Bridge21 – A Model for Team Based, Technology, Mediated Learning

In and Out of School Context

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

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Declaration

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John Lawlor

16th April 2016

Bridge21 – A model for team based, technology, mediated learning in an out of school context

Abstract

There have been calls for decades by many educational writers and commentators for a new model of learning to facilitate what is generally described as 21st Century (21C) Learning but there is a dearth of practical implementable models to facilitate such learning. This is expressed as a challenge to education to develop skilled learners rather than reproductive knowers of information who learn only to the test - the very antithesis of what is considered 21st Century Learning. Formal educational structures, given the system demands to which they are constrained, have been shown to be inhibited in adopting the significant change required to move away from an behaviourist pedagogy that is heavily reliant on extrinsic student motivation.

*Technology was presented as a driver of change in formal education but current system and practice has shown itself to be impervious to change driven solely by ICT (*Hallissy *et al., 2015). Additionally, it is argued for technology to be deeply effective in learning would require an adoption of a new pedagogy that rooted in accepted theory. Such a pedagogy should* be rooted in accepted theory *and social constructivism (Fullan & Langworthy, 2013; Conole, 2010).*

It is evident that non-formal educational systems show greater promise in their facilitation of 21st Century Learning. A common thread in such non-formal systems is the inclusion of collaborative working. A learning model seeking to facilitate 21st Century Learning could usefully embrace teamwork to provide a structure for collaborative working and to act as a vehicle for transferring responsibility in the learning to the learner.

Teamwork is a social constructivist learning approach which when implemented with ICT proves an effective partner in creating an engaging learning experience (Sutherland et al., 2004).

The Bridge21 learning model and its design and development by the author is the major contribution as described and explored in this thesis. It is a team-based model heavily influenced by the learning model of the world's largest non-formal educational movement, The World Scout Movement with its Patrol System (small group) educational method and is also aligned to the principles of social constructivism.

This thesis, through a case study, describes the design and assembly of the elements of Bridge21 and its implementation over three academic years in an out of school context and in a specially designed learning space, on the author's university campus. The model has been tested by this author and other researchers in a wide range of learning contexts and implementations, and has shown itself to be robust, flexible and effective in promoting 21C Learning.

The Bridge21 model is presented as a mix of key elements and while it can be said that nothing is new in that the individual elements are well comprehended in theory and literature, everything is new in their systematic application as constituent parts of a combined learning model and a 'jazz ensemble' of collaborative improvisation (Sawyer, 2004).

The thesis and research validates Bridge21 as an effective pragmatic model for 21st century team-based learning that promotes intrinsic student motivation, encourages personal responsibility for learning and offers a potential model for use in other learning contexts.

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I wish to acknowledge the encouragement, support and generousity of my supervisor, Professor Brendan Tangney, in guiding me through the work on this thesis and also in providing me with the unique opportunity to engage with the work that led to Bridge21.

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I wish to dedicate this thesis to my mother Kathleen who always valued learning.

Related Publications, Conference Presentations and Awards

Journal Articles

Lawlor, J., Marshall, K., & Tangney, B. (2015). Bridge21–exploring the potential to foster intrinsic student motivation through a team-based, technology-mediated learning model. *Technology, Pedagogy and Education, 1-20.*

Tangney, B., Oldham, E., Conneely, C., Barrett, E., Lawlor, J., (2010)*, Pedagogy* and processes for a computer engineering outreach workshop – the B2C model, *IEEE Transactions in Education, vol 53 no 1, pp53-60.*

Lawlor, J., Conneely, C., Oldham, E., Marshall, K., & Tangney, B. (2015). Bridge21: Teamwork, Technology and Learning - A pragmatic model for effective 21C Team-based Learning. *Technology, Pedagogy and Education* (Accepted for publication subject to revision)

Book Chapter

Conneely, C., Girvan, C., Lawlor, J., Tangney, B., An *Exploratory Case Study into the Adaption of the Bridge21 Model for 21st Century Learning in Irish Classrooms,* in editor(s) Butler, D., Marshall, K., Leahy, M., *Shaping our Future: How the lessons of the past can shape educational transformation*, Dublin, Liffey Press. 2015, pp 348-381.

Peer Reviewed Conference Paper

Lawlor J., Conneely C., Tangney B. (2010), Towards a pragmatic model for group-based, technology-mediated, project-oriented learning – an overview of the B2C model, Proceedings of the 2010 TechEduca Conference.

Conference Presentations

(1) Computers and Learning Conference, Brighton, 2008 (CAL08)

(2) TechEduca Conference, Athens May 19-21 2010

(3) Educational Studies Association of Ireland (ESAI) Conference, Dublin, April 15 2011

(4) Re-Imagining Learning Conference (Educate Together), April 8 2011

(5) Poster Presentation, International Conference on Engaging Pedagogy (ICEP) Conference, Dublin, December 15 2011

Awards

The author has been a recipient and co-recipient of prestigious national awards for the work with the Bridge21 model with colleagues Brendan Tangney and Claire Conneely.

1. Irish Learning Technology Association, Jennifer Burke Award (2009) for Innovation in Teaching and Learning with Claire Conneely and Brendan Tangney
   http://jenniferburkeaward.ie/2009-finalists/
2. Social Entrepreneurs Ireland 2009 Award
   http://socialentrepreneurs.ie/winners/john-lawlor-2/
3. Social Entrepreneurs Ireland 2010 Award
   http://socialentrepreneurs.ie/winners/john-lawlor/

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Chapter 1 - Introduction

1 Introduction

This thesis presents the Bridge21 learning model, designed and developed by the author, as a contribution to teaching and learning. The work introduces Bridge21 as a progressive, implementable model that is rooted in constructionism and social constructivist theory, the effective integration of technology in learning and a belief in the effectiveness of teamwork in learning.

Bridge21 is called a learning model in that it codifies an approach and particular assembly of elements and their systematic application that is developed abductively working from accepted theory and emerging data and applied in this work in a particular out-of-school, non-formal context with a view to its further implementation in broader learning contexts.

This chapter provides the relevant external context and demand for new learning models that facilitate 21st Century Learning, while introducing the research problem and questions and providing a summary of the influences and the path of development of this learning model. The introduction also outlines the research methodology and sets out the contribution of the work. The chapter concludes by providing the layout of the dissertation.

1.1 Background, Context and Need

21st Century learning is generally defined by the set of skills that society requires learners to have so that they can usefully contribute to life and the economy in this century and to a commitment to the concept of learning for life (Trilling & Fadel, 2009). While the set of skills varies from author to author it typically comprehends: creativity; critical thinking; problem solving; initiative; communications skills; and the ability to work with others (Fullan & Langworthy, 2013; Robinson, 2010; Voogt & Pelgrum, 2005; Wagner, 2010).

While it is evident that there is a growing demand on the education sector to develop skilled learners, rather than reproductive knowers of information, who learn only to the test, it is argued that there is also an identified weakness and dichotomy in the ability of formal educational systems and practice to comprehend, let alone meet this demand (Fullan & Langworthy, 2013; Voogt & Pelgrum, 2009; Wagner, 2014). It has been argued that existing formal educational structures are not ready to embrace the fundamental change necessary to enable 21st Century Learning, as such change would require a move away from a predominant, essentially behaviourist pedagogy that is heavily reliant on extrinsic student motivation (Claxton, 2013; Robinson, 2010). Consequently, the prevalent model of behaviourist practice is opposite to that required for engaged, student led learning (Ames, 1992; Robinson, 2010; Ryan & Deci, 2000; Wagner & Compton, 2015).

Effecting change in practice requires practical, implementable learning models and a pedagogy and practice that would facilitate and encourage 21st Century Learning. Central to the challenge in finding a learning approach that facilitates more engaged student learning is the requirement to shift responsibility from teacher to student and to redefine who leads and 'owns' the learning from teacher to student (Trilling & Fadel, 2009). Consequently, any candidate pedagogical model for 21st Century Learning will need to facilitate a transfer of control and ownership of the learning to the learner (Claxton, 2013; Robinson, 2010; Voogt & Pelgrum, 2009).

This issue of a sense of control and ownership of learning has also impacted the effectiveness of technology as a 'game changer' in learning and the importance of tackling the underlying pedagogical practice is vital to the effective integration of ICT in learning (Conole, 2004; Ottestad, 2010; Yuen, Law & Wong, 2003). Additionally, the experience of the use of ICT in formal learning is marked with a naive and largely unfulfilled assumption that it would of itself promote an impetus for positive student motivation. Technology was, for many years, predicted as a driver of change in formal education but current system and practice has shown itself to be impervious to change driven solely by ICT (Ellis & Loveless, 2013, McGarr, 2009; Conole, 2009). Transforming learning practice will require adoption of learning models that both transfer responsibility for learning to the learner and also integrate the use of technology while maintaining a balance with what has to be learned (Voogt, 2009). There is however a dearth of candidate models for this integration of technology and transfer of learning responsibility. Also, it has been observed that unless the application of technology is in tandem with a change in pedagogy and rooted in accepted theory its impact will be shallow (Conole, 2009; Fullan & Langworthy, 2013).

It is generally accepted that group work has great potential as an educational resource (Blatchford et al., 2003). There is however a dissonance in the espoused belief in the power of group work, acceptance of the theory underpinning it, and its practice and implementation in formal education (Blatchford et al., 2005). Moreover, what is evident in schools is a ‘soft’ implementation of group work with little investment or commitment in addressing the factors that are likely to lead to effective learning groups (Blatchford et al., 2005; Galton & Hargreaves, 2009). This in turn has led to a weak belief among teachers in the power of group work as a learning mechanism and the continued dominance of whole-class, teacher led learning, particularly at second level (Galton et al., 2008). The SPRinG project investigating group work in the classroom, jointly conducted by the University of Cambridge, the University of London and the University of Brighton, suggested that teachers’ view of group work is problematic and that they are prone to give up on group work and resort to more traditional approaches in the face of initial difficulties and that they perceive problems associated with group work rather than the potential to enrich the learning through group work (Blatchford et al., 2003).

Progress in the implementation of a group-work based pedagogy is more evident in the non-formal field of youth work than in the classroom (Morgan et al., 2008). Implementations of group-work in the non-formal learning sector typically seek to apply the group to a task or set of tasks. Through directing the group to a task and crucially through giving the group responsibility, and a measure of autonomy in meeting the challenge of the task, has the effect of promoting the evolution of the group to become a team (Michaelsen et al., 2002). This consideration of the group as a team to be built, developed and relied upon to learn together is characteristic of learning in some informal environments and is at variance to a tokenistic approach to group work in school (Vallory, 2012 ; Blatchford et al., 2003). The evolution of a group to become a team involves the resolution of interpersonal and team dynamic challenges as described in Tuckman's forming, storming, norming model (Tuckman, 1965). To be effective group work and moving to teamwork requires an investment in team development.

It is apparent that within the non-formal sector there is more trust in group work as the basis for learning, as evidenced by the commitment to group work as a pillar of the educational method of those agencies that work with children in the non-formal learning sector (Morgan et al., 2008; Vallory, 2012).

The educational model of The World Scout Movement is a good example of such a commitment to small group learning in the non-formal sector. Teamwork and team based learning is integral to Scouting's pedagogical model and is encapsulated in its learning approach. The 'Scout Method' as its called was conceptualised by Robert Baden Powell 100 years ago, has worked its learning model through, learning by doing, in small groups called 'The Patrol System' (Baden Powell & Boehmer, 2005; Bénard, 2002). Peer to peer learning is intrinsic to the model and children learn from each other in teams (Patrols) that take responsibility for tasks. A range of ages spanning of three to four years is typical for a Scout Patrol allowing a peer-based skills transfer. This facilitation of interaction with a 'more expert peer' sets up a Vygotskyian Zone of Proximal Development and the concept of learning from a 'more expert other' (Vygotsky, 1987).

Such approaches to group based learning, as practiced in non-formal educational models, offer exemplars to formal education in the power and potential of group work in learning and the learning dividend that can be delivered through a commitment to the centrality of group work in practice. It can be argued that there is a largely untapped potential for learning through group-centred pedagogy and this argument is supported by research in the SPRinG project (Baines et al., 2007; Blatchford et al.; 2005) that points to the power and efficacy of group work when systematically implemented in the classroom which contrasts with a weak commitment to the application of group work (Blatchford et al., 2003; Galton & Hargreaves, 2009).

A commitment and belief in the effectiveness in learning of teamwork, social constructivism and particularly the team-based learning model of the World Scout Movement, influenced the design of the Bridge21 learning model presented in this thesis.

The focus of this work is to present the Bridge21 learning model, its design and implementation, and to consider it as a candidate model for 21st Century Learning the systematic application of teamwork and the effective integration of technology. The research was conducted through a large-scale implementation over three academic years in an out of school environment and in a semi-formal learning context.

1.2 Bridge2College and Bridge21

The Bridge21 model was developed by the author through work on the Bridge2College initiative in the Centre for IT in Education (CRITE) at Trinity College Dublin. Table 1.1 summarises the history and development of the model and the programme.

