pedagogical approach employed, the structure of the programme, and the mixed out-of-school setting all contribute to this outcome. This finding would not have emerged based solely on the quantitative data collected but, without those data, we would have far less confidence in describing the gains made by students participating in the programme, and how these feed into experiences such as the transition to third level education.

7.2.2 Research Question

RQ2	**Are changes in skill levels/attitudes among Bridge to College students sustained over time?**

As discussed in Section 2.5, there is a general shortage of literature around the effectiveness of 21C skills development in non-formal education, and the literature that is available tends to be focused on immediate or short-term outcomes (Moyer, 2016). There is very little research into the long term impact of NFE programmes and their impact in terms of participants 21C skills and confidence (Decker et al., 2016).

This study has shown that the Bridge to College programme is very effective in building students' confidence in all six 21C skills covered and that these changes are sustained over several years after taking part in the programme. Student feedback, both qualitative and quantitative, gathered through questionnaires and interviews held between one and seven years after completing the programme, provides strong evidence to support this claim.

Student surveys administered one year or two years after the programme, while the students were still in school, showed a strong belief among students that they had gained experience and developed 21C skills that had set them up to continue to exercise and build those skills, both inside and outside of the formal classroom. In surveys and interviews carried out after students had finished school, they described how they believed the programme helped them develop 21C skills and explained the positive impact that those skills, and the experience of taking part in Bridge to College, had on their lives both personally and in formal education, particularly around the transition from secondary to third level education.

7.3 Contributions

Having answered the research questions, the primary contributions of this study are presented below.

7.3.1 The Design of a 21C Skills Programme (C1)

The first goal of this research (RG1) was the design of a structured non-formal education programme to effectively promote the development of 21C skills. The Bridge to College programme, a pre-existing NFE programme, was re-designed by the author to focus on the development of 21C skills. It is this new programme design that is described and analysed in this study and led to the various outcomes reported. This new design retained and built upon existing programme features, while adding many new elements including structural changes, updated content, and new resources, all designed to increase students' 21C skills and confidence.

The new design of that programme, as described in Chapter 3 - Design of the Bridge to College Programme, is a significant contribution from this study. This thesis contributes to the field by verifying the effectiveness of the programme in helping students develop 21C skills, and by describing the features of the programme, and how they build upon one another to support the students' learning in this area. The Bridge21 model, and its implementation in this particular non-formal education setting are described, and the affordances of this approach are shown to enable the style of social constructivist learning required to allow students to develop their 21C skills and confidence.

The key features of the programme are described in Chapter 3 along with discussion of the programme content, and how it is structured to emphasise and support the use of specific 21C skills. The programme design includes many of the features of effective social constructivist 21C

learning as described in the literature review and addresses many of the concerns or drawbacks associated with these approaches. The structure of the programme week, the focus on particular skills at different times, the choice of workshop resources and technologies, and the varying levels of scaffolding provided are all significant factors in helping students engage with the re-designed programme and develop their 21C skills and confidence.

7.3.2 An Effective Programme for Skills Development (C2)

The second goal of the research (RG2) was to gain a deeper understanding of the effectiveness of the Bridge to College programme in developing 21C skills, including an assessment of skills development among participating students, and an exploration of the programme structure to identify key features which support those skills.

The findings based on the 21C skills questionnaire show that students were significantly more confident in using all six 21C skills following their participation in the Bridge to College programme, with a large effect size present for the increase in confidence in each area (Section 5.1). The qualitative data reinforced these findings and helped identify the reasons for this impact. Surveyed students had an overwhelmingly positive experience on the Bridge to College programme, describing an environment where they could try new things and exercise their 21C skills in a way that would have been more challenging in school or another educational setting. Students identified collaboration, learning with technology, and project-based learning as key elements of the programme that contributed directly to their learning and skills development.

This research also provides a detailed analysis of how and why the Bridge to College approach impacted the surveyed students' confidence across a range of 21C skills. Section 5.1.3 presents an analysis of when and how various skills were exercised throughout the programme. The initial focus on collaboration and communication skills highlighted in this analysis, and the gradual introduction of self-direction and critical thinking skills, are key features of the Bridge to College programme and ideas that should be considered when introducing 21C learning approaches in other settings.

This is a significant contribution to the field in that it provides an insight into how effective a short-term intervention, such as the Bridge to College programme, can be in helping students develop skills and confidence. It also demonstrates that an understanding of how and why the programme is effective can help educators plan and deliver effective 21C learning experiences in both formal

and informal settings. It is also a clear indicator that non-formal education can play a role in the development of approaches for use in formal education and can serve as a complementary system, offering a flexibility of focus and diversity of opportunity that formal systems may struggle to generate.

7.3.3 Long-term Impact of an Out-of-School Education Intervention (C3)

The third goal of this research (RG3) was to explore the long-term impact of student participation in the Bridge to College programme. This contribution builds upon C1 and C2 in demonstrating that the 21C skills developed among Bridge to College students remain present and continue to benefit the students in the years after their participation in the programme.

In Section 6.1, data collected from students two years after they completed the programme show the students reporting on the ways in which they gained from participation in Bridge to College. This included, among other things, improved confidence and skill levels. In Section 6.2, students between four and seven years out from Bridge to College describe their memories of the programme and the impact it had on them, including as they progressed through secondary school and into third level education.

Long-term assessments of the impact on non-formal education programmes are often difficult to implement due to turnover of both participants and programme staff and the fact that reports associated with project funding are often focused on short-term outputs and outcomes. The stability and consistency of the Bridge to College programme during the years covered by this study allowed for this longitudinal assessment to take place. This is a valuable contribution to the field, both in directly assessing the long-term impact of one non-formal education programme, and in demonstrating the possible long-term impact of other short short-term educational interventions, while highlighting the need for further research in this area.

To present and fully situate the findings and contributions of this study, there are limitations that must be acknowledged. These are presented in the next section.

7.4 Validity and Limitations

This study involved the examination and analysis of a complex social phenomenon. This was undertaken thoughtfully and carefully, in an attempt to collect data and draw conclusions that were fair and accurate. A pragmatic approach was adopted throughout this study, focusing on what was possible at each point in the process. Several steps were taken to ensure validity and

minimise bias and it was an aim of the researcher that the findings of the study would have relevance beyond the specific case presented, as part of a wider conversation on 21C learning and 21C skills in formal or non-formal settings, or both. Various limitations of this study, and the steps taken to address these limitations, are discussed in this section.

One strength of this study is the large number of participating students, and the consistency of feedback across this cohort. Over 1,250 students completed surveys at Times 1 and 2, content analysis was carried out on over 600 Time 2 survey responses, and over 300 students provided longitudinal data via surveys or interviews. Across each data set, the development of 21C skills was highlighted, whether this was directly asked or not. A clear pattern was visible with certain skill sets (collaboration, communication, and learning with technology) identified most frequently, and as those in which students made the greatest and most sustained gains.

Researcher bias was a risk that was managed throughout this study. The researcher was the lead facilitator on the programme under investigation and began this study with an inherent belief in the value of the programme. This was a necessity in the design and delivery of the programme but had to be set aside in examining and evaluating it. Care was taken to use, or create, data collection instruments that were fair and unbiased and, in introducing the questionnaires, emphasis was always placed on the importance of honest responses and the value of critical feedback, where appropriate. In the interviews at Time 7, participants were encouraged to speak freely. In both cases, there were examples of negative or neutral student feedback, (e.g., reduced confidence in some skills at Time 2 or stating that Bridge to College had little or no impact on their decision to go to third level education or which course to pursue) which suggests that students felt free to answer honestly. The student interviews at Time 4 were carried out by another researcher and this feedback was in line with the various data sets collected. This suggests that the researcher was largely successful in remaining neutral in the data collection process. It may have provided increased impartiality if the data collection could have been carried out completely independently of the programme facilitator, but this was not possible due to limits in staffing and time, so the approach taken was the best practical option.

In analysing the various data collected, the use of mixed methods for data collection provided some mitigation against researcher bias. If findings were based solely on content analysis of qualitative data, it could be argued that potential researcher bias was a significant weakness of the study. The fact that the findings from the qualitative data were reflective of the findings from the

quantitative data collected, and the data generated from the review of the programme design, suggests a clear and reliable narrative. In addition to this, one significant piece of data analysis was carried out by another researcher to help eliminate, or identify, bias. The findings from this peer analysis were in line with similar work carried out by the author and generally consistent with the data collected at other times. This suggests that the author was able to minimise any personal biases during the analysis process and that the findings can be seen as a fair and accurate representation of the participating students' feedback. Peer analysis of more data would have added to the rigour of this study but, as with the data collection, the author was required to carry out the bulk of this process and use any additional support in an opportunistic and complementary manner.

The data discussed here were exclusively based on student self-reporting. Additional sources of data that were considered, but ultimately rejected, include peer assessment, skills tests, or the use of a facilitator observation protocol. Peer assessment was rejected as the author believed it would be unreliable and may have distracted the students from their own experience and their focus on growing and learning with their team. Skills tests were deemed too time-consuming for use in this setting. Facilitator observation would not have been practical as the facilitator was focused on the delivery of the programme throughout each week. For these reasons, student self-declaration was the sole source of data for this study, but this still allowed for a large and varied data set to be assembled.

Student self-declaration is one of five methods of evaluating non-formal education programmes listed by Colardyn and Bjornavold (2004). In the context of this study, a large group of students was surveyed and interviewed, individually and in groups, at various time points but nonetheless, each one was only asked about themselves and their own experience of the programme. One concern is that they may have over-estimated the impact of their participation in the programme, or credited personal development, which may be based on a broader set of experiences, solely to Bridge to College. This has been observed with self-reporting in other non-formal education programmes (Souto-Otero et al., 2013). Observation is another method listed.

The researcher was not a neutral observer of the delivery of the Bridge to College programme but, while collecting and analysing data, served to verify certain details and identify data that seemed plausible or otherwise. In this sense, the researcher's closeness to the project under examination, which carried a risk of bias, also allowed for the deep understanding of the programme held by the

author to contribute in a positive manner. The perspective and judgement of the researcher is a feature of evaluative case study research (Zainal, 2007). Researcher bias cannot be eliminated completely but it is reasonable to note that the likely presence of this bias is acknowledged in this study, and that steps, such as data triangulation and peer validation, have been taken to minimise its impact so that the closeness of the researcher to the subject of this study can, in certain ways, be a strength of the study (Anderson & Shattuck, 2012; Greene, 2014).