Table 1.1: History of Bridge2College Programme and Bridge21 Learning Model

Year	Programme	Model
2007 (May)	Bridge2College programme established and designed by the author at Trinity College Dublin in association with Suas Educational Development and Trinity Access Programme	Initial ideas formulated. Other models considered (e.g. Computer Clubhouse)
2007 (Oct)	First Implementation with partner schools recruited and students participating.	Intuitive Learning Approach Piloted
2008	Learning space designed and implemented at Oriel House on the Trinity College campus	First version of the model implemented. Model conceptualised as comprising key 'planetary' elements and first presented in academic contexts
2008-2010	Programme extended at Oriel House and an in-school programme introduced	Model refined in successive academic years working with second level students from partner schools. First academic publication of implementation of the model (Tangney et al., 2010).
2011	Programme renamed Bridge21	Model renamed as Bridge21
2011-present	Continuing implementation of the model both in Oriel House and on site in partner schools and other educational contexts	2013 presentation of the model graphic as a 'swirl' rather than a discrete set of 'planetary' elements to convey the importance of their interplay in the Bridge21 learning model

The Bridge2College (B2C) programme was established in 2007 with the author as its founding Director, as part of the university's outreach programme for second level schools in areas of social disadvantage, with the support of the Trinity Access Programme (TAP) and in partnership with Suas Educational Development (an NGO committed to social development through education). The Bridge2College initiative was renamed Bridge21 (B21) in 2011 to reflect a broader mission and to create a link to the concept of 21st Century Learning.

The Bridge2College (later Bridge21) programme and the learning model that was created were significantly influenced by the academic and pedagogical approach of CRITE which is infused with a constructionist and social constructivist philosophy in learning (Duit & Treagust, 1998; Kim, 2001) and in the constructionist use of technology in learning as promoted by Papert (Papert & Harel, 1991). Additionally, the author had extensive personal experience and belief in the pragmatism and effectiveness of the team-based learning model of the World Scout Movement (Vallory, 2012; WOSM, 1998).

The initiative is sited on the university campus in a specifically designed learning space at Oriel House that was constructed to support team-based, technology mediated learning and is consistent with social constructivist and constructionist principles. The programme commenced in late 2007 and has run continuously since.

The Bridge21 Model was developed in parallel and through implementation within the Bridge2College programme, initially with the partner schools from TAP and later with a broader range of schools. To maintain clarity the development of the model and the Bridge2College programme implementation are discussed separately in Chapters 3 and 6.

The initial deployment of a team-based, technology mediated learning model, in the context of the Bridge2College programme, was largely intuitive and based on the experience of the author and the programme team. The Bridge21 model is the product of the refinement of the early models designed as a team-based technology mediated learning model. Bridge21 is heavily influenced by the team-based learning method of the World Scout Movement, informed by the literature on social constructivism, team-based learning and 21st Century Learning and researched under the guidance and ethos of the CRITE. Since its establishment Bridge21 has become a flagship umbrella project for research in CRITE. Up to the time of submission of this work, in excess of 10,000, second level students from 80 schools have participated in workshops and interventions using the Bridge21 model. To date 380 teachers have received training at Bridge21 workshops and additionally an introduction to the Bridge21 model has been included in the programme for 270 teachers engaged in the Professional Masters in Education course at Trinity College Dublin since 2014. The Bridge21 model has now been implemented extensively in practice and this thesis traces its origin, design and development by the author and seeks evidence of its effectiveness through the research questions.

1.3 Research Questions

The primary research question and sub-questions of this work probe the effectiveness, impact and potential of the Bridge21 educational model as implemented in a structured out-of-school implementation. Specifically, the research examines and addresses:

RQ: What are the credentials of Bridge21 as a candidate model for 21st Century Learning?

> **Sub-RQ (a):** What is the effectiveness of the model in encouraging intrinsic student motivation?
>
> **Sub-RQ (b):** What is the effectiveness of the model in facilitating team-based, technology mediated learning?

1.4 Research Methodology

The research in this thesis is realised through consideration of an integrated Case Study with embedded Exploratory and Explanatory units of analysis, examined in the frame of three successive years of implementation (Yin, 2013). The development of the Bridge21 model moved from the intuitive to the informed through referencing existing theory in the literature and building evidence from data. This approach informed the design of the Bridge21 model as it evolves through testing in a series of instantiations over successive academic years. The data are gathered in conjunction with these interventions though questionnaires and focus groups. A mixed methods approach was adopted to facilitate the combination of qualitative and quantitative viewpoints and so provide a depth of understanding and corroboration. Qualitative data provides understanding of the phenomena evident and emerging in the research in both the Exploratory and Explanatory Analysis Units of the Case Study with the quantitative data supporting the qualitative data (QUAL+qual).

1.5 The Author's Contribution

The Bridge21 model, as designed and developed by the author, is presented as the major contribution in this work. The author's contribution includes the creation of the Bridge21 model and which he argues is effective as a 21st Century learning model, as demonstrated through research conducted with students participating over successive academic years at Oriel House. The Bridge21 model and its implementation has supported and enabled a significant number of contributions in the field of technology and learning, team-based learning and has provided a platform and scaffold for further research in a range of applications and contexts. Published papers and conference presentations by the author and also the receipt of significant prestigious awards validate the contribution (cf. Irish Learning Technology Association, Jennifer Burke Award (2009); Social Entrepreneurs Ireland Award (2009); Social Entrepreneurs Ireland Award (2010)).

1.5.1 The Design of the Bridge21 Model

The Bridge21 model is based on well understood and in some respects, traditional concepts of teamwork and team learning but is entirely innovative in the assembly of the elements of the model and their systematic implementation to deliver an effective and implementable learning approach. Bridge21 is a pragmatic model for 21st Century Learning that has teamwork at its core. In particular, the model is a vehicle for giving learners the lead responsibility in their learning and encourages personal growth as learners through their individual and personal contribution to the team effort. This model has had extensive implementation in a range of learning contexts since 2007 and has shown itself to be versatile, flexible and resilient with potential for further deployment in both formal and non-formal learning environments.

1.5.2 Bridge21 as a Model for 21st Century Learning

The Bridge21 model is presented in this work as a pragmatic, candidate model for 21st Century Learning. The work of this author and other researchers has shown Bridge21 to be pragmatic, implementable and flexible across an extensive range of learning contexts and capable of application with a range of learning topics and curricula. Further it has been shown to encourage and assist the development of those generalisable skills commonly referred to as 21st Century Learning. Volunteer mentors and teachers introduced to the Bridge21 model have been shown to be effective in working with it following a modest level of training. How Bridge21 could be further applied against the formal curriculum and in an in-school context is the focus of other current research (Conneelly et al., 2013).

1.5.3 Effectiveness of the Model in Encouraging Personal Responsibility for Learning

This thesis will show that the Bridge21 model through its structured teamwork approach offers a vehicle for the transfer of control of the learning from the adult/teacher to the learner and through this promotes student responsibility for the learning. It will be seen that participants who experienced Bridge21 reported a new sense of responsibility and independence in their learning journey and evidenced a personal perception of gain in self-confidence.

1.5.4 Bridge21 - Encouraging Intrinsic Student Motivation

The thesis will show that the Bridge21 model exhibits the critical characteristics of learning necessary to encourage intrinsic motivation. The experience of the participants in learning through the Bridge21 model affected their perceptions of their relationship with learning, their sense of responsibility for their learning, their sense of mastery of skills, how they can learn, with and from their peers, their attitude to technology in their learning and their enjoyment of the learning experience. These results echo the ideas espoused for intrinsically motivated learning as published in literature.

1.5.5 Effectiveness of the Bridge21 Model in Facilitating Team-Based, Technology Mediated Learning

The Bridge21 model with its focussed teamwork approach has shown itself to be an effective environment for team-based, technology mediated learning. The teams and team members take responsibility for tasks and achievement of the team objectives through combined personal contributions and the added advantage of the team contribution. The use of technology in the learning is consistent with how young people use technology in their social lives. The integration of ICT in the learning was applied on a resource-sharing basis so as to support and maintain the integrity of the team model. This approach in integrating ICT in the learning, as a team resource, offers potential in the search for models to facilitate 21st Century Learning.

1.5.6 Bridge21 as a Research and Educational Development Platform

The Bridge21 model has been a subject of interest in other research and has been subject to on-going testing and rigor in different learning contexts by other researchers. Additionally, the model has been employed as a research learning method and environment to support research in a significant number of domains to-date supporting Post-Doctoral, Doctoral and Masters studies. These cover a range of diverse fields including: introduction to programming, language learning, mathematics learning, history learning, peer learning, school transformation and teacher development.
(Bauer, Devitt & Tangney, 2015; Bray & O'Donovan, 2015; Bray, Oldham & Tangney, 2015; Bray & Tangney, 2014; Bray & Tangney, 2015; Byrne, Fisher & Tangney, 2015a; Byrne, Fisher & Tangney, 2015b; Conneely, Girvan, Lawlor & Tangney, 2015; Conneely, Girvan & Tangney, 2012; Conneely et al., 2013; Girvan, 2015; Lawlor et al., 2010; Lawlor et al., 2015a; Lawlor et al., 2015b; Tangney & Bray, 2013; Tangney et al., 2010).

The Bridge21 programme and model has contributed to the research supporting changes to Irish Second Level Education through work commissioned by the National Council for Curriculum and Assessment (NCCA) during the 2011/12 academic year.

Under the auspices of Trinity Access 21 (TA21) and in cooperation with Trinity College Dublin's Outreach Programme (TAP) and the Schools of Education and Computer Science & Statistics, Bridge21 is providing the pedagogical platform to support a programme offering a suite of initiatives to address educational disadvantage with a particular focus on 21st Century Learning and STEM (Science, Engineering, Technology and Mathematics). This programme includes a new postgraduate certificate in 21st century STEM education for teachers.

1.6 Layout of the Dissertation

This dissertation follows the succeeding structure and layout:

Chapter 1: Introduction. This chapter provides the relevant external context and background for the thesis. It presents the challenge to education to find practical implementable models to enable 21st century Learning. It also introduces the problem of integrating ICT effectively in learning. The influences bearing upon the development and the origins of the Bridge21 model are also introduced. The chapter also presents the research questions that probe the efficacy of the model. The chosen research methodology is outlined. The introduction chapter concludes with a summary of the contribution of the work.

Chapter 2: Literature Review. This chapter explores the relevant literature considering 21st Century Learning, how it is defined and how it might be facilitated. The literature is explored for promoting engaged learning, student autonomy, group work, ICT in learning, learner motivation, out-of-school programmes and technology mediated group work. The chapter also explores the literature more specifically informing the Bridge21 design including that covering team-based learning, team formation, responsibility for learning, reflection, task orientation, technology and learning, learner interactions, team oriented learning space and social learning protocols.

Chapter 3: Model development and Implementation. This chapter introduces the Bridge21 model and describes the path of development of the Bridge21 learning model as it was informed by the results from implementation. The chapter first considers the influences that bore on the inception, deployment and development of the model in the context of the Bridge2College outreach programme and explains its development as implemented in a broader programme. The progression of the model is described as it evolved in parallel with the programme of implementation. The significance of each element of the model is described and considered in its function in facilitating and encouraging teamwork and 21st Century Learning. The original pilot instantiation is described and discussed.

The Bridge2College programme at TCD provided the implementation context for the work presented in this thesis. The development of the Bridge21 model was a product of the Bridge2College programme and this chapter describes the implementation of the model as an integral part of that programme over successive academic years. The original outreach mission of the programme is explained and how the programme evolved to meet broader educational objectives through leveraging the effectiveness of the emerging learning model. The implementation is described and the structure and activity model of the workshops is presented. The student participant cohort and partnership with schools and the context of their participation is explained. The significance of the move to a specially designed learning environment at Oriel House on the Trinity College Dublin university campus is explained and the evolution and design of this learning environment is described. The activity model including the content, scope and scale of the intervention workshops is detailed.

Chapter 4: Method. This chapter explains the method employed in the research and details the rationale for the methodology adopted. It describes the consideration of an appropriate research method and framework and the adoption of a research approach to facilitate the design and development of a learning model through referencing emerging data and the consideration of accepted theory from literature. The application of a mixed methods study, the consideration of an integrated Exploratory and Explanatory Case Study and the design typology and timeframe of the research are described. The chapter also describes the data collection and the instruments used and the use of focus groups. The data analyses techniques employed are explained including the coding and theming of qualitative data, the treatment of quantitative data and the pragmatic and abductive techniques employed in analysis. The chapter concludes by discussing the robustness of the research, the generalisability of findings and the ethical considerations and compliance.

Chapter 5: Findings. This chapter describes the data analysis process, which was followed and the emergent results. The treatment of the data, the qualitative and quantitative analysis process adopted and the mixed methods analysis are explained. The data quanta are provided and themes and categories for discussion are detailed. The triangulation of data is explained and the basis for the discussion chapter is established.

Chapter 6: Discussion of Findings. This chapter discusses the findings of the research and presents the response to the research questions posed. In particular the claim for Bridge21 as a pragmatic model for 21st Century Learning is addressed, the model's efficacy in relation to encouraging personal responsibility for learning, the efficacy of the model in encouraging intrinsic student motivation and the effectiveness of the model in facilitating team-based, technology mediated learning are considered and discussed.

Chapter 7: Conclusions and Contribution. The final chapter summarises the key elements and results of the work. The research questions are revisited and considered in the light of the finding and the results are referenced against the original research challenge. The chapter concludes by presenting the contributions of the work.

The dissertation concludes with a full reference list and bibliography and an appendices section that provides: data instruments, foundation documents and abstracts of related publications.

Chapter 2 - Literature Review

2.1 Introduction

This Chapter presents a literature review that examines the educational context and pedagogical ideas that influence and shape the work in this thesis. To be effective and useful in informing research a literature review should follow a concept-centric approach (Levy & Ellis, 2006). The central focus of this thesis is the design and development of Bridge21 as a model for 21st Century Learning that is team-based and technology mediated and therefore the review of literature looks at the issues around 21st century learning, technology in learning, group based learning and engaged learning and then focuses on literature that can guide the assembly of elements that could constitute a team-based technology mediated learning model for the the 21st Century.

The literature review methodology is based on a thematic approach to facilitate a directed line of enquiry through the literature canon (Dixon-Woods et al., 2005). The review firstly sets the context of the research and informs the problem statement and goes on to seek evidence to guide the design of the learning model.