Possible self-selection bias among participants must also be acknowledged, particularly among the Time 7 participants. This group responded to an email request or social media post to take part in the surveys or interviews. As a result, this was a smaller group than was surveyed at Times 5 or 6. This attrition is typical of longitudinal studies and one must be wary of self-selection bias in any data collected from this group (Chan et al., 2014). There was possible evidence of this bias in that the Time 7 group rated the impact of their participation in Bridge to College slightly higher than the groups at Times 5 or 6. This does not invalidate the data collected at Time 7, but it is a factor to consider as those findings are evaluated. Indeed, when asked about the impact of their participation in Bridge to College on their decision to attend third level education or not, or on what to study, there were no differences between the cohorts at Times 5, 6, and 7.

In considering the validity of this study, the presence of Yin's (2014) features of quality was sought. As discussed in Section 4.6, Yin highlights the importance of triangulation using multiple sources of data, the identification of links within the various data gathered, the potential to draw general conclusions from the specific case studied, and that the procedures followed in the study are documented and can be replicated. These features are all present and applicable to this study. Creswell (2003) also suggests several approaches to ensuring validity in a study such as this. As with Yin, triangulation is suggested as the primary method of ensuring validity and this is certainly present in this study. Three forms of triangulation were used in the research undertaken. Methodological triangulation was ensured by using mixed methods, including qualitative and quantitative data collection. Data triangulation was achieved through the analysis of data from different year groups, different school groups, and data collected at different points in time. When possible, investigator triangulation was also used to reinforce the work done by the author in collecting and analysing data. Creswell also identifies peer-validation, the presentation of negative findings, prolonged time in the field, and clarification of researcher bias as being valuable in

ensuring the validity of any research study. The presence of each of these in this study provides good reason to have faith in the methods used and the findings produced.

There are clear limitations to this study which have been presented here. The steps taken to address them and make the best use of the data and resources available, were described in Section 4.6.1. A pragmatic outlook, as described in Section 4.1.1, focusing on what was possible rather than what was perfect, was appropriate and necessary, but some strong evidence has emerged, and reliable findings have been reached. The degree to which these findings can be transferred to other settings is discussed in the next section.

7.4.1 Transferability/Generalisation

One limitation of case study methodologies is that it can be difficult to generalise from a single case or a small sample (Tellis, 1997; Zainal, 2007). The primary aims of this study involve understanding the case in question, and that some aspects of the programme may not be easily replicable. That does not prevent aspects of the study and the findings from transferring to other settings or informing wider conversations.

The specific setting for this study is one factor to consider in judging the transferability of the programme, and the related findings. The Bridge to College programme takes place in a unique, custom-designed learning space in the author's university. It is designed to support the Bridge21 model, with shared access to computers and collaborative resources such as whiteboards and team workspaces. The campus location, in the city centre, is a new place to visit and learn and is an exciting opportunity for the young students. All of the students participating in this study experienced the Bridge to College programme in this setting, and many, at Times 5 and 6, identified the college setting and their "college experience" as a factor in encouraging them to pursue third level education.

> *"There's always that third level education influence from the environment you're in, you've left school and are somewhere new, it's like something in the back of your mind that you might not be always thinking of it, you're part of something bigger."*

Similarly, all of the students taking part in Bridge to College during the years covered by this study worked with the same lead facilitator, the author of this study. This helped provide a consistency of experience across several years. The facilitator had full control over each day of the

programme, without set class periods or break times. This programme also allowed students from different schools to mix and work together. These are aspects that may not be easily replicated within a single school or education programme.

This study sought to derive analytic generalisations (Yin, 2014) based on the results and findings that contributed to determining if, and to what degree, participation in the Bridge to College programme impacted students' skills and confidence (RQ1). The significant data sets gathered and analysed ensure that sufficient information was available to present an in-depth picture of the intervention and the students' perception of its impact on them. This allows for a degree of confidence in making inferences about the effectiveness of the programme, and the applicability of the findings in other educational settings.

Bassey (1999) argues that "fuzzy" generalisation – identifying what is possible or likely given a set of circumstances similar to those in the case study – should be the aim of any educational case study. The fact that short, focused programmes such as Bridge to College can have such a dramatic impact on students' skills and confidence levels can be instructive in a range of education settings. This could help inform the design of education programmes in formal settings to include dedicated 21C skills sessions, or to allow time for students to take part in non-formal programmes, such as Bridge to College.

The design of the programme content, with a particular focus on certain skills early in the experience, is one aspect that is relevant to a range of educational settings. Allowing students to build up their collaboration and communication skills before moving on to more challenging project content leads to very positive outcomes for Bridge to College students. This is an idea that has relevance in both formal education and other non-formal settings where there is a focus on 21C skills development.

The long-term impact of this programme on the participating students is a finding that may be relevant in other settings. There is a general shortage of longitudinal studies on NFE programmes, and this study suggests that their long-term impact can be significant. This is something to consider for those that create and deliver NFE programmes, and the organisations and individuals that provide support or funding for them. If we wish to gain an understanding of the long-term impact of NFE programmes, a greater level of stability than is often currently present, sustained funding, and continued research, will be required.

There are many unique or specific features that make up a programme such as Bridge to College and it will never be possible to perfectly recreate the experience described in the case study but it is clear that there are many aspects of the case that can be replicated in, or transferred to, other educational settings. Examples of this would include the use of the Bridge21 model, the initial focus on collaboration and communication skills, working with students from several schools together, shared use of technology, use of shared whiteboards to support collaboration and creativity, having a single facilitator deliver the programme from start to finish, the varied focus on certain skills throughout the programme, and the gradual reduction in scaffolding as students' confidence and skill levels grow. Some of this may be further explored in future work on this project.

7.5 Future Work

The Bridge to College programme is an ongoing initiative and research is continuing into various aspects of the programme and its impact. Recently, the programme has expanded to include a second location, off campus and outside the city centre, and a new team of facilitators. This will allow for the exploration of the level of impact that a certain location, or facilitator, has on students' experience of the programme.

For the 2020/21 academic year, due to Covid 19 restrictions, the majority of the Bridge to College programme was delivered online. The use of Zoom breakout rooms and shared online whiteboards allowed for many pedagogical aspects of the programme to be maintained in this virtual setting. This is an area rich in possibilities for further study, both in exploring the experience of the students during, and after, participating in the programme, and in contributing to the development of best practice for remote teaching and learning.

In this study, various measures of 21C skills including peer assessment, skills tests, or facilitator observation protocols were considered but ultimately rejected. It may be possible to use one or more of these strategies with future Bridge to College cohorts. Another area to consider during the programme is the period between Times 2 and 3 in which student skill levels drop from the high levels of Time 2. Smaller interventions, in school or as part of the programme, could help students to exercise and maintain their 21C skills outside of the main Bridge to College weeks. Student leadership projects or after-school drop-in activities may be options in this area.

When students in this study were asked about their use of ICT in school or their participation in collaborative learning in their Senior Cycle classes, many students reported an absence of both. This may be representative of second level schools across Ireland, or it may be that the socio-economic profile of these schools is a factor. A better understanding in this area would be relevant to any plan to introduce 21C skills into formal education and is worthy of further research.

Of the students participating in Bridge to College during the years of this study, around 50% took part in a Return week. This was an opportunity to build upon the skills and experience gained during their Core week and engage in challenging, curriculum-based project work. The long-term impact of completing two Bridge to College weeks rather than just one is a topic worth exploring. Is it best to have a smaller group of students take part in a two-week programme? Or do students gain most of what they will gain during their Core week? Are the gains more sustained among students who complete a Return week? This information would inform the future design of the Bridge to College programme and offer insights into NFE and skills development education more broadly.

Some avenues of research were initially explored in this study but eventually set aside as beyond the scope of the case study. These tangential data were presented in Section 5.2 (Times 1, 2, 3 & 4) and Section 6.3 (Times 5, 6 & 7). These initial findings are discussed briefly in the next section. They offer further possibilities for future research.

7.5.1 Tangential Data

Student Subgroups

This study featured a large student cohort, and this allowed the researcher to consider sub-dividing this group and making comparisons between various sub-groups. This avenue was initially explored, and findings included:

- Lower skill levels reported by students in DEIS schools (when compared with participating Non-DEIS students).
- Girls initially reported lower skill levels than boys.
    - Girls then closed this gap significantly during the programme.
- Students were not selected for Return weeks based on pre-existing skill levels.

Each of these findings could be part of further studies. One particular area of interest would be to collect and analyse additional qualitative data at Time 1 to gain a better understanding of why

some students gain more from participation in the Bridge to College programme than others. This could be valuable in assigning limited programme places to the students who would benefit most from the opportunity.

Third Level Education

A founding aim of the Bridge to College programme was to raise the educational aspirations of participating students. By spending time on campus, and enjoying a positive educational experience, it was hoped that students would be motivated to remain engaged in their secondary school education and work towards a goal of attending university.

The data related to third level education showed that many students had some existing desire to go to third level education before they came to Bridge to College. For many undecided students, participation in the programme served to increase their belief in the importance of going to college, and the likelihood that they would do so. For others, the programme reinforced an existing desire to go to college or helped them make decisions about which courses to study.

At Times 5, 6, and 7, students re-iterated that the impact of the programme in this area was often to reinforce an existing desire to go to third level and, particularly in relation to subjects that featured directly in the programme content, help students discover an interest in, or aptitude for, a particular area of study.

These findings suggest a link between the skills and experience gained during the Bridge to College programme and raised aspirations, or increased confidence in decision-making, related to third level education. This is an area worth further investigation.

7.6 Conclusion

The thesis presented a description of a particular approach to the development of 21 skills in an out-of-school setting, the Bridge to College programme, an investigation into the impact of participation in the programme on students' 21C skills and confidence, and a longitudinal review of the sustained impact of this skills development in the years after Bridge to College.

The results of the study align with, and reinforce, the existing literature around 21C skills and 21C learning, and found that when social constructivist ideas are implemented in a structured and scaffolded manner, they can be very effective in helping students develop their skills and confidence. The programme design avoids the documented drawbacks of 21C learning by

providing appropriate scaffolding and support for the participating students, and by using technology in a shared, productive manner (Fullan & Langworthy, 2014; Kirschner et al., 2006). The initial focus on collaboration skills as suggested by Johnson and Johnson (1990), the gradual build-up from beginner to advanced level 21C learning (Fullan & Langworthy, 2014), and the challenging, curriculum-based content in the Return weeks (Claxton, 2014), are all examples of best practice in 21C learning present in the design of the Bridge to College programme. The large impact on 21C skills reported by the students highlights the effectiveness of these approaches.