Section 2.2 Addresses the broader background to the work, considering the themes of 21st century learning and the demands of an Information Society for active learner rather than passive knowers, the challenge for ICT in learning in a formal context and the opportunity evident in implementations in less formal contexts. The application of groupwork in formal learning contexts is examined and how this relates to the integration of technology in learning. Consequently, the requirement to situate the effective use of technology in learning in a renewed pedagogical approach is also considered. The two strands of constructivism: cognitive and social constuctivism are examined for how they mutually promote a learner-centered approach and how they respectively underpin learner construction of meaning and socio-culturally situated learning. The link between a social constructive approach and reflection in learning is traced. The critical topic of student motivation is considered and how it might be positively encouraged through enhanced student autonomy and learner engagement. The requirement to shift responsibility to the learner is explored and how that might be facilitated through teamwork.

Section 2.3 Seeks insight and guidance from the literature for the design of a specific learning model that is team-based and technology-mediated. The studied literature provided a reference for the elements of the emergent model and looks at the components of a team-based approach, a specific influencing exemplar from the non-formal education sector, learning space and a team environment and how technology might be employed to support a team-based, engaged learning model. This consideration of the literature also informs the research problem and helps frame and define the research aims and research questions.

2.2 Literature on Influencing Background

This section of the literature review considers the external context and influencing background that prompted the work to develop a learning model to support 21st Century Learning. The relevant literature relating to theme of 21st Century (21C) Learning is explored, how 21C Learning is commonly defined, why it is considered an important requirement and how it might be facilitated. The literature is studied for relevant perspectives regarding engaged learning, student autonomy and intrinsic motivation, social constructivism, group work, ICT in learning, out-of-school programmes and technology mediated group work.

2.2.1 21st Century Learning - A New Learning Requirement for a Changing Society

The development of the Bridge21 model is against the background and context of a search for a change in practice that can deliver what is generally described as 21st Century Learning (Voogt & Roblin, 2012]. The prevalent discourse among industry leaders and policy-makers is that the economic and social trends of the 21st century, largely due to advances in information and communications technology (ICT), have transformed the global economy and its work practices, from one based on material goods and services, to one based on information and knowledge (Claxton, 2013; Dede, 2010; CISCO, Intel & Microsoft, 2008; Tucker, 2014). As a result of these changes, it is suggested that the 21st century workforce is required to have a higher level of cognitive skills, encompassing the ability to “respond flexibly to complex problems, to communicate effectively, to manage information, to work in teams, to use technology, and to produce new knowledge” (CISCO et al., 2008). However, while such dramatic transformations have taken place in the global economy and in society generally, many commentators argue that education systems have been slow to respond to the changing environment and still emphasise information transfer over the development of skills and capabilities (Fullan & Langworthy, 2013). They claim that curricula, pedagogy, school organisation, assessment and critically classroom practice remain fixed in a cycle of information transfer, absorption and regurgitation that stunts the development of critical thinking, problem solving and personal initiative and responsibility in learning.

A predominant focus on the ability to reproduce received information has produced results and learning habits with students that has led to many calls to move away from subject-based learning and focus on meta-cognitive skills, problem-solving and the development of the whole person (Collins, 2007). Claxton observed that there is a requirement to develop ‘learners with positive transferable learning dispositions rather than ‘knowers’ who can absorb and reproduce received information (Claxton, 2013). Achieving outcomes with learners rather than knowers requires a move from a teacher-centered educational paradigm to a learner-centered paradigm (Saulnier et al., 2008).

It is dramatically argued in the P21 Partnership for 21st Century Learning programme, that if the the gap between how students learn and how they live is not bridged, then today’s education system will face irrelevance (Tucker, 2014). Looking to the positive, the adoption of new pedagogies, with technology supporting new learning partnerships between teachers and students would provide a foundation for deep learning and would facilitate teachers’ ability to put students in control of the learning process (Fullan & Langworthy, 2013). Voogt and Pelgrum suggest a new balance of pedagogical approaches in order to better align formal education with the demands of the world outside of school and enable students to prepare for the challenges of the information society (Voogt & Pelgrum, 2005). Voogt compares and contrasts the requirements on pedagogy with what is commonly called the Information Society with those of the Industrial Society and considers these societal requirements on pedagogy under the headings: Active, Collaborative, Creative, Integrative and Evaluative. This analysis is summarised by Voogt in Table 2.1.

Table 2.1 Pedagogy in a Knowledge-Based Society Versus the Information Society

Aspect	(Less) Pedagogy In an Industrial Society	(More) Pedagogy In The Information Society
Active	Activities prescribed by teacher Whole class instruction Little variation in activities Pace determined by the programme	Activities determined by learners Small groups Many different activities Pace determined by learners
Collaborative	Individual Homogeneous groups Everyone for him/herself	Working in teams Heterogeneous groups Supporting each other
Creative	Reproductive learning Apply known solutions to problems	Productive learning Find new solutions to problems
Integrative	No link between theory and practice Separate subjects Discipline-based Individual teachers	Integrating theory and practice Relations between subjects Thematic Teams of teachers
Evaluative	Teacher-directed Summative	Student-directed Diagnostic

(Voogt & Pelgrum, 2005)

Conceptualising and designing learning approaches and models that will be effective and pragmatic in delivering learning for the Information Society or 21st Century Learning requires critical consideration of the issues surrounding the design, pedagogical basis, learner centricity and practicality of the learning approach proposed (Beetham & Sharpe, 2013). A pedagogy effective for 21st Century learning would also be consistent with the development of skills oriented towards lifelong learning (Voogt, 2009).

2.2.2 ICT in Learning - Presenting a Challenge and Unfulfilled Opportunity

ICT presents a challenge to prevailing pedagogical practice in its potential to shape the practice of learning (Hennessy, Ruthven, & Brindley, 2005). This challenge by ICT, has long been identified by those who espouse a more open, student centric, constructivist and constructionist approach to learning (Beetham, & Sharpe, 2013; Brown, 2006; Leask, & Younie, 2001; Coupal, 2004). It is argued that the failure, thus far, to fully exploit the potential of technology in formal education, is rooted in attempts to corral ICT within the existing school system and practice and in the latent beliefs of teachers (Conole, 2004; McGarr, 2009; Orlando, 2013). Moreover, unless teachers engage with the theoretical underpinnings for the change in practice required to facilitate the integration of ICT in learning, their efforts in adopting technology in their teaching and learning practice are likely to be shallow (Sang et al, 2010; Somekh, 2008).

Those who argue for the integration of technology in a transformative way in learning flag a requirement for a change in mindset by those orchestrating the learning, with trans-disciplinary thinking and an understanding of the capability of ICTs in creating transformative teaching and learning for the 21st Century. (Mishra, Koehler, & Henriksen, 2010)

The reliance on computer science labs that are remote from the normal class room and used infrequently or at best within strict timetable context is a tangible example of how existing practice imposes constraints that neutralise much of the power of ICT in learning. Teachers are constrained by an inherited model of learning that owes more to a prescription for teaching determined by overriding constraints of school-life, timetable, rigid belief systems and examination systems than to possibilities afforded by ICT or the power of more flexible learning models (Ertmer, et al., 2012; Jimoyiannis & Komis, 2007; Prestridge, 2012).

An approach to learning based on the imparting of information through a behaviorist pedagogy has long been identified as rooted in the failure of formal education to progress beyond the Victorian model of classroom (Jones & Brader-Araje, 2002). This model of classroom is itself emblematic of a rigid and sterile learning environment. This sense of rigidity in formal education and classroom practice that has in recent decades characterised and framed the poor impact of ICT in education has been understood by reforming educationalists for over a century.

"The principle of slavery still pervades pedagogy, and therefore, the same principle pervades the school. I need only give one proof—the stationary desks and chairs." Maria Montessori (1912).

Montessori would find little has changed particularly at second level and that the stationary desk approach persists as we enter the second decade of the 21st century. The model of computer room or lab commonly seen in schools echoes this fixed desk traditional classroom, individualised approach with little consideration or room for collaborative working, peer learning and communities of practice and foregoes the opportunity and potential for the teacher to be a mediator and orchestrator of transformative learning experiences (Mishra et al., 2010; Saulnier et al., 2008).

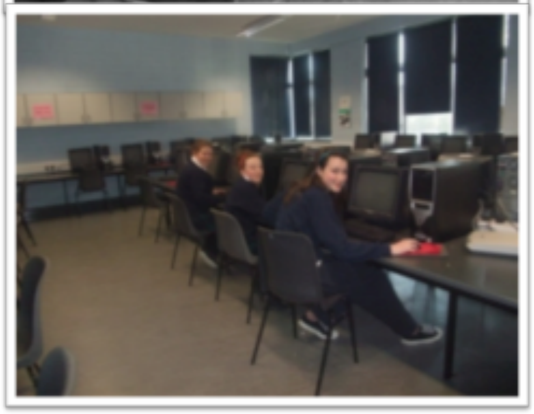
Additionally, the typical configuration for computer labs is not arranged for groupwork or teamwork or to facilitate collorative project-based learning. Technology readily enables project-based learning, but this can be difficult in a classroom that does not facilitate moving furniture or creating space for groups or teams (Hertz, 2013).

This style of configuration in computer labs owes its origins to traditional didactic teaching concepts where the computer takes the place of the slate or copybook on the desk with the same basic underlying pedagogy transplanted from the classroom to the computer room (Trucano, 2011) as illustrated in Figure 2.1. The use of these dedicated facilities that are separate from the classroom is commonly attended by limiting access to set periods in the timetable. This separation of computer facilities from the classroom, which is the normal workplace of the students, creates an artificial break between the work students are doing and the technology they are using (Hertz, 2013; Trucano, 2011).

Figure 2.1 Enduring Victorian Pedagogy

The Victorian Classroom 1890

The Victorian Computer Classroom 2015



It is argued that in the field of e-learning much of what is presented as constructivist, and collaborative could more properly be described as didactic and behaviourist and there is a dissonance between the hype and the reality in implementation (Conole, 2004; Lowerison et al., 2008). Conole suggests that if the potential of technology in education is to be realised then what is required is a genuine understanding of how technologies can be used effectively (Conole, 2004). It can be argued that the difficulty in exploiting technology in the classroom is rooted in the pedagogy and praxis applied. At a practical level, difficulties in the application of e-learning strategies may be traced to the reliance of formal education on systems and practices that actively discourage learning in collaboration with others or the creation of communities of practice (Stahl, Koschmann & Suthers, 2006).

Conole et al. argue that to meet this challenge for the meaningful integration of ICT in learning, a theoretically based approach to learning design is essential, relating theory with the desired features of the learning intervention, approach or initiative. The design approach should align heuristics, techniques and practical tools produced with the theoretical principles and theory so the new practice can faithfully reflect understood and accepted theory (Conole et al, 2004). They propose a model relying on an abductive process for designing effective learning which integrates elements of existing theories and shows how they link and interact. Abduction, sometimes called retroduction, is the process of examining facts and constructing theory to explain them (Richardson, & Kramer, 2006). In abduction researchers move back and forth between induction and deduction, first converting observations into theories and then assessing these theories through action (Morgan, 2007). Abduction has been described as a “sensible and scientific” form of inference that facilitates deep insight and new knowledge (Reichertz, 2007).

The abductive approach, proposed by Conole et al., offers an algorithm for building a learning model with meaningful integration of ICT which follows a methodology consisting of the following elements:

1. Reviewing learning theories.
2. Identifying common characteristics across different learning theories.
3. Building a model using these characteristics.
4. Mapping learning theories to the model and identifying learning theory clusters.
5. Applying and testing the model

(Conole et al., 2004) abductive

2.2.3 The Development of Learners Rather than Knowers

A long-standing disquiet has existed around the weakness of an educational system that emphasises information transfer over reflective thought. As far back as the 1870s Newman railed against the then emerging trend of ‘teaching to the exam’:

“..those earnest but ill-used persons, who are forced to load their minds with a score of subjects against an examination, who have too much on their hands to indulge themselves in thinking or investigation……….. having gained nothing really by their anxious labors, except perhaps the habit of application”

(Newman & Turner, 1996)

In more modern times this relentless focus on the ability to reproduce received information has led to many calls to move away from the subject base and focus much more on meta-cognitive skills, problem solving, and the development of the whole person (Leat & Lin, 2003; Collins, 2007). Claxton observed that there is a requirement to develop 'Learners' with positive transferable learning dispositions rather than 'Knowers' who can absorb and reproduce received information. Claxton points to the requirement for a change of heart by those who run and work in schools to achieve such a goal (Claxton, 2013).

It has been observed that prevalent practice in schools is impacting third level education. Developing an ability to assimilate and reproduce received information as trained at second level as opposed to developing higher order learning skills has been pointed to (in an Irish context) as leading to poor performance at third level:

"our second-level system is producing students who learn to the test; who in ever greater numbers are not learning to think for themselves; who receive spoon-feeding at second level and expect the same at third level" (Boland, 2009).

It may be argued that the idea that group-work is peripheral to mainstream learning is endemic to formal education practice and this is captured succinctly in an injunction in a piece of resource material prepared for teachers employing group-work (in an Irish context) to:
"*Return room to original arrangement"* when the group task was complete
(LCVP, Senior Cycle Programme of the Department of Education and Science, Ireland, 2015).

2.2.4 Constructivism and Social Constructivism

Constructivism is a psychological theory of learning initially based on the work of Jean Piaget and Lev Vygotsky that focuses on cognitive development and deep understanding as constructions of active learner engagement with learning understood as a complex non-linear process (Fosnot & Perry, 1996). Definitions vary for constructivist learning but there is consistency in describing learning as an active process where learners construct meaning through linking new knowledge with their existing knowledge (Naylor & Keogh, 1999).