The longitudinal aspect of the study demonstrated that the benefits of short-term interventions, such the Bridge to College programme, can be significant and long-lasting. This is an area that is under-researched and may have significant value in both formal in non-formal education settings (Moyer, 2016).

This chapter presented discussion of the findings of this study (Chapters 5 and 6) in the context of the Literature Review (Chapter 2), Design of the Bridge to College Programme (Chapter 3), and Methodology (Chapter 4), and posits answers to the research questions set out in Chapter 1. Discussion of the contributions of the study, and the validity and limitations of the research, are also presented here along with possible avenues for future research in this area.

RQ1	**Is the Bridge to College programme effective in developing 21C skills in participating students?**
RQ1(a)	**Which features of the programme help promote skills development?**

In addressing RQ1, data presented in Chapter 5 show a large increase in student confidence in six 21C skills. These data are supported by qualitative sources in which students describe the skills they used and developed during the Bridge to College programme. This provides strong evidence that the Bridge to College programme is effective in developing 21C skills in participating students.

Analysis of the design of Bridge to College shows that the use of 21C skills is embedded throughout the programme, and that the positive outcomes for students in this area are a direct result of this. The emphasis on specific skills at different times throughout the Core programme, the use of technology to be productive and creative, and the gradual build towards challenging curriculum-based project work are significant parts of this process. The project-based approach to learning, the style of facilitation, the shared access to technology and other resources, the open brainstorming activities, and the regular team presentations are other features of the programme

which promote the use of specific 21C skills. These are pragmatic approaches to implementing social constructivist ideas and contribute to an effective 21C learning experience.

RQ2	**Are changes in skill levels/attitudes among Bridge to College students sustained over time?**

In addressing RQ2, the data presented in Chapter 6 show that students reported sustained gains in skills and confidence following their participation in the Bridge to College programme. This was evident in their positive engagement in collaborative and technology-mediated learning activities during their remaining years in secondary school. They reported that transition to third level education was an area where the skills and experience gained during Bridge to College were particularly relevant and valuable.

The case study methodology employed in this study and the mixed methods used to collect and analyse data allow for a level of confidence in the findings presented here. There are limitations to the study, and these have been acknowledged, considered and, where possible, minimised through various steps including data triangulation and peer analysis. There are many possible options to consider for continued or additional research in this area, but this study has answered the research questions, successfully met the research aims set out in Chapter 1, and confirmed the related hypothesis.

The Bridge to College programme is a framework for developing 21C skills that is pragmatic, effective, and has a long-lasting impact.

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Appendices

Appendix 1 – Bridge21 Research

Researcher	Summary
Dr. John Lawlor	Research carried out in the early years of the Bridge to College programme included the establishment of the programme, the development of the Bridge21 model and exploration of the potential for this approach to foster intrinsic motivation among participating students (Lawlor, 2016; Lawlor et al., 2018; Lawlor et al., 2016).
Dr. Claire Conneely	Dr. Conneely's research focused on the adaptation of the Bridge21 model for use in formal education, particularly second level classrooms. This involved working with 160 teachers across 16 Dublin schools (Conneely, 2018; Conneely et al., 2015). This work laid the foundations for the establishment of a Postgraduate Certificate in 21C Teaching and Learning, based in the School of Education in Trinity College Dublin.
Dr. Aibhín Bray	Dr. Bray's research explored the use of the Bridge21 model for mathematics education. This included a system of classification for technology interventions in mathematics education, a set of design heuristics for collaborative, contextual mathematics activities and the development and evaluation of a selection of mathematics education activities (Bray, 2015).
Dr. Sharon Kearney	Dr. Kearney's research focused on the use of the Bridge21 model in English education. This included an exploration of how and why this approach impacts students' attitudes, the development of a validated quantitative tool to quickly measure students' attitudes to working and learning English in this way, and the development of several "Bridge21 "activity plans for teaching English (Kearney, 2018).
Dr. Lorraine Fisher	Dr. Fisher's research explored the use of the Bridge21 model in teacher professional development, particularly in the area of Computer Science (CS) education. Her findings included that this approach, as used in the Postgraduate Certificate in 21C Teaching and Learning and in informal, non-certified PD workshops, was effective in helping teachers learn CS

	concepts (Fisher, 2018). These teachers reported an increase in engagement among their students through the use of the Bridge21 model.
Ms. Grace Lawlor and Dr. Jake Byrne	The use of the Bridge21 model in Computer Science has been extensively explored through a series of education programmes for second level students. Dr. Byrne explored the use of a hackathon-style approach to teach CS and to promote careers in computing (Byrne, O'Sullivan, & Sullivan, 2017). Findings included increased motivation and self-efficacy among participating students. Ms. Lawlor's research focused on the issue of female under-representation in CS courses and the wider tech industry. This included the delivery of a female-only CS programme for second level students, CodePlus. Findings showed a significant positive impact on students' attitudes towards and intentions to studying CS (Lawlor, Byrne, & Tangney, 2020).
Mr. Ciarán Bauer	Mr. Bauer's research explored the use of the Bridge21 model for second language acquisition. This included the use of computer-mediated communication tools to allow students connect with native speakers of their target language and to collaborate remotely on project work (Bauer, Devitt, & Tangney, 2015). Findings suggested that students were able to collaborate effectively and displayed increased communicative competence in their target language.

Appendix 2 – NFE & Bridge to College

The Bridge to College programme includes many typical features of NFE: it is process-oriented, learner centred, and focuses on learning by doing. However, it is in a formal setting in many ways too: it is held in a dedicated, on-campus, learning space during school hours, participation is optional but not open to all, it is led by full-time professional educators, and the experience is designed similarly for the whole group rather than being individually tailored. Student recruitment takes place through their school (see Appendix 3 – Student Background and Selection) and the

programme aims to directly address the formal education system focus on content by focusing on 21C skills. This is in line with Hoppers' (2006) description of NFE. It is a short-term intervention and not directly aligned with formal education policies or curricula, but it aims to boost students' 21C skills and raise students' aspirations to thrive within the formal system (Yasunaga, 2014). Lawlor (2016) described the Bridge to College programme as a semi-formal learning environment. This could be seen as a type of NFE which is aligned with, and complementary to, formal education but takes place away from school.

NFE programmes that promote skills development often include regular use of those skills within the programme content. They can involve students engaging in active learning, collaborating to construct knowledge for themselves, and reflecting on their work and their learning (Moyer, 2016). All of these features are present within the Bridge to College programme.

Eshach (2007) raised several concerns about the limitations of NFE programmes. These include students feeling nervous in a new environment, the facilitator not knowing the students or having the chance to build a trusting relationship with them, and the novelty of a short-term intervention potentially making it difficult to assess whether or not the programme has any real impact on the participating students. The design of the Bridge to College programme goes some way towards addressing each of these concerns. In recruiting students, the facilitator will visit most of the participating schools to introduce the programme in person. The early emphasis on icebreakers and team-building activities helps students feel more relaxed and also allows the facilitator to see the students working together in an informal manner. The same facilitator is with the group for the duration of the programme so, while it is a relatively short intervention compared to a full year in school, there is a consistency throughout the four days that allows for trusted relationships to develop (Fullan & Langworthy, 2014). For similar reasons, the student teams remain fixed throughout the week.

Appendix 3 – Student Background and Selection

The Bridge to College programme was open to students from a network of schools linked to the university access programme. The students in these schools would typically have below average progression rates to third level education, with various social, cultural, and economic factors contributing to this (Hannon et al., 2017). The students were in Transition Year, an optional in-school gap year between the Junior and Senior exam cycles in Irish secondary schools. They were typically 15 or 16 years of age. Prior to the workshop, a member of the Bridge to College team

visited each school to introduce the programme. The students often had little or no experience of collaborative project work. When asked about fears or sources of nerves at the start of the programme, students often cited meeting new people, making presentations, and a lack of tech skills.

In some schools, a selection process was required as programme places were limited. Students were asked to write a personal statement about why they would like to take part in the programme (Appendix 9 – Student Statement) but a teacher from the school decided which students should take part. Teachers were encouraged to choose students with the academic potential to go on to third level education, and with a good record of attendance and behaviour. In mixed schools, teachers were asked to maintain a 50/50 gender balance where possible and, in larger schools, they would distribute programme places across several class groups.

Appendix 4 – Facilitator and Mentors

The role of the Bridge to College facilitator is to introduce and scaffold the programme activities, support the students through their project work, and to lead whole group discussions. The level of support or scaffolding required will vary from group to group, team to team, and depend on the content covered within the project. Typical supports provided to teams include planning sheets, team leader meetings, and informal check-ins as teams are working. A newly formed team on day one of Bridge to College may need more guidance than they will need on their third or fourth project later in the week.

The facilitator or mentors make use of the Socratic method in their guidance of the students. They do not provide all of the information a team will require up front, or immediately give the answer to every query a team may have, without discussing what the team have already tried to solve the problem or work it out themselves. This approach encourages students to take ownership of their project work, to try things for themselves, and to develop leadership and self-direction skills.

As the students are working, they are encouraged to take on different roles each day, e.g., if a student was working on sound editing on day one, they should allow, or help, a team-mate to learn those skills during a subsequent project. The roles taken by each team member is one aspect of the programme that requires careful monitoring by the facilitator and is an area where intervention is often needed to ensure this changing of roles takes place.

During this study, each day of the programme was led by the same facilitator, the author. This allowed for a degree of familiarity and trust to develop between them and the students, and helping the facilitator make informed decisions about the progress and the needs of the students. Each day, up to three volunteers assisted with the running of the programme. Mentors would typically spend half a day (three hours) with the students during programme weeks. This high level of direct support for students may not be easy to replicate in other education settings. The mentors supported the teams as they worked through their projects, contributing ideas to discussions, helping teams make decisions, providing technical help, or any additional support that was needed. The mentors would step back if they were not needed and allow the students to get on with their work. Mentors were encouraged to circulate from team to team and not to spend too long with a single team, to avoid the team becoming too reliant on that mentor.

Appendix 5 – Third Level Setting / Learning Space

The Bridge to College programme takes place in a dedicated learning space on a university campus. This university setting means that, for all students, they are travelling to a new location on day one of the programme. The students are instructed to meet the facilitator at the front of the university on the first morning of the programme. Once the group have all arrived, they walk across the campus together to the learning space.

Each team is responsible for their own team space (pod) and for the equipment within it. Each team uses the same pod each day and it is recognised as their space for the week. The facilitator will decide which room is most appropriate for each activity or may allow the teams to choose where or how they work at certain times.