The move toward learner-centered philosophies in education is prompting the idea that such learning is of necessity constructive (Hains, & Smith, 2012) and it is argued that for teachers and students to communicate optimally in the pursuit of deep learning requires a commitment to constructivist principles (Powell & Kalina, 2009)

There are two strands of constructivism implemented in formal learning:

1. Cognitive or individual constructivism based on the theories of Piaget.
   and
2. Social constructivism based on the theories of Vygotsky.

(O'Loughlin, 1992; Wadsworth, 1996; Hodson & Hodson, 1998).

Social constructivism is a learner-centered philosophy that emphasises the social and cultural context within which learning takes place (McMahon, 1997). This emphasis on social context and culture is aligned with Bandura's social cognitive theory, with reference to what drives human motivation and action from a social cognitive perspective (Bandura, 1986) and social constructivism provides a view of knowledge that crucially links motivation and learning (Oldfather et al., 1999).

Social constructivism offers a significant alternative to traditional approaches to teaching and learning in a move away from the understanding of learning as a singular process for the individual to building learning and meaning through social interdependence and "the coordinated efforts of two or more persons" (Gergen & Wortham, 2001).

To achieve the objective of getting students to think about their learning requires a social constructive approach, because learning and understanding are social activities where deep learning and higher order thinking largely depend on talk and interaction (Leat & Lin, 2003).

In summary, social constructivism provides a strong basis for deep and engaged learning and is founded on the following premises:

- Reality is constructed only through human activity.
- Knowledge is a human product, and is socially and culturally constructed.

- Learning is a social process and meaningful learning happens when learners are engaged in a social activity.
- Learning models based on social constructivism are strongly collaborative.

(Lave & Wenger, 1999; Kim, 2001).

2.2.5 Experience Based Learning (EBL)

The concept of learning by doing is acknowledged as a method for deep and effective learning (Schank, Berman, & Macpherson, 1999). The learning by doing approach can be facilitated by technology and communications through enabling the creation of authentic learning experiences (Lombardi, 2007). Experiential learning is a well-defined approach in education and Kolb describes it as the creation of learning through transformative experience and reflection by the learner to assimilate the learning in a plan-do-review cycle (Kolb, 2014).

Experience Based Learning (EBL) embraces the universe of the learning encounters including formal learning, informal learning, non-formal learning, lifelong learning, incidental learning and workplace learning (Andresen, Boud & Choen, 2000). The Kolb Experiential Learning Theory presents the learning cycle with four elements: 1. Concrete Experience, 2. Reflective Observation, 3. Abstract Conceptualisation, 4. Active Experimentation. The application of technology in learning, learning with technology and through technology is most effective where knowledge, confidence and skills are built through such experiential ‘hands-on’ learning. This theory for learning is consistent with Papert’s concepts in constructionism thought of as “learning-by-making" (Papert & Harel, 1991).

The criteria and attributes required for Experienced Based Learning have been defined as:

1. The foundation and stimulus for learning is experience.
2. Learners construct their experience.
3. Learning is socially and culturally situated and influenced by the socio-emotional context in which it occurs.

4. A learning experience that is meaningful or personally significant to the learners.
5. Personal engagement by the learners.
6. Facilitation of reflection and meta-cognition by the learners.
7. The learning experience bears on the whole person: intellect, senses, feelings and personality.
8. Prior learning is recognised and acknowledged.
9. The relationship with teachers is based on trust, mutual respect, openness and concern for well being of the learners.

(Andresen, Boud & Cohen, 2000)

This requirement that Experiential Learning is socially and culturally situated is aligned to the concept of Legitimate Peripheral Participation, which defines learning as a situated activity where learners gain a mastery of knowledge and skills in communities of practice within the context of socio-cultural norms (Lave & Wenger, 1999). The subject of this thesis, which is the creation of a pragmatic learning model for the 21st Century, can usefully borrow these principles of Experience Based Learning, Learning By Doing and Situated Learning.

2.2.6 Group Work, Formal Education and ICT

Individualised learning and assessment is so embedded in the formal educational systems as to prevent the advancement of group-work in classroom practice (Galton & Hargreaves, 2009) There is clearly a dissonance between espoused best practice as promulgated in teacher training colleges and on the ground practice in the classroom (Blatchford et al, 2003). The SPRinG programme, a substantial research programme in the UK, trialled a systematic implementation of group based learning among 4,500 students in Key Stages 1, 2 & 3 (5-14 years) over a full school year in association with the University of Brighton, University of London and Cambridge University. The study results suggest that group work can have a stronger influence on academic progress than other forms of teaching and learning, pupil’s behaviour improves because they spend more time on task and engage in higher level discussions and relationships improve between teachers and pupils and among themselves (Galton et al., 2009). In some schools pupils may sit in groups but rarely work as groups. It has been seen in many classroom in the UK that groups are formed without a clear strategic view of what they are intended to achieve and based on a perceived efficacy of the use of the approach for social development rather than academic progress (Blatchford, Galton, Kutnick, & Baines, 2005). This frontline perception by teachers is also reflected at policy level and it has been observed that group-work in many countries is confined to a minor role in educational policy (Blatchford et al., 2003).

Technology facilitates, enables and mediates group-based learning (Meyers & Jones, 1993; Springer et al., 1999; Duffy & Jonassen, 2013). There is therefore an opportunity given an appropriate learning model to change pedagogical practice to release the potential of ICT and to leverage the power of group work in the classroom. However, formal education has shown itself to be resistant to change as exampled by the corralling of ICT within the boundaries of a separate learning space and significant systemic changes must be made before there can be a more integrated use of ICT in school (McGarr, 2009).

Individualised and teacher led learning systems militate against collaborative learning and peer learning. This is evidenced by the failure to bridge the gap between accepted potential of the power of group work and its implementation in formal learning (Galton, Hargreaves & Pell, 2009). The SPRinG research points to this reticence in formal education to introduce systemic practice change required to provide for the gains possible through the adoption of a structured group approach in the classroom (Blatchford et al, 2003). At the same time the affordances of ICT present a unique opportunity to fundamentally change educational practice. The potential of ICT for meaningful learning is undermined by the constraints inherent in the school setting (Arbelaiz & Gorospe, 2009). The challenge to have schools step up technically needs to be underpinned by a shift in teaching and learning practice. A new model for classroom praxis is required that is built on strongly established teams that learn through group work and work with technology as a social learning medium.

2.2.7 Out-of-School Learning with Technology and Groupwork

The constraints, real and perceived, imposed by system and latent teacher belief on formal learning practice in its adoption of technology do not apply in the non-formal sector and in how young people interact and learn with technology informally (McDarby,2003; Sefton-Green, 2004). Sefton-Green observes that while the study of ICT in learning in school is well researched, learning with ICT in a non-formal context is less understood. It has also been observed that young people are fundamentally different than previous generations in how they relate to, interact with and learn with technology (Buckingham & Willett, 2013). This difference in how young people assimilate technical skills and learn with technology, offers a potential opportunity for new learning approaches.

Apart completely from their in-school learning, young people form their own communities of practice among their peers and teach themselves a range of skills and competencies through peer learning and/or as mediated by ICT. Their social and out-of-school learning experience with technology affects how young people increasingly regard adults as equals in the ICT space and this trend and phenomenon could be usefully assimilated in formal learning contexts (Fullan & Langworthy, 2013, Sefton-Green, 2004).

A number of approaches have been developed and applied in out-of-school non-formal learning contexts to attempt to exploit the potential of technology to engage young people positively and to facilitate a new model of learning. These include: Computer Clubhouse, KLICK, Fifth Dimension, Pincel y Ratón (Alexander & Wade, 2000; Arbelaiz & Gorospe, 2009; Resnick & Rusk, 1996). They share common characteristics in their attempts to encourage creativity and learning through the affordances and motivational potential of ICT (Wong, Packard, Giroda, & Pugh, 2000).

The Computer Clubhouse model is an exemplar of technology mediated, out-of-school learning programmes implemented as local outreach drop-in centres. Devised at Massachusetts Institute of Technology (MIT) in the mid-90's, the Clubhouse is guided by four core principles: support learning through design experiences, help youth build on their own interests, cultivate an "emergent community" and create an environment of respect and trust (Resnick & Rusk, 1996).

The Computer Clubhouse model seeks to strike a balance between structure and freedom and between directive and exploratory learning in the learning process, facilitating young people to express themselves and gain confidence as active, independent learners (Resnick & Rusk, 1996; Resnick, Rusk, & Cooke, 1999; Resnick, 2001). The Computer Clubhouse involves the assembly of elements that could usefully be included in an ICT mediated learning model. These would typically include: design, teamwork & collaboration, creativity, stimulating learning spaces, social setting & social interaction, learning by doing, peer learning, children teaching children, project based activity, personally meaningful activities and mentoring. How these components are assembled and applied is critical to the effectiveness of any ICT mediated learning model (Rusk, Resnick, & Cooke, 2009).

The evaluation framework applied to the Computer Clubhouse reporting is particularly attuned to the distinctive qualities of the Computer Clubhouse model and makes no observation on broader learning outcomes. It is also evident that the results on teamwork and collaboration are weak and this may be related to the lack of specific team construction and development (Pryor et al., 2002). This may be explained by the lack of structured team work or team-building in the Clubhouse model and as observed by Blatchford et al, group work is unlikely to be successful without preparation and training in its skills (Blatchford et al., 2003). Clubhouse is not unique in avoiding the challenges of structured group work with ICT. The systematic building of learning teams accompanied by the appropriate deployment of group based ICT learning projects is generally absent from learning programmes in both the formal and informal domains (Fullan & Langworthy, 2013; Smeets, 2005). In summary, while it is generally acknowledged that group work and ICT are powerful learning partners (Alavi, 1994; Roberts, 2009) and that non-formal learning contexts have adopted more progressve use of technology, it can be argued that there is a dearth of pragmatic models in either out-of-school or formal domains that combine these two powerful components.

2.2.8 Learner Motivation

Learner motivation is a vital enabler for deep and effective learning. Conversely lack of the same learning ingredient is a chief inhibitor to deep and effective learning (Covington, 2000; Maehr & Midgley, 1991). Intrinsic motivation arises from inside the individual and is driven by the pleasure and satisfaction gained from completing or working on a challenge. Intrinsic motivation carries a unique possibility to release human potential (Ryan & Deci, 2000). It is has been shown that children's intrinsic motivation to learn decreases from pre-school through secondary school and this is a huge challenge for effective learning (Skinner & Belmont, 1993). The intrinsic motivation of the learner is directly affected by the set-up of the learning regime which can be characterised by the degree of student autonomy that is facilitated, the orientation of learning goals, the relationship among peers, the level of collaborative working, the student- teacher relationship and the social environment of the classroom (Wentzel & Wigfield, 1998; Ryan & Deci, 2000). In particular student control is critical to intrinsic motivation (Ames, 1992)

Separately ICT was touted as an unstoppable force that would change learning and learner motivation and orientation (Conole, 2004). However, there is little evidence in school that the introduction of ICT has prompted a change in pedagogy to a more student engaged classroom practice. Instead it is argued that the hype surrounding ICT has flattered the reality of on-the-ground implementation (Conole, 2004; McGarr, 2009; Livingstone, 2012).

Enhancing student motivation involves valuing effort and implementing effort-based learning strategies though the design of mastery-oriented learning structures (Ames, 1992). Effecting a change in student responsibility for his or her learning requires a change in who leads the learning. Resolving Freire's teacher-student contradiction critically requires a ceding of control by the teacher (Freire, 2000 ; Panitz, 1999). To quote from Freire: *"To resolve the teacher-student contradiction is to exchange the role of depositor, prescriber, domesticator for the role of student among students* *would be to undermine the power of oppression and serve the cause of liberation (sic)".*

This sense of liberation in learning can be linked with enjoyment of the learning experience (Aubusson, Schuck, & Griffin, 2006) indeed enjoying a learning experience and drawing intrinsic motivation from learning are intuitively linked and intrinsic motivation has been described as wanting to do something just because it is in and of itself enjoyable (Husman & Lens, 1999).

The pressure on formal schooling to 'deliver to the test' reduces the scope to provide for learning that is student directed and develops key competencies (Covington & Omelich, 1985). It is argued that new models of practice or 'vehicles for learning' are required to provide for learner control and to address this student motivation challenge (Ford et al., 1998; Drexler, 2010; Claxton, 2007; Claxton, 2009).

2.2.9 Technology and Motivation

A naive expectation that the application of technology in learning on its own would lift student motivation was commonplace in the early implementations of ICT in a school context (McGarr, 2009; Mistler-Jackson & Butler Songer, 2000). One flaw at the heart of this belief was the continued reliance on individualised instruction with a high dependency on the teacher to direct the learning. Applying an individualised teacher-led approach to working with ICT may still be observed in the computer science labs of many second level schools (Conole, 2004; Donnelly et al., 2011; McGarr, 2009). Conversely the typical characteristics of a learning experience that is likely to enhance student motivation involves ceding control of the learning to the student and facilitating collaborative working (Ames, 1992).

There is, however, evidence that learning regimes which takes cognisance of how students perceive, relate to and use technology in their social lives and which encourages exploration and curiosity are more likely to tap into intrinsic motivation (Martens, Bastiaens, & Kirschner, 2007).

Engaging adolescents on personally meaningful activities in a socially supportive environment is a strong motivation to producing worthwhile work and higher order learning (Pintrich, Roeser, & de Groot, 1994; Ryan & Patrick, 2001). The adolescent learners of today are likely to be more technically competent in ICT than most of their teachers. This can be perceived as a threat to traditional models of teaching and learning and the didactic teacher-pupil power relationships (Resnick & Rusk, 1996). The adolescent use of computers has much deeper implications than the development of specific technical skills. How adolescents use computers is related to how they see themselves and how they relate to society (Dinter, 2006) Tapping into this relationship between adolescents and computers provides a potential avenue to improved learning (Dinter, 2006). While traditional and formal education is strained to accommodate these trends, non-formal educational models offer more flexible opportunities (Resnick & Rusk, 1996).