Both rooms are decorated with large murals. This is intended to create a stimulating environment and to make the space feel different to other learning spaces or classrooms the students may have experienced. This design feature is intended to encourage students to open themselves up to a new learning experience or a new style of learning.

Some of the activities during the week take place around the university campus and the week usually ends with the whole group having lunch together in the college dining hall, near where they met on day one. The chance to have a positive educational experience in a university setting is one important element of the programme. This setting also helps create a fresh start for the group of students each week, allowing the facilitator to encourage students to participate in a

different approach to teaching and learning, and to work to a level that is perhaps beyond what they might normally contribute in their everyday school setting.

Appendix 6 - Team Role Sheet

Team Roles

Role	Name(s)
Project Manager	
Video editor/slide maker	
Sound editor Downloading music Editing Music with Audacity Voice recording and editing	
Artist Image editor	
Researchers x 2 Finding pictures and information online	
Script Writers x 2 Write Script and Captions for Video	
Actors / Actresses (Video & Voice) To record voiceovers or appear in the video	

Appendix 7 - Team Reflection Sheet

Team Reflection

1. Overall, how would the team rate their performance today?

Excellent	Good	Average	Fair	Poor
☐	☐	☐	☐	☐

Why does the team feel this way?

_____

_____

2. What was the team's best achievement today?

3. How often did the following happen in your team today?

	Never	**Only now & again**	**Sometimes**	**Nearly always**	**Always**
We took turns when talking to each other					
We were sensitive to the needs of one another					
We discussed things and did not argue					
We were well organised					
We were interrupting & cutting each other off when speaking					
We got on well together					
We all did our fair share of the work					

4. List **3 skills** the team have learned today

_____

_____

_____

5. List **3 skills** the team would like to develop/improve on

_____

_____

_____

Appendix 8 - Consent Forms / Information Letters

Parent/Guardian Consent Letter

Dear Parent/Guardian,

Bridge21 is a joint research initiative between Trinity College's Centre for Research in IT in Education and the Trinity Access Programmes. The principal investigator is Brendan Tangney. The overall aim of the programme is to provide a learning experience for young people to become confident learners through the use of technology and teamwork. The programme seeks to positively engage students and encourage them to raise their personal learning aspirations.

During 2016/17, some students from the school will get the chance to take part in various projects with **Bridge21**. These students will engage in challenging learning activities involving digital media, gaming, animation, mobile technology and web design, across a range of subject areas. As part of the programme, your son/daughter will be using modern technology, which will include access to the internet and use of cameras. They will be under the supervision and guidance of adults and trained college student mentors at all times. All activities will comply with best practice in Child Protection and the policies of the school and Trinity College in this area to ensure that students benefit from the learning opportunities offered by technology in a safe and effective manner. Management of photographic images will be strictly in compliance with the above policies.

During the programme, researchers from Trinity College may be present to collect information about the students' learning experiences. During the activities, interactions between the students working together may be recorded using observation tests. The students will also complete a pre- and post-questionnaire. When the programme is over, the research team *may* visit the school at a later date to conduct an interview with a selection of students.

All information that is collected by the researchers will be anonymised and stored in accordance with the Data Protection Act at Trinity College, Dublin. In the unlikely event that information about illegal activities should emerge during the study, the researchers will follow the school's Child Protection policy and inform the relevant authorities. There may be lectures, PhD theses, conference presentations and peer-reviewed journal articles written as a result of this project, however the students and school will not be identified.

We wish to seek your permission for your son/daughter to participate on the programme and to use the technology available in a safe and effective manner. Where appropriate, we would also like to publish work they may create during the programme that would be of educational benefit to other students.

We also wish to seek permission for your son/daughter to participate in the research part of the programme. Participation in this part of the programme is voluntary and you may remove your son/daughter from the process at any time, for any reason, without penalty and any information already recorded about them will not be used. Should you wish your son/daughter to be omitted from the research part, they can still participate in the programme, but none of their information will be used in the research.

From time to time, we may also record video footage and images of your son/daughter and their classmates and teachers at work – this will be used in communications and promotional/marketing material about **Bridge21**. Use of video footage and images will be strictly in accordance with best practice in Child Protection policies and guidelines. Should you wish your son/daughter to be omitted from promotional material, they can still participate in the programme, but no images/video footage of them will be used.

Please sign below to indicate your consent and return the form to the school as soon as possible. If you have any questions in relation to this, please do not hesitate to contact us.

Kind regards,
Kevin Sullivan & Ciarán Bauer
Bridge21 Programme Team
Phone: (01) 8961397
Email: Kevin@bridge21.ie

I _____ (name of parent/guardian)

consent to _____ (name of child) taking part in the **Bridge to College** in 2016/17.

I have been provided with an information letter which outlines the activities my child will take part in, how research data will be collected and stored and how I can contact the research team. I understand that I may withdraw my child from the research project at any time should I wish to do so for any reason and without penalty.

I also know that images/video footage of my child may be used for promotional material about **Bridge to College** programme but their name will not be identified.

Data Protection: I agree to Trinity College, University of Dublin storing of any personal data relating to my child which results from this project. I agree to the processing of such data for any purposes connected with the research project as outlined to me.

Signature of parent/ guardian: _____

Date: _____

Signature of Project Leader (TCD): _____

Date: _____

Please note: As this research involves the use of computers, children with epilepsy cannot take part in either the learning activity or research study, please inform the school if this is the case. If there is a family history of epilepsy the child may take part, but does so at your risk.

Participant Consent Letter

Participant Information Sheet

You are invited to participate in the Bridge21 research project (www.bridge21.ie). The project is based in Trinity College's Centre for Research in IT in Education. The aim of the project is to investigate new ways of learning in the classroom based upon: using technology; project based learning and working in teams. The principal investigator is Brendan Tangney and the programme director is Claire Conneely.

During the programme you will be involved in different innovative learning experiences and researchers from Trinity College may collect information about your views on those experiences. Interactions between you and your classmates working together may be observed. Interactions between you and your teacher may also be recorded. You may also be asked to complete questionnaires and feedback forms at different times during the programme. You may also be selected to take part in an interview with a small group of your classmates.

All information that is collected by the researchers will be anonymised (all names will be removed) and stored in Trinity College, Dublin. In the unlikely event that information about illegal activities should emerge during the study, the researchers will have to inform the relevant authorities. The results of the research are likely to be used in lectures, PhD theses, conference presentations and journal articles, but you or your school will not be identified.

Your participation in the research is voluntary and you can change your mind about it at any time – in that case we will not use any information already collected about you.

From time to time, we may also record video footage and images of you, your classmates and your teachers at work – this will be used in communications and promotional/marketing material about the **Bridge to College** programme. You have the right to be anonymous; therefore your name will not appear alongside any images/video footage. Please keep in mind that you can change your mind at any time and in that case we will not use any images/video footage associated with you.

If you have any questions, please do not hesitate to ask Kevin or any member of the Bridge21 team.

Kind regards,
Brendan Tangney (principal investigator) and Kevin Sullivan
Bridge21 Programme Team
(01) 8961397 / kevin@bridge21.ie

Bridge21 Participant Consent Form

I, _____(your name)
agree to take part in the research part of the **Bridge21** programme.

I have read the information sheet provided about the project and know how information will be collected and stored. I understand that I can choose not to take part in the research at any time.

I also know that images/video footage of me may be used for promotional material about the **Bridge21** programme and that I can change my mind about this at any time.

Data Protection: I agree to Trinity College, University of Dublin storing and using my information from this project.

Signature of participant: _____

Date: _____

Signature of Project Leader (TCD): _____

Date: _____

Appendix 9 – Student Statement

So, what's it all about?

The Bridge to College programme is based in Trinity College Dublin. Students attend the programme for 4 days (Tues – Fri) to work on various technology-based learning activities and projects, such as movie-making, animation, radio shows, web design and much much more.

Students work together in teams of 4-5 for the entire programme, and are mixed with students from other schools. There is also a group of 3rd level students who volunteer as mentors to provide a helping hand with the projects and some advice on what going to college is all about.

Now, why do you want to do it?

In your own words, tell us why you would like to take part in the Bridge to College programme...

Name: _____

Class: _____

Date: _____

Appendix 10 – Qualitative Questions

Time 2/4

- How would you rate your overall experience on the Bridge to College programme?
    - Please explain your answer.
- Write down three things I learned about myself and how I learn during Bridge to College programme…
- Any other comments?

Time 5/6

- Write down three things I learned about myself and how I learn during Bridge to College programme…
- Since Bridge to College – Have you taken part in any activities where you used the tech skills you learned, or where you learned new tech skills?
    - If yes, please explain.
- Since Bridge to College – Have you taken part in any activities where your worked as part of a team?
    - If yes, please explain.
- Since Bridge to College – Has anything you learned on Bridge to College been useful since, in or out of school?
    - If yes, please explain.
- Did your participation in Bridge to College influence your decision to go to college or not?
    - If yes, please explain.
- Did your participation in Bridge to College influence your choice of college course?
    - If yes, please explain.
- Any other comments?

Time 7

- [All questions from Time 5/6]
- How would you explain the Bridge to College programme to a friend?

Appendix 11 – Questionnaires

Time 1

1. Name
2. School
3. Age
4. Gender
5. Mobile Phone Number
6. Were you born in Ireland?
7. What is your first language?
8. Email Address
9. From the list below please indicate the highest level of education completed by your mother/female guardian?
10. What is your mother's/female guardian's occupation?
11. From the list below please indicate the highest level of education completed by your father/male guardian?
12. What is your father's/male guardian's occupation?
13. Do you hope to go to 3rd level (university or college) after school?*
14. What level did you take for Junior Cert Maths?
15. What grade did you achieve in Junior Cert Maths?
16. What level do you intend to take in Leaving Cert Maths?
17. How important is it to you to go to 3rd level after school?*
18. In a normal week, how much time would you spend on the following activities? [Using a computer (laptop, desktop etc.)]
18. In a normal week, how much time would you spend on the following activities? [Using a mobile phone (calls, text, mobile internet etc.)]
18. In a normal week, how much time would you spend on the following activities? [Playing computer games (PC, online, console, handheld)]
18. In a normal week, how much time would you spend on the following activities? [Social Networks (Facebook, Twitter, Whatsapp, Snapchat, etc.)]
18. In a normal week, how much time would you spend on the following activities? [Listening to music]
18. In a normal week, how much time would you spend on the following activities? [Watching tv shows/movies (on TV or online)]
18. In a normal week, how much time would you spend on the following activities?