A central aspect of human knowledge combines the ability to think creatively through analysis, reflection, generation of ideas and to act creatively implementing ideas, building things and experimenting (Claxton, 2006). Moving work through technology to a more thoughtful and reflective context is potentially a motivational strategy when working with young people). It has been argued, that if a learning initiative approaches the use of ICT from a skills acquisition perspective only, or purely for access to content and avoids how young people can learn with and through technology, it potentially excludes deep learning and motivational opportunities. (Fullan & Langworthy, 2013).

2.2.10 Models for Learner Engagement, Autonomy and Motivation

Collaboration and group work are often mentioned in connection with ICT based learning interventions but it is very important to realise that group work is unlikely to be successful without preparation and training to develop group work skills (Blatchford et al., 2003). While it is generally acknowledged that group work and ICT are powerful learning partners (Alavi, 1994; Baskin, Barker, & Woods, 2005; Pauleen, Marshall, & Egort, 2004), the systematic building of learning teams accompanied by the appropriate deployment of group based learning projects is generally absent from learning programmes (Galton & Hargreaves, 2009).

The concept of Minimally Invasive Education arose from experiments conducted by Sugata Mitra cf. The Hole in the Wall programme (Mitra et al., 2005). Sugata Mitra, the pioneer behind this project, defined this new mode of learning, claiming that it "uses the learning environment to generate an adequate level of motivation to induce learning in groups of children, with minimal, or no, intervention by a teacher" (Mitra et al., 2005). At the heart of this concept is a belief that children can learn for themselves and that they can and will teach each other with a supportive but 'hands off' approach from adults where domain knowledge is accessed through the internet. These ideas have been codified in a learning model called Self-Organised Learning Environments (SOLEs) in which students self-organise in groups and which has been implemented in classrooms in several countries (Dolan et al., 2013).

This belief in the ability of students to learn with and from each other is consistent with the Vygoskian view on peer learning and Zone of Proximal Development (Vygotsky, 1987). The hypothesis of Mitra et al. is consistent with the results from the 'Learning Circles' experiment of Sullivan et al., which relied on the learning model that is the major contribution in this thesis (Sullivan, Marshall, & Tangney, 2015).

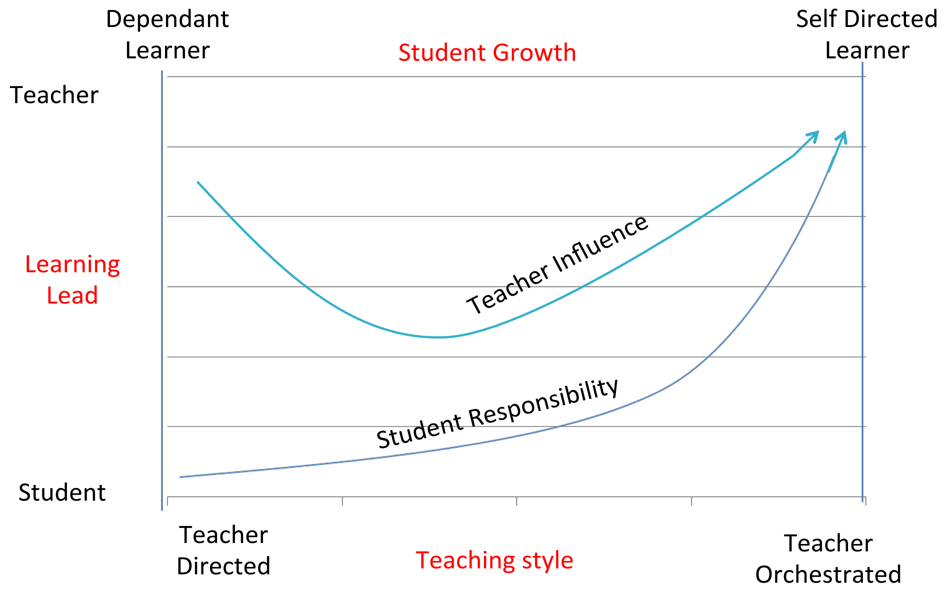
Allowing the learner to lead in the learning requires that the lead role of the adult or teacher be changed. For the student to 'step up' the teacher must 'step back' to allow the creation of a Vygtokian learning space with the teacher accepting the status of co-learner, consistent with Freire's concepts for liberation of both the teacher and the learner (Freire, 2000; Vygotsky, 1987). Applying this view to technology in learning raises the issue of the personal ownership of technology and the attendant extensive engagement with social media by young people which taken together is moving learning outside the institutional context. This phenomenon is of itself a 'game changer' in that it places the learner in the position of the one who is one sense more 'expert' and requires a real transition to a less teacher-led approach to learning where content will be co-constructed rather than delivered by a domain expert teacher (Sharpe et al., 2010). This is not to say that the learner has the understanding required to convert aptitude and skill with technology into meaningful further learning and the teacher as guide and orchestrator rather than director plays an important if different role in the co-construction of learning (De Freitas & Conole, 2010).

2.2.11 Student Autonomy and Motivation

What students believe about their ability to regulate their own learning and to master academic challenges is a determinant of their educational horizon, motivation and academic achievement (Bandura, 1993). This idea of students regulating their own learning speaks to a sense of personal responsibility for learning. Effecting a change in student responsibility for their learning requires a change in who leads the learning (Maehr & Midgeley 1991). It is necessary that teachers relinquish some of their direct control and adopt a more indirect influencing style so that the student starts on a path that leads to them taking responsibility for their learning and becoming self-directed learners.

In an attempt to synthesise this idea, the author presents the graphic Figure 2.2 below to illustrate the significant learning dynamics for both teachers and students that arise in the context of a paradigm shift in influence and responsibility and in who leads the learning. For the teacher, this represents a move from being a director to being an orchestrator of the learning. For the student, it represents a move from the dependant learner to self-directed learner. As the teacher yields control, the student takes more responsibility. This is illustrated by the dip in the curve representing the teacher influence. Paradoxically this apparent surrender of control by the teacher will ultimately lead to a deeper influence by the teacher as the student and teacher travel the learning journey together as co-learners (Fullan & Langworthy, 2013; Pogue & AhYun, 2006).

Figure 2.2 Changing the Influence and Responsibility Paradigm



In team based learning Adair identified the task as a unifying objective for the team with the shared responsibility its completion rendering the task as independent of the individual (Adair, 1988). Through this approach, control of the learning moves to the team and the team is addressed to the task. The individual team members enjoy the support of their peers and the comfort of shared responsibility (Pyle, 1995). This opportunity could provide an approach to mitigate the phenomenon of ‘learned helplessness’ that has been related to students' immature beliefs anchored on their simple certainties around knowledge and learning (Qian & Alvermann, 1995). This ‘learned helplessness’ phenomenon may be seen in the poor intrinsic motivation typically evident among struggling students in formal learning contexts (Pell, Galton et al., 2007). Conversely, in a team based learning environment, a challenge arises in that top students may resist the loss of what for them is a personal unilateral learning strategy and may need reassurance while the remainder of the students see less risk in trying than in not trying (Pyle, 1995).

2.3 Literature Informing the Design of the Bridge21 Model and Team-Based Learning

The literature informing the Bridge21 design includes that covering team-based learning, team formation, responsibility for learning, reflection, task orientation, technology and learning, learner interactions; team oriented learning space and social learning protocols.

2.3.1 Team-Based Learning

It has been argued that the human species has worked in teams since primitive man first learned to hunt and that sharing and co-operation has always been a feature of how we live and that the ability to work in teams is a significant factor in how the human race came to dominate other species and to control the world around us (Hills, 2001). Credit for the identification of a team-based approach to learning should go to Robert Baden Powell, the founder of the Scout Movement and his ground-breaking Patrol System (Baden-Powell & Boehmer, 2005; Bénard, 2002; Jeal, 2007; Reynolds, 1943; Vallory, 2012). The pioneering application of team-based learning in a formal educational context is credited to Michaelsen in the 1970's (Freeman, McGrath-Champ, Clark, & Taylor, 2006). It's implementation in the decades since has struggled and still struggles with institutional scepticism and a teacher-led systemised approach that maintains a dependency on individualised learning (Baines, Blatchford, & Kutnick, 2008; Blatchford et al., 2003; Claxton, 2013; Michaelsen, Fink & Black, 1996). Facilitating team-based learning in formal education has been identified as contingent on attention to a set of essential elements including: 1. Team Formation, 2. Team Accountability, 3. Team Reflection, Feedback and Review and 4. Tasks to Grow the Team (Michaelsen & Sweet, 2008). These identified elements and principles for team-based learning provide guidance for the design of a pragmatic model reliant on this pedagogy.

2.3.2 Learning from the Scouts

From its inception, the idea at the heart of the learning method of the World Scout Movement is that young people can learn from each other and that the role of the adult in this is to guide and mentor and this learning model is firmly rooted in a system of self-organised teams (Bénard, 2002; Kavanagh, 2003; Vallory, 2012; WOSM, 1998). The educational method of Scouting drew eminent educational admirers. Montessori wrote of Scouting as: 'freeing children from the narrow limits to which they have been confined' (Jeal, 2007). Scouting's method provides for a transference of control and responsibility for learning to the young person is what Scouting calls 'The Patrol System' (Baden Powell, 2007). Robert Baden Powell observed that young boys naturally formed gangs and these could be arrangements: "for mischief or for good" (Baden Powell, 2007). He formalised this gang system into teams of 6- 8 Scouts called Patrols and made the Patrol the primary setting for learning. Each Patrol was to have a name and identity so that they would be seen to have status and significance. The Patrol has a Patrol Leader drawn from the Patrol members and he or she has the responsibility to ensure that the Patrol works together in a range of activities interweaving fun and learning. Peer to peer learning is intrinsic to the model and older Scouts provide role models, knowledge, experience and mentoring for younger members. Younger members provide opportunities for responsibility, leadership and coaching for older scouts. A range of ages spanning up to 4 years is typical for a Patrol. The Scout Patrol can be described as a learning community where young people support each other's development, work together as a team and interact with similar groups (Bénard, 2002).

The first Scout Camp at Brownsea island in 1908 had 4 such patrols: Curlews, Bulls, Ravens and Wolves (Jeal, 2007). This sense of identity was seen as crucial to the team-building. Each patrol has its own space called a Patrol Corner (Reynolds, 1943). The Patrol Corner, usually within the meeting place of a Scout Troop, is intended to give the team a space of their own and a measure of privacy for the internal business of the team (Wood, 1952). The Patrol System endures today as a key cornerstone of the educational method of the World Organisation of the Scout Movement implemented with over 30 million young people in 161 nations across the world (Vallory, 2012; WOSM, 1998).

2.3.3 Team Formation

Building teams requires time and attention to the formation process. Placing students in an ad-hoc group and assuming that they will act as a team is a naive but not uncommon approach (Blatchford et al., 2005). Groups do not become teams just because they are labelled so (Katzenbach & Smith, 1993). The formation of teams is an important process to get right. Michaelsen and Sweet propose three principles to guide team formation: (1) never use student-selected teams, (2) create diverse teams, (3) make the selection process transparent. They suggest that the temptation to allow student selected teams should be avoided as they often are just social entities and underperform compared to instructor selected teams (Michaelsen & Sweet, 2008).

The investment in building the team is worth the effort, in that teams are distinct and potentially more powerful than ad-hoc groups, the argument being that if effective, the whole is greater than the sum of the parts (Michaelsen, Knight, & Fink, 2002). To achieve this level of performance requires that the team is developed over time and that the identity, stability and integrity of team is maintained. Constantly changing the team is a recipe for disorganisation and team ineffectiveness (Blatchford et al., 2003; Sweet, 2013). Developing the skills for working together is crucial (Blatchford et al., 2005). Evenly distributing the human resourses among multiple teams, within a class or student group is important so that diversity, different talents and different perspectives are integrated in the team. This approach is opposite to and challenges the practice of streaming and ability grouping which is all too common in formal second level education (Oakes, 2005; Smyth & McCoy, 2011). Developing and supporting the team and enhancing its integrity as a key unit in the learning provides a vehicle to promote autonomy in the sense that it is the team that takes the ownership of the learning as opposed to the teacher. Additionally the strength of the team promotes belongingness among team members and internal interdependence between team members echoing the Social Pedagogy suggested by Blatchford et al and Slavin's ideas on making group-work effective (Blatchford et al., 2003; Slavin, 2010).

2.3.4 Team Accountability and Effectiveness

If teams are to be more effective than ad-hoc groups then the essence of this effectiveness can be judged in how the team takes responsibility for the task given (Michaelsen et al., 2002). Teams accept and share common objectives and do real work together to achieve their objectives and can be measured for their performance against these objectives (Katzenbach & Smith, 1993). Requiring accountability for performance promotes interdependence and greater satisfaction within the team (Fandt, 1991). This process of transferring responsibility for the task from the teacher to the team gives control to the learners and has the important effect of making the team a 'vehicle' for student responsibility for the learning (Lawlor, Marshall, & Tangney, 2015a; Pyle, 1995). A crucial element in team accountability is the sense of accountability both to self and to fellow team members. It is about the sincerity of the personal promises made and the bond of trust between peers within the team (Katzenbach & Smith, 1993; Peterson, 1997). This type of accountability can be encouraged and supported through a structured team reflection process (Whitebread et al., 2009).