[School work (homework or study)]
18. In a normal week, how much time would you spend on the following activities? [Searching (Google etc.) for info, not school related.]
18. In a normal week, how much time would you spend on the following activities? [Multimedia activities (Moviemaker, photo editing, sound editing)]
18. In a normal week, how much time would you spend on the following activities? [Maintaining a blog/website]
18. In a normal week, how much time would you spend on the following activities? [Word processor, e.g. Word, Google Docs]
18. In a normal week, how much time would you spend on the following activities? [Email]
18. In a normal week, how much time would you spend on the following activities? [Presentation software, e.g. PowerPoint, Prezi]
18. In a normal week, how much time would you spend on the following activities? [Spreadsheets, e.g. Excel]
18. In a normal week, how much time would you spend on the following activities? [Databases, e.g. Access]
18. In a normal week, how much time would you spend on the following activities? [Writing computer programs]
19. How likely is it that you will go to college?*
20. How confident are you to.... [Answer questions in front of an audience]
20. How confident are you to.... [Communicate an idea using something other than writing (video, audio, poster etc.)]
20. How confident are you to.... [Prepare and deliver a spoken presentation]
20. How confident are you to.... [Organise data for a presentation (e.g. create charts or graphs)]
20. How confident are you to.... [Decide how to present your work]
20. How confident are you to.... [Use creation techniques such as brainstorming]
20. How confident are you to.... [Come up with your own ideas to solve a problem or answer a question]
20. How confident are you to.... [Test different ideas and work to improve them]
20. How confident are you to.... [Create something new to help you express your ideas]
20. How confident are you to.... [Invent a solution to difficult problems]
21. How confident are you to.... [Work in pairs/teams to complete a task]
21. How confident are you to.... [Work with others to set goals/create a plan for your team]
21. How confident are you to.... [Create joint products with contributions from each student]

21. How confident are you to.... [Present your teams work to a class/group]
21. How confident are you to.... [Work with your team to react to advice or feedback about your project]
21. How confident are you to.... [Give feedback to other students or assess their work]
21. How confident are you to.... [Select the right technology tools to complete a task]
21. How confident are you to.... [Use technology to contact people who can help you learn]
21. How confident are you to.... [Use technology/the internet to help you learn things for yourself]
21. How confident are you to.... [Use technology to help you share information (sound/video/slides etc.)]
21. How confident are you to.... [Use technology to work in a team]
21. How confident are you to.... [Use technology to keep track of your work on a project]
21. How confident are you to.... [Judge how good/useful online resources are]
22. How confident are you to.... [Try to solve problems or answer questions that have no single correct answer]
22. How confident are you to.... [Compare information from different sources before completing a task]
22. How confident are you to.... [Form your own ideas based on numbers, facts or other information]
22. How confident are you to.... [Summarize or create your own version of what you have read or been taught]
22. How confident are you to.... [Analyse different points of view or solutions to a problem]
22. How confident are you to.... [Use evidence to build an argument or explain your opinion]
22. How confident are you to.... [Take the lead when faced with a difficult problem or question]
22. How confident are you to.... [Choose what you want to find out about or learn]
22. How confident are you to.... [Plan the steps you will take to complete a big/difficult task]
22. How confident are you to.... [Choose what will help you learn best]
22. How confident are you to.... [Track your own progress and make changes if things aren't going well enough]
22. How confident are you to.... [Judge the quality of your work before it is finished]
22. How confident are you to.... [Use feedback from students, teachers or experts to change your work]
23. If you have been part of a team, give an example of something your team achieved or a task you completed.

Time 2 - Part 1 (Online)

1. Name
2. Mobile Phone Number
3. Do you hope to go to 3rd level (university or college) after school?*
4. How confident are you to.... [Answer questions in front of an audience]
4. How confident are you to.... [Communicate an idea using something other than writing (video, audio, poster etc.)]
4. How confident are you to.... [Prepare and deliver a spoken presentation]
4. How confident are you to.... [Organise data for a presentation (e.g. create charts or graphs)]
4. How confident are you to.... [Decide how to present your work]
4. How confident are you to.... [Use creation techniques such as brainstorming]
4. How confident are you to.... [Come up with your own ideas to solve a problem or answer a question]
4. How confident are you to.... [Test different ideas and work to improve them]
4. How confident are you to.... [Create something new to help you express your ideas]
4. How confident are you to.... [Invent a solution to difficult problems]
5. How likely is it that you will go to college?*
6. How confident are you to.... [Work in pairs/teams to complete a task]
6. How confident are you to.... [Work with others to set goals/create a plan for your team]
6. How confident are you to.... [Create joint products with contributions from each student]
6. How confident are you to.... [Present your teams work to a class/group]
6. How confident are you to.... [Work with your team to react to advice or feedback about your project]
6. How confident are you to.... [Give feedback to other students or assess their work]
6. How confident are you to.... [Select the right technology tools to complete a task]
6. How confident are you to.... [Use technology to contact people who can help you learn]
6. How confident are you to.... [Use technology/the internet to help you learn things for yourself]
6. How confident are you to.... [Use technology to help you share information (sound/video/slides etc.)]
6. How confident are you to.... [Use technology to work in a team]
6. How confident are you to.... [Use technology to keep track of your work on a project]
6. How confident are you to.... [Judge how good/useful online resources are]
6. How confident are you to.... [Use technology to analyse info (e.g. spreadsheets, graphs)]

7. How important is it to you to go to 3rd level after school?*
8. How confident are you to.... [Try to solve problems or answer questions that have no single correct answer]
8. How confident are you to.... [Compare information from different sources before completing a task]
8. How confident are you to.... [Form your own ideas based on numbers, facts or other information]
8. How confident are you to.... [Summarize or create your own version of what you have read or been taught]
8. How confident are you to.... [Analyse different points of view or solutions to a problem]
8. How confident are you to.... [Use evidence to build an argument or explain your opinion]
8. How confident are you to.... [Take the lead when faced with a difficult problem or question]
8. How confident are you to.... [Choose what you want to find out about or learn]
8. How confident are you to.... [Plan the steps you will take to complete a big/difficult task]
8. How confident are you to.... [Choose what will help you learn best]
8. How confident are you to.... [Track your own progress and make changes if things aren't going well enough]
8. How confident are you to.... [Judge the quality of your work before it is finished]
8. How confident are you to.... [Use feedback from students, teachers or experts to change your work]

Time 2 - Part 2 (Written)

Name

School _____

Team Name _____

1. Overall, how would you rate your experience at the Bridge to College programme?

Excellent ☐ Good ☐ Average ☐ Fair ☐ Poor ☐

Why do you feel this way?

_____

_____

_____

_____

2. Has the Bridge to College programme impacted on you in any of the following ways?

	Strongly disagree	**Disagree**	**Unsure**	**Agree**	**Strongly agree**
Improved my attitude to working as part of a team					
Improved my attitude to education					
Increased my confidence using technology					
Made me feel that I would learn better in school as part of a team					
Allowed me to make new friends					
Improved my communication and presentation skills					
Increased my independence					

3. Would you be interested in participating in other Bridge21 workshops during the year?

Yes ☐ No ☐

Please explain your decision…

_____

_____

_____

_____

4. How well did your team work together during the programme?

	Never	Rarely	Sometimes	Very Often	Always
We enjoyed working together					
We took turns when talking to each other					
We discussed things and did not argue					
We were well organised					
We were interrupting & cutting each other off when speaking					
We got on well together					
We tried to help one another					
Some team members tried to boss others					
We listened to one another					
I liked being in my team					

5. **Three** things I learned about **myself** and **how I learn** during the programme…

1. 2. 3.

6. Any other comments?

_____
_____
_____
_____

Thanks! ☺

Time 3

1. Name
2. School
3. Age
4. Gender
5. Mobile Phone Number
6. Email Address
7. Do you hope to go to 3rd level (university or college) after school?*
8. How important is it to you to go to 3rd level after school?*
9. In a normal week, how much time would you spend on the following activities? [Using a computer (laptop, desktop etc.)]
9. In a normal week, how much time would you spend on the following activities? [Using a mobile phone (calls, text, mobile internet etc.)]
9. In a normal week, how much time would you spend on the following activities? [Playing computer games (PC, online, console, handheld)]
9. In a normal week, how much time would you spend on the following activities? [Social Networks (Facebook, Twitter, Whatsapp, Snapchat, etc.)]
9. In a normal week, how much time would you spend on the following activities? [Listening to music]
9. In a normal week, how much time would you spend on the following activities? [Watching tv shows/movies (on TV or online)]
9. In a normal week, how much time would you spend on the following activities? [School work (homework or study)]
9. In a normal week, how much time would you spend on the following activities? [Searching (Google etc.) for info, not school related.]
9. In a normal week, how much time would you spend on the following activities? [Multimedia activities (Moviemaker, photo editing, sound editing)]
9. In a normal week, how much time would you spend on the following activities? [Maintaining a blog/website]
9. In a normal week, how much time would you spend on the following activities? [Word processor, e.g. Word, Google Docs]
9. In a normal week, how much time would you spend on the following activities? [Email]
9. In a normal week, how much time would you spend on the following activities? [Presentation software, e.g. PowerPoint, Prezi]

9. In a normal week, how much time would you spend on the following activities? [Spreadsheets, e.g. Excel]
9. In a normal week, how much time would you spend on the following activities? [Databases, e.g. Access]
9. In a normal week, how much time would you spend on the following activities? [Writing computer programs]
10. How likely is it that you will go to college?*
11. How confident are you to.... [Answer questions in front of an audience]
11. How confident are you to.... [Communicate an idea using something other than writing (video, audio, poster etc.)]
11. How confident are you to.... [Prepare and deliver a spoken presentation]
11. How confident are you to.... [Organise data for a presentation (e.g. create charts or graphs)]
11. How confident are you to.... [Decide how to present your work]
11. How confident are you to.... [Use creation techniques such as brainstorming]
11. How confident are you to.... [Come up with your own ideas to solve a problem or answer a question]
11. How confident are you to.... [Test different ideas and work to improve them]
11. How confident are you to.... [Create something new to help you express your ideas]
11. How confident are you to.... [Invent a solution to difficult problems]
12. How confident are you to.... [Work in pairs/teams to complete a task]
12. How confident are you to.... [Work with others to set goals/create a plan for your team]
12. How confident are you to.... [Create joint products with contributions from each student]
12. How confident are you to.... [Present your teams work to a class/group]
12. How confident are you to.... [Work with your team to react to advice or feedback about your project]
12. How confident are you to.... [Give feedback to other students or assess their work]
12. How confident are you to.... [Select the right technology tools to complete a task]
12. How confident are you to.... [Use technology to contact people who can help you learn]
12. How confident are you to.... [Use technology/the internet to help you learn things for yourself]
12. How confident are you to.... [Use technology to help you share information (sound/video/slides etc.)]
12. How confident are you to.... [Use technology to work in a team]
12. How confident are you to.... [Use technology to keep track of your work on a project]
12. How confident are you to.... [Judge how good/useful online resources are]

12. How confident are you to.... [Use technology to analyse info (e.g. spreadsheets, graphs)]
13. How confident are you to.... [Try to solve problems or answer questions that have no single correct answer]
13. How confident are you to.... [Compare information from different sources before completing a task]
13. How confident are you to.... [Form your own ideas based on numbers, facts or other information]
13. How confident are you to.... [Summarize or create your own version of what you have read or been taught]
13. How confident are you to.... [Analyse different points of view or solutions to a problem]
13. How confident are you to.... [Use evidence to build an argument or explain your opinion]
13. How confident are you to.... [Take the lead when faced with a difficult problem or question]
13. How confident are you to.... [Choose what you want to find out about or learn]
13. How confident are you to.... [Plan the steps you will take to complete a big/difficult task]
13. How confident are you to.... [Choose what will help you learn best]
13. How confident are you to.... [Track your own progress and make changes if things aren't going well enough]
13. How confident are you to.... [Judge the quality of your work before it is finished]
13. How confident are you to.... [Use feedback from students, teachers or experts to change your work]

Time 4

1. Name
2. Mobile Phone Number
3. Do you hope to go to 3rd level (university or college) after school?*
4. How confident are you to.... [Answer questions in front of an audience]
4. How confident are you to.... [Communicate an idea using something other than writing (video, audio, poster etc.)]
4. How confident are you to.... [Prepare and deliver a spoken presentation]
4. How confident are you to.... [Organise data for a presentation (e.g. create charts or graphs)]
4. How confident are you to.... [Decide how to present your work]
4. How confident are you to.... [Use creation techniques such as brainstorming]
4. How confident are you to.... [Come up with your own ideas to solve a problem or answer a question]
4. How confident are you to.... [Test different ideas and work to improve them]
4. How confident are you to.... [Create something new to help you express your ideas]
4. How confident are you to.... [Invent a solution to difficult problems]
5. How likely is it that you will go to college?*
6. How confident are you to.... [Work in pairs/teams to complete a task]
6. How confident are you to.... [Work with others to set goals/create a plan for your team]
6. How confident are you to.... [Create joint products with contributions from each student]
6. How confident are you to.... [Present your teams work to a class/group]
6. How confident are you to.... [Work with your team to react to advice or feedback about your project]
6. How confident are you to.... [Give feedback to other students or assess their work]
6. How confident are you to.... [Select the right technology tools to complete a task]
6. How confident are you to.... [Use technology to contact people who can help you learn]
6. How confident are you to.... [Use technology/the internet to help you learn things for yourself]
6. How confident are you to.... [Use technology to help you share information (sound/video/slides etc.)]
6. How confident are you to.... [Use technology to work in a team]
6. How confident are you to.... [Use technology to keep track of your work on a project]
6. How confident are you to.... [Judge how good/useful online resources are]
6. How confident are you to.... [Use technology to analyse info (e.g. spreadsheets, graphs)]

7. How important is it to you to go to 3rd level after school?*
8. How confident are you to.... [Try to solve problems or answer questions that have no single correct answer]
8. How confident are you to.... [Compare information from different sources before completing a task]
8. How confident are you to.... [Form your own ideas based on numbers, facts or other information]
8. How confident are you to.... [Summarize or create your own version of what you have read or been taught]
8. How confident are you to.... [Analyse different points of view or solutions to a problem]
8. How confident are you to.... [Use evidence to build an argument or explain your opinion]
8. How confident are you to.... [Take the lead when faced with a difficult problem or question]
8. How confident are you to.... [Choose what you want to find out about or learn]
8. How confident are you to.... [Plan the steps you will take to complete a big/difficult task]
8. How confident are you to.... [Choose what will help you learn best]
8. How confident are you to.... [Track your own progress and make changes if things aren't going well enough]
8. How confident are you to.... [Judge the quality of your work before it is finished]
8. How confident are you to.... [Use feedback from students, teachers or experts to change your work]

Graduate Questionnaire – Times 5 & 6

What is your name?
Which school did you attend for Transition Year?
In which Bridge to College workshops did you take part?
What year did you do Transition Year?
Did taking part in the Bridge to College Programme impact on you in any of the following ways? [Improved my attitude to working as part of a team]
Did taking part in the Bridge to College Programme impact on you in any of the following ways? [Improved my attitude to education]
Did taking part in the Bridge to College Programme impact on you in any of the following ways? [Increased my confidence using technology]
Did taking part in the Bridge to College Programme impact on you in any of the following ways? [Made me feel I would learn better in school as part of a team]
Did taking part in the Bridge to College Programme impact on you in any of the following ways? [Allowed me to make new friends]
Did taking part in the Bridge to College Programme impact on you in any of the following ways? [Improved my communication and presentation skills]
Did taking part in the Bridge to College Programme impact on you in any of the following ways? [Increased my independence]
Did taking part in the Bridge to College Programme impact on you in any of the following ways? [Increased my confidence around new people]
Since your last Bridge to College Programme workshop, have you taken part in any activities where you worked as part of a team?
If yes, please give any examples you can.
Did your participation in the Bridge to College Programme influence your decision to go to college or not?
Since your last Bridge to College Programme workshop, have you taken part in any activities where you used the tech skills you learned in Bridge to College Programme or where you learned new tech skills?
If yes, please give any examples you can.
Are you still in school?
Did your participation in the Bridge to College Programme influence your decision on what to study in college?
If yes, please explain.
Do you hope to go to 3rd level (university or college) after school?
How important is it that you go to 3rd level after school?
Write down up to three things you learned about yourself and how you learn during the Bridge to College Programme.
Any other comments?

How confident are you to... [Answer questions in front of an audience]
How confident are you to... [Communicate an idea using something other than writing (video, audio, poster etc.)]
How confident are you to... [Prepare and deliver a spoken presentation]
How confident are you to... [Organise data for a presentation (e.g. create charts or graphs)]
How confident are you to... [Decide how to present your work]
How confident are you to... [Use creation techniques such as brainstorming]
How confident are you to... [Come up with your own ideas to solve a problem or answer a question]
How confident are you to... [Test different ideas and work to improve them]
How confident are you to... [Create something new to help you express your ideas]
How confident are you to... [Invent a solution to difficult problems]
How confident are you to... [Work in pairs/teams to complete a task]
How confident are you to... [Work with others to set goals/create a plan for your team]
How confident are you to... [Create joint products with contributions from each student]
How confident are you to... [Present your teams work to a class/group]
How confident are you to... [Work with your team to react to advice or feedback about your project]
How confident are you to... [Give feedback to other students or assess their work]
How confident are you to... [Select the right technology tools to complete a task]
How confident are you to... [Use technology to contact people who can help you learn]
How confident are you to... [Use technology/the internet to help you learn things for yourself]
How confident are you to... [Use technology to help you share information (sound/video/slides etc.)]
How confident are you to... [Use technology to work in a team]
How confident are you to... [Use technology to keep track of your work on a project]
How confident are you to... [Judge how good/useful online resources are]
How confident are you to... [Use technology to analyse info (e.g. spreadsheets, graphs etc.)]
How confident are you to... [Try to solve problems or answer questions that have no single correct answer]
How confident are you to... [Compare information from different sources before completing a task]
How confident are you to... [Form your own ideas based on numbers, facts and other information]
How confident are you to... [Summarise or create your own version of what you have read or been taught]
How confident are you to... [Analyse different points of view or solutions to a problem]
How confident are you to... [Use evidence to build an argument or explain your opinion]
How confident are you to... [Take the lead when faced with a difficult problem or question]
How confident are you to... [Choose what you want to find out about or learn]

How confident are you to... [Plan the steps you will take to complete a big/difficult task]
How confident are you to... [Choose what will help you learn best]
How confident are you to... [Track your own progress and make changes if things aren't going well enough]
How confident are you to... [Judge the quality of your work before it is finished]
How confident are you to... [Use feedback from students, teachers or experts to change your work.]
How often are you in contact with friends you made in Bridge to College?
Did your participation in the Bridge to College Programme influence your decision to go college or not?
If yes, please explain.
Did your participation in the Bridge to College Programme influence your decision on what to study in college?
If yes, please explain.
Did you attend 3rd level education when you left school?
If yes, please give details.
Was there anything you learned in Bridge to College that has been useful since, in or out of school?
If yes, please explain.
How confident are you to... [Create joint products with contributions from each student]
How confident are you to... [Present your teams work to a class/group]
How confident are you to... [Work with your team to react to advice or feedback about your project]
How confident are you to... [Give feedback to other students or assess their work]
How confident are you to... [Select the right technology tools to complete a task]
How confident are you to... [Use technology to contact people who can help you learn]
How confident are you to... [Use technology/the internet to help you learn things for yourself]
How confident are you to... [Use technology to help you share information (sound/video/slides etc.)]
How confident are you to... [Use technology to work in a team]
How confident are you to... [Use technology to keep track of your work on a project]
How confident are you to... [Judge how good/useful online resources are]
How confident are you to... [Use technology to analyse info (e.g. spreadsheets, graphs etc.)]
How confident are you to... [Prepare and deliver a spoken presentation]
How confident are you to... [Organise data for a presentation (e.g. create charts or graphs)]
How confident are you to... [Decide how to present your work]
How confident are you to... [Use creation techniques such as brainstorming]

How confident are you to... [Come up with your own ideas to solve a problem or answer a question]
How confident are you to... [Test different ideas and work to improve them]
How confident are you to... [Create something new to help you express your ideas]
How confident are you to... [Invent a solution to difficult problems]

Graduate Questionnaire – Time 7

What is your name?
Which school did you attend for Transition Year?
What year did you do Transition Year?
In which Bridge21 workshops did you take part?
Did taking part in the Bridge to College Programme impact on you in any of the following ways? [Improved my attitude to working as part of a team]
Did taking part in the Bridge to College Programme impact on you in any of the following ways? [Improved my attitude to education]
Did taking part in the Bridge to College Programme impact on you in any of the following ways? [Increased my confidence using technology]
Did taking part in the Bridge to College Programme impact on you in any of the following ways? [Made me feel I would learn better in school as part of a team]
Did taking part in the Bridge to College Programme impact on you in any of the following ways? [Allowed me to make new friends]
Did taking part in the Bridge to College Programme impact on you in any of the following ways? [Improved my communication and presentation skills]
Did taking part in the Bridge to College Programme impact on you in any of the following ways? [Increased my independence]
Did taking part in the Bridge to College Programme impact on you in any of the following ways? [Increased my confidence around new people]
If a friend asked you to explain what the Bridge to College programme is, what would you tell them?
Since your last Bridge to College workshop, have you taken part in any activities where you worked as part of a team?
If yes, please give any examples you can.
How often are you in contact with friends you made in Bridge to College?
Since your last Bridge to College workshop, have you taken part in any activities where you used the tech skills you learned in Bridge to College or where you learned new tech skills?
If yes, please give any examples you can.
Are you still in school?
Do you hope to go to 3rd level (university or college) after school?
How important is it that you go to 3rd level after school?
Did your participation in the Bridge to College programme influence your decision to go college or not?