2.3.5 Team Reflection Feedback and Review

Team reflection provides an opportunity for the team to hold itself to account as a team and for individuals to consider their personal contribution (Hills, 2001; Whitebread et al., 2009). The process of thinking about their learning and sharing that thinking with others in a group, builds confidence in the learner and encourages an understanding that it is their reasoning and ergo their higher order thinking that is being valued in the process (Leat & Lin, 2003). Additionally, providing feedback and encouraging team reflection on performance is an important element in creating cohesive learning teams (Michaelsen & Sweet, 2008; Sweet, 2013). Providing the team(s) with structured tools and formal aids can be helpful in encouraging constructive team 'reflection on action' and individual reflection and meta-cognition on the learning experience (Apple, 2000; Schön, 1995). To facilitate effective team reflection also requires that appropriate time and a suitable space and environment are provided (Nair & Gehling, 2008; Schön, 1995).

2.3.6 Tasks to Grow the Team

Teams get stronger by achieving things together and the tasks that are set for them should be designed so as to grow the team. Creating effective team assignments is a key ingredient for team-based learning and the quality of the task given can moderate the performance and success or otherwise of the team and its members (Lou et al., 2001; Stewart & Barrick, 2000). Michaelsen and Sweet point to a fundamental requirement that team assignments are designed so as to require group interaction so that they will promote both learning and team development (Michaelsen & Sweet, 2008).

Open and loosely structured tasks have been shown to encourage team productivity and exploratory learning to a deeper level than might occur with highly structured challenges (Lou et al., 2001). It has been seen in mathematics learning that a move away from textbook type questions to more open questions encourages mathematician-like enquiry by the team (Paterson & Sneddon, 2011). It has also been shown that team-based problem-solving deepens both individual and team learning outcomes (Freeman et al., 2006).

2.3.7 Integration of Technology in Team-Based Learning

The advantages of a team-based experiential learning approach can be significantly enhanced through the creative integration of ICT in the learning (Pauleen et al., 2004). It has been argued that having students work and learn collaboratively in a technology supported environment can be more effective than individual learning (Crook, 1995; Johnson & Johnson, 1996). A useful and practical strategy in promoting teamwork and collaboration is to allow for sharing of computers within the team, rather that having a machine per student, which could encourage individualisation (Lin, Chan, & Hsiao, 2011; Mitra, Leat, Dolan & Crawley, 2010). Sharing computers has been shown to be more than a strategy to counter limited resources and presents advantages in productivity though peer learning and collaboration (Best, Kollanyi & Garg, 2012). Conole et al identify activity based learning with ICT as shifting the focus of learning from information transfer to collaboration and communication among learners in an environment where computers are a resource for the learning community (Conole et al., 2004).

2.3.8 Teamwork and Team Interactions

It is essential that team members interact for team-based learning to be successful (Hills, 2001). Students who believe that the team interactions are adding value to their education both enjoy the learning and benefit from deeper learning (Gomez, Wu, & Passerini, 2010). Team based learning requires a focus that has regard to how people interact within a social structure and situation so as to maintain its integrity and realise its goals. It is argued that the new pedagogies that wil enable for 21st Century Learning will require that the entire learning experience is deeply embedded in relationships (Fullan & Langworthy, 2013). This must be reflected in the attention given to interpersonal interaction and conversation, which can be inhibited by a dominant focus on the individual (Koschmann, Stahl, & Zemel, 2004; Leat & Lin, 2003)

2.3.9 Learning Space: Creating Team Space

Careful consideration needs to be given to the design and configuration of learning space that would support a team-based learning approach. The rationale for presenting a team-based pedagogy is rooted in the idea of transferring ownership of the learning to a learner directed group. Thought must therefore be given as to how and where the team would go about its business so that it can be an effective context for learning (Jolliffe, 2007; Taylor, 2007). Learning space is a key component in this learning environment. How the learning space looks and feels is important to those who will learn in it. The physical and spatial aspects of the learning environment communicate a symbolic message of what one expects to happen in a particular space and there needs to be an alignment between the intended learning approach and the learning space configuration. (Proshansky & Wolfe, 1974)

For team based learning this symbolic message is critical as it elevates the importance and pre-eminence of the team. The design of the learning environment requires that the needs of the team and the promotion of teamwork, are referenced with consideration of how they will work cooperatively, plan-do-review together and how they will identify with each other as a team (Jolliffe, 2007; Taylor, 2007).

The design of a learning space for 21st Century Learning also needs to have regard to the creation of a social setting that will embrace the concepts of social constructivism and will contribute to supporting creativity and thinking 'outside the box' (Vygotsky, 1987; McMahon, 1997).

Thornburg presents a primordial metaphor for three categories of learning space: the Campfire, the Waterhole and the Cave. 'The Campfire' is the setting where the 'expert' shares information with listening learners, 'The Waterhole' allows for learner interaction in small groups and 'The Cave' is a personal space for individual private reflection. Thornburg argues for the need for a balance of these learning environments to best support learning (Thornburg, 2004). Nair and Gehling speak of the 'binary structure' that divides formal learning from students own time with the learning space or classroom clearly defined as a binary model with the classroom as the place for learning time and everywhere else as places for free time (Nair & Gehling, 2008). This form of isolated classroom has been described as a 'cells and bells' system with teachers and students learning within their classroom/cell and moving at the bell to another cell while learning is officially confined to the cell (Nair & Fielding, 2008).

2.3.10 Technology and Learning Space

Providing for the affordances and opportunities of integrating ICT in the learning is a further challenge to traditional formal learning environments, with the common configuration of computer science labs emblematic of an approach that seeks to shoehorn technology into a 'cells and bells' classroom structure (Conole, 2004; Donnelly et al., 2011). Sugata Mitra addresses this challenge with his Self-Organised Learning Environments (SOLEs) to enable children to work in groups, with ready access to the internet and with resource sharing of typically four children to each computer in the group (Mitra & Quiroga, 2012). Through this approach the building of the learning group is integrated into an ICT enabled learning environment.

Facilitating and growing creative 21st century learners requires learning space that is a stage and forum for problem solving, creativity, teamwork and learner responsibility, the integration of technology and what could be described as a 'jazz ensemble' of collaborative improvisation (Claxton, 2007; Frueauff, Wall, Essley, & Hall, 2011; Jilk, 2002; Nair & Gehling, 2008; Sawyer, 2004; Nevison, 2010; Wagner, 1997; Fullan & Langworthy, 2013).

2.3.11 Social Protocols – Structured Informality

Students' experience of formal learning is presented in the context of a strict set of protocols, rules and principles that govern how learning is conducted. This impacts social interaction and what is understood as socially relevant (Sieber, 1979). Uniforms, calling teacher 'Sir' or 'Miss', general silence in the class and deferring to the teacher in the control of the learning are part and parcel of how formal learning conducts itself. This is in support of a pedagogy that favours a superior to subordinate relationship (Skinner & Belmont, 1993; Freire, 2000; Goodman, 2009). A more constructivist pedagogy would centre on the role of the child in the learning and would facilitate authentic and purposeful interactions with the child taking responsibility and opportunities for making decisions in an environment of mutual respect and collaborative engagement (Dangel & Guyton, 2003). A social constructivist pedagogy would relax formality in favour of the encouragement of the learning community (McMahon, 1997; Windschitl, 2002). Non-formal learning contexts have demonstrated commitment, pragmatism and efficacy in delivering social constructivist learning models in contexts of structured informality (Resnick & Rusk 1996; Vallory, 2012).

2.4 Literature Summary

To provide an educational context for the development of a model for 21st Century Learning, this literature review examined the influencing background to this thesis through themes of: 21st Century Learning; ICT in learning; constructivism, the implementation of group work in learning; learner motivation and student autonomy and learning; and approaches to encourage deep and engaged learning.

The literature review went on examine the literature that would inform a team-based technology-mediated learning model through topics including: team-based learning; the example of Scouting; structuring teamwork; reflection in teams; tasks for teams; technology and teamwork; social learning; and learning space for teamwork.

The review informed the formulation of the research problem:

- The dearth of effective pragmatic learning models to facilitate 21st Century Learning.
- The struggle to integrate ICT in a codified learning model that exploits its affordances while facilitating engaged learning.
- The challenge to design and test an effective model for 21st Century Learning that is pragmatic, robust and flexible in different learning contexts.

Chapter 3 – Development of a Model for Teamwork – Bridge21 and its Implementation

3.1 Introduction

This chapter describes the path of development of the Bridge21 learning model and its implementation over three successive academic years. The chapter first considers the influences that bore on the inception of the model in the context of an extensive outreach programme to second level schools.

The origins and design of the Bridge21 learning model are also traced with reference to other key influences bearing on the model's development and how the model was formed based on principles of team-based learning, the intuitive ideas of the author as formed by his experience in the non-formal educational sector and infused with the constructionist ethos of the Centre for Research in IT in Education at Trinity College Dublin.

The chapter goes on to describe and discuss the original pilot instantiation. The origins of a learning model concept, as informed by this pilot experience, are explained. The evolution of the model over five academic years is described within the context of the broader implementation of the learning programme as described in the previous chapter. The chapter then describes the refining of the model and goes on to explain the key elements in detail.

The approach applied to building the Bridge21 model is outlined in this chapter and with both the literature and evidence from data informing the design of the model as it evolves through testing a series of instantiations.

The model was refined in the light of initial findings in the Exploratory Analysis Unit of the Case Study and ideas and concepts surfaced and explored in the literature as discussed in Chapter 2.

The model was tested in the Explanatory Analysis Unit of the Case Study with particular reference to the research questions:

RQ: What are the credentials of Bridge21 as a candidate model for 21st Century Learning?

> **Sub-RQ (a):** What is the effectiveness of the model in encouraging intrinsic student motivation?
>
> **Sub-RQ (b):** What is the effectiveness of the model in facilitating team-based, technology mediated learning?

3.2 The Intuitive to the Informed – The Path to the Bridge21 Model

The development of the Bridge21 model was essentially evolutionary and moved from the intuitive to the informed guided by the literature and the emerging data. This path of development was guided by the data that surfaced through the experience and impact on the participants as evidenced in their responses to questionnaires and in focus groups arising from the successive years of the programme implementation. The evidence from data was referenced through an abductive process against relevant literature relevant to the elements comprising the model. A useful starting point in considering the origins, development and evolution of the model is to consider the significant factors impacting on this development.

3.2.1 Influences on the Learning Model Development

The Bridge21 learning model, which is the significant contribution in this work, owes its origins and development to a complex set of influencing factors. The pedagogical approach to the pilot deployment was influenced by intuitive and personal convictions of the author and project team and by the significant external influences on the project.

A summary of the influences on the project team and the author were as follows:

- The academic and pedagogical approach of the Centre for IT in Education (CRITE) at TCD is infused with a constructionist philosophy in learning and in

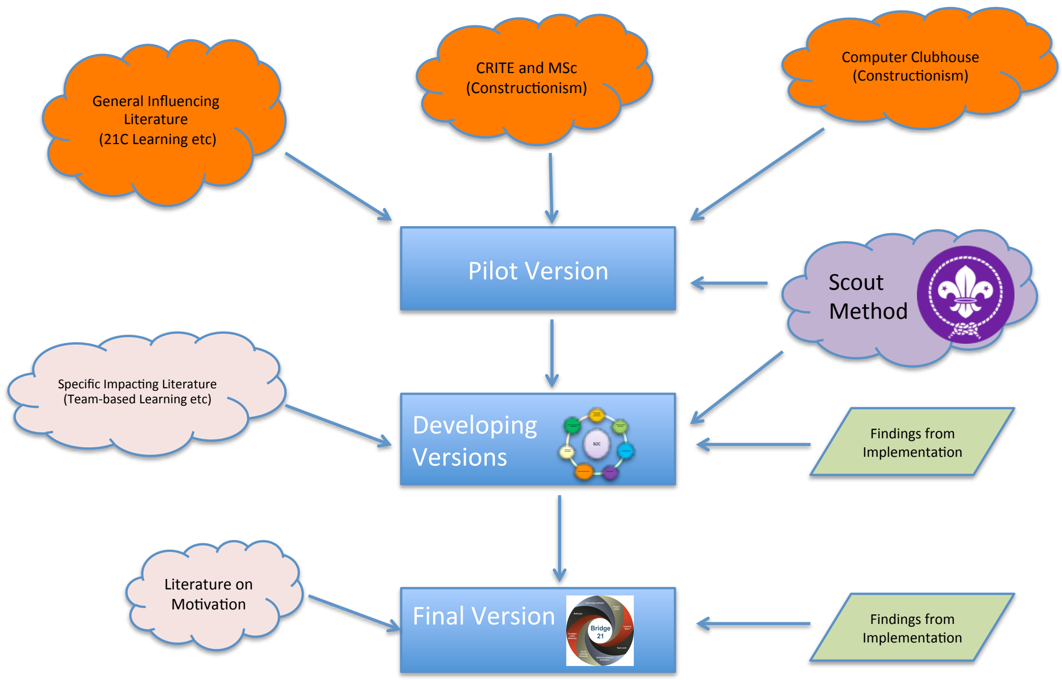
the use of technology in learning as promoted by Papert (Papert, 1993). It should be noted that Papert considered constructionism to be beyond a simple learning-by-making definition and to embrace an approach to learning that touches on student-led learning, student-teacher relationship, authentic tasks and facilitating reflection on learning and technology in learning. Additionally the academic influence of CRITE promoted a belief in the power of a social constructivist learning environment that would embrace the concept of constructing knowledge, setting authentic tasks, creating a knowledge community and promote collaborative learning in a social context.
The team working on the project, including the author, came from CRITE and volunteers from CRITE had previously operated a version of the Clubhouse model in an out of school context on the University campus in the Trinity Access Programme premises. This previous implementation provided a context and basis for the pilot instantiation of the learning approach that ultimately became the Bridge21 learning model.