If yes, please explain.
Did your participation in the Bridge to College programme influence your decision on what to study in college?
If yes, please explain.
Did your participation in the Bridge to College programme influence your decision to go to college or not?
If yes, please explain.
Did your participation in the Bridge to College programme influence your decision on what to study in college?
If yes, please explain.
Did you attend 3rd level education when you left school?
If yes, please give details.
Write down up to three things you learned about yourself and how you learn during the Bridge to College Programme.
In general, have you noticed any differences between people who have attended Bridge to College (including yourself), and those who have not?
Was there anything you learned in Bridge to College that has been useful since, in or out of school?
If yes, please explain.
Any other comments?

Appendix 12 – Time 4 Interview Questions

1. Do you remember any of your team names?
2. Do you remember who was in your team?
3. Did participating in the Bridge to College Programme have an impact on you?
4. Has anything you did/learned on Bridge to College been useful since, in or out of school?
5. What was your favourite bit of the programme?
6. Is there anything about the programme that should change?
7. Any other comments?

Appendix 13 – Time 7 Interview Questions

Setting the scene

1. Do you remember your first day?
2. Do you remember any of your team names?
3. Do you remember who was in your team?
4. Which workshops did you do?

These questions are an easy introduction to the conversation. They allowed the students to relax and get comfortable with the environment without having to share anything too personal straight away. They also encouraged the students to think back to their time in Bridge to College, what they did and who they worked with.

5. How would you describe the Bridge to College programme to a friend?

This question opened up the discussion to include what the students believed Bridge to College was designed to do, what it was like to take part in the programme and what impact the programme may have had on them.

Skills & Personal Development

6. Did taking part in the Bridge to College programme make a difference to you?
7. What did you learn?

Surveys completed at Times 2 and 4 include sets of questions in which student identified a range of ways in which the Bridge to College programme had an impact on them. These included increased skills involving technology, communication and presentation, an improved attitude to teamwork, improved social skills and new friends. Similar findings emerged from survey questions on 21C Skills completed at Times 1, 2, 3 & 4. An open question on the Time 2 survey also saw students describe improved teamwork, technology and communication skills.

Students identified a positive impact in several areas immediately after completing the programme, with many similar reports at Times 5 and 6, one and two years later. Questions 6 - 7 allow further discussion of these findings.

8. How or when was that useful?
    a. In school?
    b. Out of school?
9. Have you done anything since Bridge to College that you wouldn't have done had you not been to Bridge to College?

When surveyed at Time 5 or 6 (still in school) 79% of students said that skills they had learned in Bridge to College had been useful since completing the programme. Education (schoolwork, extra-curricular and non-formal education) was by far the most cited setting for the use of these skills. Whether this remains true among students who have completed school or moved on to third level education was of interest. Question 9 built on this by exploring whether increased confidence in various skills triggered further practice or development in these areas.

10. Was it different on your second visit?

Data collected at Times 5 and 6 suggest there were increased benefits for students who take part in more than one instance of the Bridge to College programme. Key skills data collected at Time 3 shows higher confidence levels in several skills when compared with Time 1. This suggests students were starting their second week more confident and more capable than they did their first week. Facilitator observations back this up further. Students tended to mix more easily with their new team-mates on Return weeks and require less support from mentors, even when the programme content was more challenging than that covered on the Core programme. Student perspectives on this experience could have proven to be valuable for this research.

3rd Level

11. Did Bridge21 influence your decision to go to college or not?
12. Did Bridge21 influence your decision on what to study?

Data collected at Times 1 and 2 shows an increased aspiration and intention to go to college following participation in the Bridge to College programme. About 50% of students stated that going to college was "Very Important" and "Very Likely" at Time 1, which left no room for a higher rating a Time 2. There was a significant shift in attitudes among undecided students.

When asked question 11 in a survey at Times 5 and 6, 40% of students said "Yes". When asked to explain their choice, the most common answer was that they got a taste of life at third level. Other

responses included a belief that college would be fun, increased confidence, discovering a course or a university they wanted to attend and increased independence.

When asked question 12 at Times 5 and 6, 25% of students said “Yes”. They cited discovering an interest in a subject, confirming a prior interest or ruling out a subject as ways in which this occurred.

Further discussion of these questions with students who have gone on to third level, or chosen not to, were of interest.

13. Did your experience with Bridge21 make any difference to you during college?
14. Did your experience with Bridge21 make any difference to you during the transition from second level to third level?

For the first three groups interviewed at Time 7, there were no questions about transition to college, but it was mentioned by students in all three groups. They mentioned skills and confidence developed in Bridge to College and how they directly impacted their experience of starting and moving through third level education. These questions were then added for subsequent interviews.

Programme Content

15. What was your favourite bit of the programme?
16. Is there anything about the programme that should change?
17. Any other comments?

These questions allowed the students to mention the aspects of the programme they enjoyed most or least and to discuss why.

Appendix 14 - Use of Software in Data Analysis

In analysing quantitative data for this study, Microsoft Excel and SPSS were two key tools. Microsoft Excel was used to review, sort, and arrange the online questionnaire responses from each group. Likert scale responses such as “Strongly Agree” or “Strongly Disagree”, or “Very Confident” or “Not Confident at All”, where replaced with numeric values. This allowed for calculation of mean values for various categories of data. It is those mean values that fed into the statistical tests described above. Excel also allowed for easy sorting of data. Sorting a column from largest to smallest (or vice-versa) allowed for a quick count of each response, allowing to us to make statements about how many (or what percentage of) students agreed or strongly agreed with a given statement.

Excel was used to prepare data sets to be tested using SPSS. Sorting and arranging this data and creating matched sets across various time points was a significant task but using Excel made this manageable. Excel was also used to carry out basic calculations, such as comparing means across two time points or analysing responses to certain questions. Excel was also used to create graphs and charts to visualise various sets of data and to highlight trends and patterns.

Prior to using SPSS, Excel was used to carry out various t-test comparisons. This was part of an effort by the author to become familiar with the data and the various tests and processes needed to analyse it. Comparisons of various subsets of data (e.g., male v female students) were carried out at this stage. These were ultimately excluded from this study but some of these results are presented as tangential to the main findings in Section 5.2.1. In retrospect, an earlier move to SPSS would have been more efficient as much of the work that was done in Excel on the main findings was ultimately repeated in SPSS, with proper normality checks and additional factors such as skew and kurtosis calculated and considered. The quantitative data presented in Chapters 5 & 6 was analysed in SPSS and in various Excel sheets.

Appendix 15 – Qualitative Codes and Themes

Themes	Codes
Tech Skills	Can do technology
	Improved tech skills
	Like using technology skills
	Want to improve tech skills
Collaboration Skills	Can do collaboration
	Like collaboration
Confidence	Improved confidence
	Feel less shy
	Can be yourself
	Want more confidence
Social Skills / New People (Positive)	Can new people
	Like new people
	Improved social
	Improved new people
	Can social
Social Skills / New People (Negative)	Dislike new people
Communication Skills / Presentation	Listen to peers
	Can do communication
	Improved communication skills
	Can do public speaking
	Improved public speaking
	Want to improve public speaking
Creativity	Can do creativity
	Like creativity
Self-direction / Leadership	Independence
	I can be a leader
	I like to lead
	Organisation / Timekeeping
	Project Management
College / Campus Experience (Positive)	Confirmed existing desire to go to college
	Prepared me for college
	Helped me choose a course
	I want to go to college
College / Campus Experience (Neutral / Negative)	No impact on course choice
	I was going to college anyway

Appendix 16 – Qualitative Data: Peer Analysis – Myself and How I Learn Codes

	KS 2013-15	FO 2015-17	RM 2015-17
Responses	375	329	329
Codes	40	41	42
Data points	1018	1241	1113
Themes			
Collaboration	236	219	183
Technology	149	184	155
Communication	76	90	60
Learning	115	147	164
Confidence	124	112	91
Public speaking	95	137	118
New people	111	156	152
Facilitation	9	51	32
Project based	93	145	158

	KS 2013-15	FO 2015-17	RM 2015-17
Themes	Rank (1 – 9)	Rank (1 – 9)	Rank (1 – 9)
Collaboration	1	1	1
Technology	2	2	4
Communication	8	8	8
Learning	4	4	2
Confidence	3	7	7
Public speaking	6	6	6
New people	5	3	5
Facilitation	9	9	9
Project based	7	5	3

Appendix 17 - Skills Tables: Day by Day

Day 1

	Setup	Warm-up	Investigate	Planning	Create	Present	Reflect
	Bridge game	Team formation	What do we know about movies?	Storyboard	Filming	Prepare presentation	Team reflection
	Pole game				Editing	Present video	
	Sum of all fears						
Collaboration Skills							
Work in pairs/teams to complete a task together?	1	1	1	1	1	1	1
Work with other students to set goals and create a plan for your team?				1	1		
Create joint products using contributions from each student?				1	1		
Present your group work to the class, teachers, or others?		1				1	
Work as a team to use feedback on group tasks?	1			1	1	1	
Give feedback to peers or assess other students' work?	1			1	1	1	

Communication Skills							
Structure data for use in written products or oral presentations (e.g., creating charts, tables, or graphs)?							
Communicate your ideas using media other than a written paper (e.g., posters, video, blogs, etc.)		1		1	1	1	
Prepare and deliver an oral presentation to the teacher or others?						1	
Answer questions in front of an audience?		1	1			1	
Decide how you will present your work?				1	1	1	
Creativity Skills							
Use idea creation techniques such as brainstorming?			1				
Generate your own ideas about how to solve a problem or answer a question?	1	1		1			
Test out different ideas and work to improve them?				1	1		
Invent a solution to difficult problems?							