- The author had extensive personal experience and belief in the efficacy of the team-based learning model of the World Scout Movement (Vallory, 2012; WOSM, 1998)
- The author had recent experience of team working and technology in learning with second level transition year students in India in 2007 in the context of his Masters research project (Lawlor, 2007). The approach to the development of the model was guided by the author's work and collaboration with colleagues and mentors in pursuit of the Masters Degree in Technology and Learning at TCD.
- Some knowledge of the Intel Computer Clubhouse model as developed by Resnick and Rusk in MIT (Resnick & Rusk, 1996) was assimilated through learning in the MSc in Technology in Education course at TCD. Consideration of the Computer Clubhouse model also included site visits to the Computer Clubhouse in The Liberties in Dublin 8 and meetings with their staff.
- The guidance and advice of the academic director of the Bridge2College/Bridge21 programme, Professor Brendan Tangney, helped

ground the model in a theoretical context and particularly in relation to the integration of technology in the learning consistent with constructionist and social constructivist learning theory and principles.

- The author's colleague and co-founder on the programme was Ms. Claire Conneely who had experience as a second level teacher. Claire's knowledge and understanding of the dynamics of school life and the requirements of school leaders and teachers was very influential in shaping a learning model that would work with school children and also in determining an offering to schools that could secure support. Claire also played a critical role in building a partnership with the participating schools. Claire is also a research colleague in CRITE. Figure 3.1 illustrates the most significant influences bearing on the model development.

Figure 3.1 Influences Impacting on Model Development



In summary, the original significant influences suggested that the learning approach should be constructionist and constructivist, could usefully incorporate some of the principles of the Computer Clubhouse, should promote peer and collaborative working, that structured teamwork should be explored and that the use of technology should be integrated in the learning.

Additionally, the intent to build a model that could influence formal practice suggested that the learning approach should be tested in school time and in partnership with schools. This implementation with schools had a number of effects. Firstly, it framed the implementation in the context of the school academic year and mapped the intervention against the school timetable and it also meant that successive new cohorts of students would become available in successive years.

The set of influences on the model development moved from the intuitive to the informed as the model was tested in the broader learning programme. The development and refinement of the learning model was a product of the outputs of this implementation and attendant research over the successive academic years starting with the Pilot implementation in late 2007 and reaching a final published version in February 2013.

3.2.2 The Pilot

The pilot involved the engagement with three local DEIS (Delivering Equality of Opportunity in Schools) that were participating in the Trinity Access Programme. – The acronym DEIS also means 'opportunity' in the Irish language. The students were boys and girls average age 16 years drawn from 5th year and transition year classes. It is important to note that the participating schools initially saw the intervention as an adjunct to the Trinity Access Programme and therefore related to TCD's outreach activity with an objective of encouraging access of Third level learning for children from areas of designated disadvantage. This perception was underlined through the pilot activity being sited on Trinity Access Programme premises and the outreach mission of the programme has been retained since. The significance of the intervention for its own intrinsic educational value emerged during the pilot and the mission for the programme extended to the challenge of developing and implementing a new learning model.

The pilot encompassed five discrete workshops, which took place over a period of five weeks. The Pilot was implemented in a computer science lab in the Trinity Access department, on the university campus, with a standard configuration of learning space with technology typical in formal educational contexts as may be seen in Figure 3.2. The learning space available and its configuration was a significant constraint on the implementation of the constructionist and collaborative ideas for the learning intervention.

Figure 3.2 Learning Space with students in the Pilot Instantiation

(Note plainly decorated, standard computer lab environment)

3.2.3 Learning Approach to Model Development - Objectives for the Pilot

The Pilot instantiation was intended to assist in refining, validating and correcting the learning approach as appropriate. This refined learning approach would become a codified learning model. The original objectives for the Pilot related to exploring a learning approach that subsequently became a learning model were:

- Engage the children successfully with an innovative learning experience
- Validate the learning approach
- Identify potential weaknesses
- Refine the approach

The key elements of the pilot initiative are summarised in Table 3.1 below.

Table 3.1 Pilot Instantiation Summary

Pilot Initial Intuitive Deployment	
Adapted 'Computer Clubhouse' Model	Principle 1: Support Learning Through Design Experiences Principle 2: Help Members Build on Their Own Interests Principle 3: Cultivate an Emergent Community of Learners Principle 4: Create an Environment of Respect and Trust
Groups and pairs	Encouragement of collaborative working in pairs and small groups
Shared Technology Resource	Sharing computers and avoiding individualisation on machines
Typical Computer Studio	Students seated in a row facing machines
Out of school but in school time	In contact and partnership with school on one week block release
Multimedia Tasks	Modest short technical challenges
Outreach Focus	Linked to the University access programme for disadvantaged schools

3.2.4 Outputs from the Pilot

The five-week Pilot exercise provided a valuable insight into what might work for a new learning model. An exercise in observational research was undertaken during the pilot and a number of impacting issues in the approach were evident:

1 The children enjoyed the experience and were clearly happy in the learning.

2 The use of teamwork, collaborative working and co-operative working proved effective.

3 The collaborative working with technology and resource sharing of technology was particularly successful.

4 A model of 'light touch' mentor/coaching support was effective.

5 The children learned quickly and achieved tasks more quickly than the mentor team originally expected and could take on more challenging tasks.

6 It was obvious that group working with technology sharing would require a different configuration of learning space.

Additionally, the experience gained in the pilot suggested that a more structured collaborative framework might be introduced and that a team-based approach could form the basis of an effective learning approach. In general, this pilot instantiation provided a measure of confidence in the approach and in the ideas tried and provided experience and evidence for a more ambitious instantiation that was to be called Bridge2College. The pilot also assisted in attracting support for a broader programme of activity.

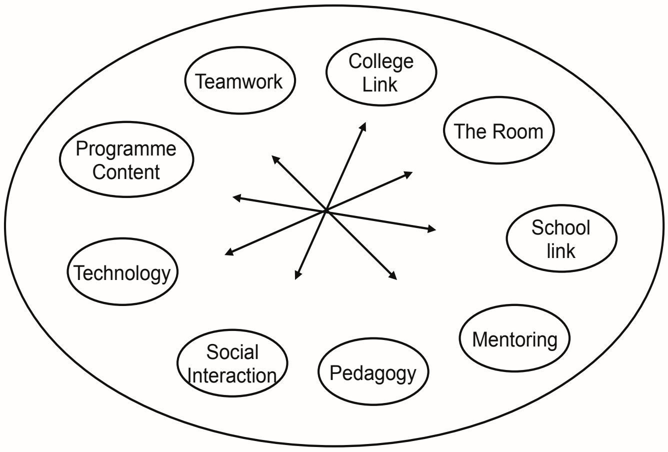
3.2.5 A Model for Team-Based Learning

The pilot experience provided the basis for the deployment of a learning model with a greater reliance on the effectiveness of teamwork. This commitment to a team-based approach provided the key focus for the development of the model. The author and the programme team had greater confidence in the theoretical, intuitive and practical basis for a structured team-based approach and the ideas surfaced in the pilot could be further developed and deployed. It was particularly identified, through the experience with the pilot, that learning space was crucial to supporting an effective team-based learning model and the design and development of a learning space configured to support the model was conducted in parallel with the Pilot.

3.2.6 Thinking about a Model

The author started to conceptualise the learning approach as a model in the spring of 2008 and described it as a 'learning stew' and identified the learning experience as embracing the interaction of many factors including: Team-Working; Technology; Mentoring; Link to College; School Link; Learning Environment; Social Interaction; Learning Programme; Personal Growth and Challenge. The first (contemporaneous) graphic, sketched by the author in April 2008, is shown in Figure 3.3 and illustrates the original thoughts of the author about the components of the model.

Figure 3.3 The First Graphic of the Learning Approach (April 2008)

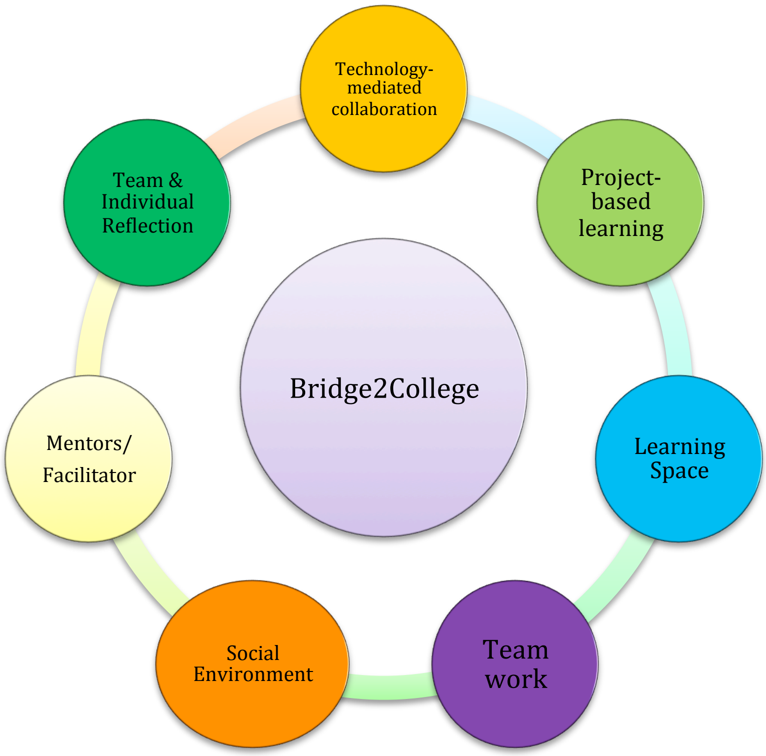


3.2.7 The Model from First to Final Versions – Concept and Schematic

The author sought to conceptualise and codify the learning model and drew the first version called Bridge2College (or B2C) following a full academic year (2007-2008) of implementation comprising fifteen four-day workshops with a total of 280 students. Describing the model in a graphic as a set of discrete planetary elements was intended to portray the combination of their impacts in a universal learning system while identifying and acknowledging the individual significance of each element.

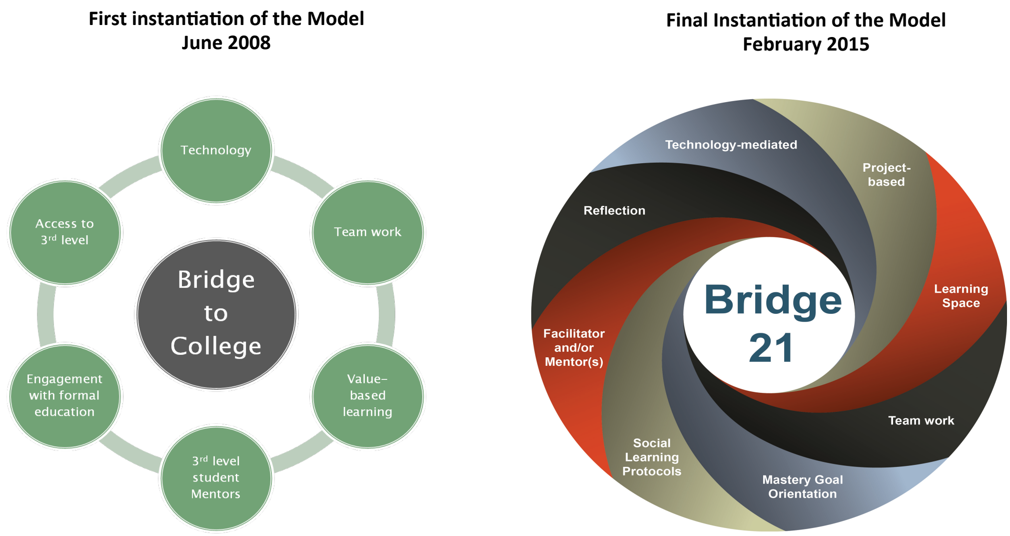
The model went through a series of iterations over two years before producing the schematic and concept of the model featured in Figure 3.4 below and first presented by the author in an external academic context at the TECH-EDUCATION 2010, International Conference on Technology Enhanced Learning, Quality of Teaching and Reforming of Education, Athens 2010 (Lawlor et al, 2010).

Figure 3.4 The First Published Version of the Model (2010)



The development and enhancement of the model extended through a six-year period as the model was implemented and tested in a range of learning contexts. The final version of the Bridge21 model was presented and published in the Technology Pedagogy and Education journal (Lawlor et al, 2015) in February 2015. Figure 3.5 illustrates the difference between the first and the final model.

Figure 3.5 The First and Final Instantiations of the Learning Model Compared



This extended process of development and evolution of the model followed a continuous programme of large-scale interventions, referencing theory and techniques from the literature, exploring emerging phenomena and with findings from the research informing the design.

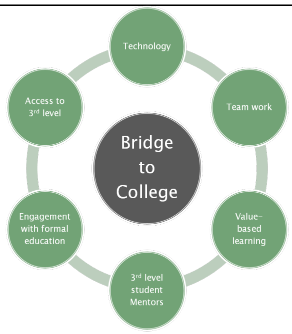
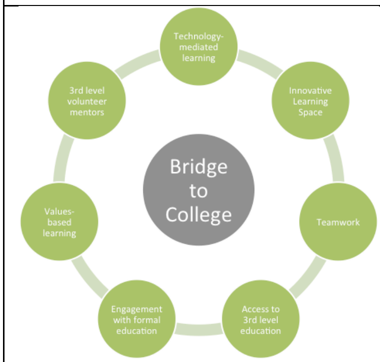
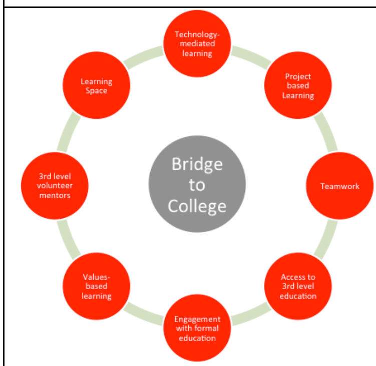
3.2.8 The Evolution of the Model

The learning model evolved through the implementation of the broader programme from 2008 to 2013. The changes reflected the significance of findings through the research and also through observation in the implementation:

- What worked and what needed to change
- What was fundamental to the model
- What was important to the mission of the overall programme, though not necessarily fundamental to the learning model itself. (For this reason the early versions of the model tended to reflect the mission of the outreach programme whereas later versions tuned to a model that could be applied more generally and in other learning contexts).