Create something new that can help you express your ideas?				1	1		
Critical Thinking							
Try to solve problems or answer questions that have no single correct solution or answer?		1		1	1	1	1
Compare information from different sources before completing a task or assignment?							1
Draw your own ideas based on analysis of numbers, facts, or relevant information?							
Summarize or create your own interpretation of what you have read or been taught?						1	
Analyze different arguments, perspectives, or solutions to a problem?				1			
Use evidence to develop arguments?							

Learning with Tech							
Select the right technology tools or resources for completing a task?					1		
Use technology to talk with experts or members of communities?							
Use technology or the Internet to help you learn things for yourself (e.g., tutorials, self-instructional websites, etc.)?							
Use technology to help to share information (e.g., multi-media presentations using sound or video, presentation software, blogs, podcasts, etc.)?					1	1	
Use technology to work in a team (e.g., shared work spaces, email exchanges, giving and receiving feedback, etc.)?		1			1	1	
Use technology to keep track of your work on assignments?							
Judge how good and useful online resources are?		1			1		

Use technology to analyse information (e.g., databases, spreadsheets, graphic programs, etc.)?							
Self-Direction Skills							
Take the lead when faced with a difficult problem or question?	1	1		1		1	
Choose your own topics of learning or questions?				1			
Plan the steps you will take to accomplish a difficult task?				1	1		
Choose for yourself what to study or what to use to help you study?							
Track your own progress and change things if you are not working the way that you should be to complete a task?					1		
Assess the quality of your work before it is completed?				1	1	1	
Use peer, teacher, or expert feedback to change your work?				1	1		

Day 2

	Setup	Warm-up	Investigate	Planning	Create	Present	Reflect
	Introduce a team-mate	Intro to brainstorming	Future Tech brainstorm	Team Roles	Filming & Editing	Prepare presentation	Team reflection
	Elect leaders		Future Tech Pros & Cons	Storyboard, Script	Poster	Present project	
					Recording		
Collaboration Skills							
Work in pairs/teams to complete a task together?	1	1	1	1	1	1	1
Work with other students to set goals and create a plan for your team?	1			1			
Create joint products using contributions from each student?				1	1		
Present your group work to the class, teachers, or others?	1		1			1	
Work as a team to use feedback on group tasks?			1	1	1	1	
Give feedback to peers or assess other students' work?		1	1	1	1		

Communication Skills							
Structure data for use in written products or oral presentations (e.g., creating charts, tables, or graphs)?			1		1		
Communicate your ideas using media other than a written paper (e.g., posters, video, blogs, etc.)				1	1	1	
Prepare and deliver an oral presentation to the teacher or others?	1		1			1	
Answer questions in front of an audience?	1	1	1			1	
Decide how you will present your work?			1	1	1	1	
Creativity Skills							
Use idea creation techniques such as brainstorming?		1	1		1		
Generate your own ideas about how to solve a problem or answer a question?	1	1	1	1	1		
Test out different ideas and work to improve them?				1	1		

Invent a solution to difficult problems?			1	1	1		
Create something new that can help you express your ideas?				1	1		
Critical Thinking							
Try to solve problems or answer questions that have no single correct solution or answer?	1		1	1	1	1	1
Compare information from different sources before completing a task or assignment?							1
Draw your own ideas based on analysis of numbers, facts, or relevant information?							
Summarize or create your own interpretation of what you have read or been taught?	1					1	
Analyze different arguments, perspectives, or solutions to a problem?							
Use evidence to develop arguments?							

Learning with Tech							
Select the right technology tools or resources for completing a task?					1		
Use technology to talk with experts or members of communities?							
Use technology or the Internet to help you learn things for yourself (e.g., tutorials, self-instructional websites, etc.)?					1		
Use technology to help to share information (e.g., multi-media presentations using sound or video, presentation software, blogs, podcasts, etc.)?					1	1	
Use technology to work in a team (e.g., shared work spaces, email exchanges, giving and receiving feedback, etc.)?					1	1	
Use technology to keep track of your work on assignments?							
Judge how good and useful online resources are?					1		

Use technology to analyse information (e.g., databases, spreadsheets, graphic programs, etc.)?							
Self-Direction Skills							
Take the lead when faced with a difficult problem or question?	1			1	1	1	
Choose your own topics of learning or questions?			1	1	1		
Plan the steps you will take to accomplish a difficult task?				1	1		
Choose for yourself what to study or what to use to help you study?					1		
Track your own progress and change things if you are not working the way that you should be to complete a task?					1		
Assess the quality of your work before it is completed?	1		1	1	1	1	
Use peer, teacher, or expert feedback to change your work?			1	1	1		

Day 3

	Setup	Warm-up	Investigate	Planning	Create	Present	Reflect
		What makes a good infographic?	Brainstorm: Teen survey topics	Write questions	Administer survey	Prepare presentation	Discuss results & limitations
				Questionnaire feedback	Analyse data	Present project	
					Create Infographic		
Collaboration Skills							
Work in pairs/teams to complete a task together?		1	1	1	1	1	1
Work with other students to set goals and create a plan for your team?			1		1		
Create joint products using contributions from each student?				1	1		
Present your group work to the class, teachers, or others?						1	
Work as a team to use feedback on group tasks?			1	1	1	1	
Give feedback to peers or assess other students' work?			1	1	1	1	1

Communication Skills							
Structure data for use in written products or oral presentations (e.g., creating charts, tables, or graphs)?					1		
Communicate your ideas using media other than a written paper (e.g., posters, video, blogs, etc.)					1	1	1
Prepare and deliver an oral presentation to the teacher or others?						1	1
Answer questions in front of an audience?			1			1	1
Decide how you will present your work?				1	1	1	
Creativity Skills							
Use idea creation techniques such as brainstorming?			1	1			
Generate your own ideas about how to solve a problem or answer a question?		1	1	1			1
Test out different ideas and work to improve them?			1	1	1		
Invent a solution to difficult problems?							

Create something new that can help you express your ideas?				1	1		
Critical Thinking							
Try to solve problems or answer questions that have no single correct solution or answer?		1	1	1	1	1	1
Compare information from different sources before completing a task or assignment?					1	1	
Draw your own ideas based on analysis of numbers, facts, or relevant information?					1	1	1
Summarize or create your own interpretation of what you have read or been taught?				1	1	1	1
Analyze different arguments, perspectives, or solutions to a problem?		1					1
Use evidence to develop arguments?					1	1	

Learning with Tech							
Select the right technology tools or resources for completing a task?				1	1		
Use technology to talk with experts or members of communities?							
Use technology or the Internet to help you learn things for yourself (e.g., tutorials, self-instructional websites, etc.)?				1	1		
Use technology to help to share information (e.g., multi-media presentations using sound or video, presentation software, blogs, podcasts, etc.)?					1	1	
Use technology to work in a team (e.g., shared work spaces, email exchanges, giving and receiving feedback, etc.)?				1	1	1	
Use technology to keep track of your work on assignments?				1	1		
Judge how good and useful online resources are?					1		

Use technology to analyse information (e.g., databases, spreadsheets, graphic programs, etc.)?					1		
Self-Direction Skills							
Take the lead when faced with a difficult problem or question?			1	1	1	1	
Choose your own topics of learning or questions?			1	1			
Plan the steps you will take to accomplish a difficult task?			1	1	1		
Choose for yourself what to study or what to use to help you study?			1	1	1		
Track your own progress and change things if you are not working the way that you should be to complete a task?				1	1		
Assess the quality of your work before it is completed?				1	1	1	
Use peer, teacher, or expert feedback to change your work?				1	1		1

Day 4

	Setup	Warm-up	Investigate	Planning	Create	Present	Reflect
	College Q&A	Brainstorm: School likes & dislikes	Brainstorm: Ideas to make school better	Plan team presentation	Create slides	Present ideas	
		Group discussion			Prepare to speak		
Collaboration Skills							
Work in pairs/teams to complete a task together?	1	1					
Work with other students to set goals and create a plan for your team?							
Create joint products using contributions from each student?							
Present your group work to the class, teacher, or others?		1					
Work as a team to use feedback on group tasks?							
Give feedback to peers or assess other students' work?		1					
Communication Skills							

Structure data for use in written products or oral presentations, (e.g., creating charts, tables or graphs)?					1		
Communicate your ideas using media other than a written paper (e.g., posters, video, blogs, etc.)	1				1	1	
Prepare and deliver an oral presentation to the teacher or others?					1	1	
Answer questions in front of an audience?		1				1	
Decide how you will present your work?				1	1		
Creativity Skills							
Use idea creation techniques such as brainstorming?	1	1	1				
Generate your own ideas about how to solve a problem or answer a question?		1	1	1			
Test out different ideas and work to improve them?				1			
Invent a solution to difficult problems?			1	1			

Create something new that can help you express your ideas?				1	1		
Critical Thinking							
Try to solve problems or answer questions that have no single correct solution or answer?		1	1	1			
Compare information from different sources before completing a task or assignment?	1						
Draw your own ideas based on analysis of numbers, facts, or relevant information?							
Summarize or create your own interpretation of what you have read or been taught?					1		
Analyze different arguments, perspectives, or solutions to a problem?	1				1		
Use evidence to develop arguments?				1			

Learning with Tech							
Select the right technology tools or resources for completing a task?							
Use technology to talk with experts or members of communities?					1		
Use technology or the Internet to help you learn things for yourself (e.g., tutorials, self-instructional websites, etc.)?							
Use technology to help to share information (e.g., multi-media presentations using sound or video, presentation software, blogs, podcasts, etc.)?					1		
Use technology to work in a team (e.g., shared work spaces, email exchanges, giving and receiving feedback, etc.)?					1		
Use technology to keep track of your work on assignments?							
Judge how good and useful online resources are?					1		

Use technology to analyse information (e.g., databases, spreadsheets, graphic programs, etc.)?							
Self-Direction Skills							
Take the lead when faced with a difficult problem or question?		1	1	1			
Choose your own topics of learning or questions?				1			
Plan the steps you will take to accomplish a difficult task?				1			
Choose for yourself what to study or what to use to help you study?							
Track your own progress and change things if you are not working the way that you should be to complete a task?							
Assess the quality of your work before it is completed?				1			
Use peer, teacher, or expert feedback to change your work?					1		