As the programme progressed elements were added and removed and the evolution of the model through six described instantiations is illustrated in Table 3.2 below.

Table 3.2 The Path of Development of the Model

Instantiation	Date and context	Features Added	Features Removed
	June 2008 (Suas & CRITE)	Technology Teamwork Value-based Learning Third Level Student Mentors Engagement with formal education Access to Third level	
	September 2008	Technology **'Mediated'** Learning Innovative Learning Space	
	February 2009 (Computers and Learning Conference)	Project based learning	
	July 2011	Team and Individual Reflection Mentor/Facilitator Integrated Curriculum **Bridge21** Title	Value-based learning Third Level Student Mentors Access to Third level Engagement with formal education **Bridge2College** Title

 	January 2012	Social Learning Protocols Skills Focussed	Integrated Curriculum
 	February 2013 (Technology Pedagogy and Education)	Mastery Goal Orientation The 'Swirl'	Skills Focussed

3.2.9 The Progressive Changes

The significant changes that occurred through this process, as the model evolved and the rationale for these changes is as follows:

1. **Removal of 'Access the Third level' as part of the model**

   The original inclusion of Access to Third Level in the model reflected the original outreach mission of the programme but while social outreach remains part of the mission the model is applicable in broader contexts and so this element was removed. This change was significant in that it marked separation of the model and the mission and the model and the context of its implementation, signalling a belief in an emergent generalisable learning model.

2. **Removal of 'Engagement with formal education' as part of the model**

   The decision to engage with formal education was an important strategic decision at the inception of the programme and the structured approach was influenced by the need to win support from partner schools. However, this engagement was identified as an implementation issue rather than a fundamental element of the model and so it was removed. The model has been implemented in both out-of-school and in-school contexts and has potential to facilitate change in classroom practice in formal education and also to facilitate learning in less formal contexts.

3. **Removal of 'Value-based learning' as part of the model**

   The original inclusion of Value-Based Learning as part of the first instantiation of the model reflected the interest of the author from his M.Sc. work on how meaningful issues could assist in engaging young people with technology (Lawlor, 2007; McDarby, 2003). However, this was found not to be a necessary element of the model.

4. **Amendment of 'Third Level student mentors' to 'Facilitator and/or Mentors'**

   The programme originally relied on Third level volunteer mentors and interaction with Third level students was believed to assist in encouraging access to college however as the programme progressed the cohort of mentors became more diverse, the key issues for the mentors in Bridge21 became how they acted as facilitators in the learning and their behaviour as co-learners with the students (Billig et al., 2000). The learning model was amended to reflect this.

5. **Amendment of 'Technology' to 'Technology Mediated'**

   Learning through and with technology is a key element of the Bridge21 model and has been included from the beginning. Technology's mediating role in the model is acknowledged in the amendment, as it was identified that paradoxically, while technology is integral to the model, it is not central to it. The original influences from the Computer Clubhouse on the new learning model placed a high significance on the idea of learning with technology. This was tempered with experience to acknowledge technology's mediating function.

6. **Addition of 'Reflection' to the Model**

   The significance of the metacognition for the students through the individual and team reflection sessions became apparent in the research and is also supported in the literature as a key enabler for engaged learning, building confidence, understanding and higher order thinking (Fogarty, 1994; Gama, 2004; Herrington & Oliver, 1999; Jonassen et al., 1993; Leat & Lin, 2003; Mezirow, 1990; White et al., 1999). Consequently, reflection was added as a core element of the model.

7. **Addition of 'Learning Space'**

   The addition of learning space as an element in the model reflects the emergent importance of this aspect as seen in the research and experience from the implementation. The significance of impact of the learning space in the model was immediately apparent when the programme moved to the specially designed environment at Oriel House. The research shows that the surroundings had a significant effect on the participants and on the effectiveness of the team-based system. Configuring learning space to support teams has also been seen to be important in implementations of the model in other contexts and particularly in in-schools implementations.

8. **Addition of 'Project Based'**

   The scaffolding of the learning challenges given to the teams was seen to be a significant and effective aspect of the approach and therefore a Project Based Learning element was included in the model. Project based learning (PBL) is a good fit for team-based working as it facilitates allocation of roles and responsibilities in working together to achieve a common objective. PBL is also associated with authentic learning contexts and real-world relevance and is typically associated with learning with ICT (Beetham & Sharpe, 2013; Bell, 2010; Trilling & Fadel, 2009).

9. **Addition of 'Mastery Goal Orientation'**

   The concept of Mastery Goal Orientation was assimilated into the model to reflect the issue of the impact of Bridge21 on intrinsic student motivation. From the beginning a skills acquisition approach rather than a performance goal approach was adopted. The significance of this element became apparent in the data gathered from participant responses and the identification of a Mastery Goal Orientation as an element of the model was a direct result of the findings in research and as referenced against theory on intrinsic student motivation. These findings and research were subsequently published (Lawlor, Marshall, & Tangney, 2015).

10. **Addition of 'Social Learning Protocols'**

    The research clearly reflects the significance of the social learning dimension of the model and so the concept of Social Learning Protocols was added to the codified model. The original intuitive approach to providing a relaxed less formal learning environment was intended to make the students feel welcome, to feel trusted and important and to feel like Third level students. This approach was also generally disruptive of their previous perceptions of learning experiences. The experience of implementation and research prompted consideration of concepts in Self Determination Theory (SDT). The component from the theory of 'belongingness' is relevant here and a sense of a 'social pedagogy' as described by Blatchford et al. (Blatchford et al., 2003). Such a social pedagogy needed to comprehend pupil-pupil and teacher-pupil relations and the general social framework of the learning (Foley & Leverett, 2011). For these reasons, Social Learning Protocols became an element of the model.

11. **The Swirl**

    The presentation of the model graphic as a swirl rather than a discrete set of 'planetary' elements is a change intended to convey the importance of the interplay of the elements of the Bridge21 learning model in producing its overall effectiveness in a 'learning stew' as became apparent in the implementation and attendant research. The Bridge21 model is now presented as mix of key elements and while it can be said that nothing is new in that the individual elements are well comprehended in theory and literature but everything is new in their systematic application as constituent parts of a combined learning model.

3.3 Refining the Bridge21 Model – The Key Elements and Design Heuristics

A process of refinement, sharpening of the definition and identifying heuristics for the model augmented the changes described in the previous section, as a deeper understanding of what was effective in enhancing the learning experience on the students became evident from the implementation. This process of building out the model focussed on: developing structured team working; determining how and what technology would be used; structuring suitable learning projects; establishing the social learning environment; defining and refining the mentor/facilitators role; integrating team and individual reflection in the learning.

The model was renamed Bridge21 in 2011 to reflect its evolution and to brand its codified form. The name Bridge21 was chosen to reflect the concept of the model assisting in bridging to a new way of learning, to echo the idea of a link to 21st Century Learning and to retain part of the Bridge2College name and identity. The change also reflects the broadening of the intent for the model beyond promoting third level access.

This thesis presents the Bridge21 as the final instantiation of the development of the learning model and this is the version that has been implemented in successive academic years since. However, Bridge21 is a living developing learning model that could be further refined based on experience and research. The Bridge21 model has been explored and researched by the author and other researchers since and efficacy for learning in a wide range of learning contexts has been tested. The analysis and discussion chapters (Chapters 5 and 6) will address the efficacy and robustness of the model that has maintained its essential principles, characteristics and elements since the model was codified as Bridge21.

3.3.1 The Key Elements of the Bridge21 Model

Building on the Bridge2College instantiation, the developed Bridge21 learning model refines the elements of the earlier model as described in the succeeding sections. The key elements of the Bridge21 model therefore are as follows:

1. **Team work** - Building teamwork and team dynamic development,
2. **Technology-mediated learning** – Promoting collaborative working with technology and utilising technology as a resource for the team,
3. **Learning space** – A team-friendly learning space designed to provide the team with a dedicated area to promote and encourage the integrity of the team

4. **Project based learning** – Project based challenges designed to test and develop the team
5. **Reflection** – Facilitating team and individual reflection to help understanding, aid meta-cognition and cement learning
6. **Mastery goal orientation** – Promoting an assimilation of skills rather than a normative performance based approach
7. **Social learning protocols** – Providing a social and relaxed context for the learning underlining trust, respect and personal responsibility.
8. **Facilitator/mentor** – The role of the adult is characterised as supporting, guiding and co-learning.

These elements are implemented in a systemised and structured mix in the Bridge21 model presented in Figure 3.6 and their components are outlined in Table 3.3. Each element of the model plays its part in facilitating the learning and promoting teamwork and the complimentary interplay between the elements makes the overall effect of the model greater than the sum of the parts.

Figure 3.6 The Bridge21 Learning Model

Table 3.3 Elements of the Bridge21 Model

Element	Components
Building Teamwork	• Structured teams • Team stability • Team development • Team Tasks • Team Roles • Team Leaders
Technology-mediated collaboration	• Technology as a Tool • Technology and resources sharing in the team
Learning Space	• Learning Space designed to support the team • Team ownership of space • Flexible space • Presentation area • Stimulating environment
Project Based Learning	• Scaffolded • Team Oriented • Problem-based learning • SMARTER (Specific, Measurable, Attainable, Relevant, Time-bound, Engaging, Recordable)
Team and Individual Reflection	• Team Plan, Do, Review • Individual 'Cave' time
Mastery Goal Orientation	• Breaking the performance-ability connection • Valuing effort in the learning • Encouraging team and peer affirmation
Social Learning Environment	• Social informality • Student led approach
Mentor/Facilitator	• Adult as guide and support • Adult as co-learner

3.3.2 Structured Team Working

Teams don't just happen, they must be established, developed and nurtured (Katzenbach & Smith, 1993). The team structure requires attention and considerations such as team selection and team leader are critical to success. Michaelson and Sweets injunction to avoid student selection of teams was adopted for Bridge21 so as to avoid a potential 'me and my pals' problem, where students avoid engaging with those they don't know and seek to bring their legacy social bonds into the team, and also to ensure diverse and heterogeneous teams (Michaelsen & Sweet, 2008).

Team Leader

The idea of a team leader was introduced in the model. This was intended to facilitate a sense of responsibility in the team through working with a peer as leader, provide for a communication channel with the team, allow the adult lead be moderated and to promote the team as a peer-based Vygotskyian Zone of Proximal Development (Vygotsky, 1987). The team appoints a team leader. This takes place early in the formation of the team. How to pick team leaders presents a challenge, given that the young people in the team are either strangers to each other, or have to consider a known school acquaintance in a new light in the role of leader. This challenge is addressed through a structured exercise in considering what the role and responsibilities of a team leader are and what qualities would be required for the job. Following this exercise the team meet and select their leader. Subsequently the team can change team leader if they wish following reflection on the completion of their first task together on 'no shame, no blame' basis. After this opportunity, the team leader appointment holds until the finish of the workshop. The team leader role in Bridge21 requires the exercise of a range of leadership skills including: coordination, delegation, motivation, coaching and representation of the team. The adult facilitator/mentor communicates to the teams via the team leader. In this way, the team leader role is pivotal in transferring responsibility to the team.

Team Stability and Team Roles

Team stability is encouraged in the model so as to allow the teams to 'form' and iron out any issues that arise so that the team can go on to perform as a unit. Maintaining stability also encourages team loyalty. The process of meeting a series of progressively challenging tasks has the effect of developing the team. When and if problems arise, the team is encouraged to discuss and seek to resolve the problem itself before resorting to external intervention. This interaction has the effect of building the team and strengthening the learning (Michaelsen & Sweet, 2008).

The team also meets to discuss what jobs are necessary to deliver on their assigned project. For each project, a team member takes on a role, as agreed by the team and is expected to deliver in that role. Examples of roles include: Researcher, Editor, Multimedia Artist, Audio Technician, Script Writer. This peer accountability contributes to team cohesion and effectiveness. This encourages an internal interdependence among team members to achieve team tasks and promotes a team spirit with team members inclined to support and encourage each other (Slavin, 2010).

Team Size

The optimal size for the teams was considered and was set at four to five participants. This was originally estimated based on the experience of the author with the intention to best facilitate collaborative interaction, a team dynamic and limited to allow for a closeness and bonding in the team and also to match the technology resource deployed. It proved an accurate estimate based on experience with the implementation of the model and this team size has been retained in the model since. The Bridge2College model was first implemented with five teams of five students allowing for a measure of inter-team competition. This competitive edge was moderated through an encouragement to friendly cooperation between teams and a spirit of acknowledging and applauding the efforts of others.

Team Selection

A protocol on how to select the membership of each team had to be developed. It is intended that the teams should be balanced in ability, of mixed gender and would avoid predetermined cliques or groups of friends. The reasoning for this was so that the teams would develop without a potential distortion of prior formed relationships or loyalties. For these reasons the mentors picked the teams. The effect of this approach was regularly commented upon by participants: *"I met new people, made friends, got to know the girls from my own class better, had a great team and learned lots of new things"* and *"I learned to work with people who are not my friends".*

3.3.3 Use of Technology

Paradoxically technology is both integral and ancillary to the Bridge21 model. The use of computers in Bridge21 is not in itself the object of the exercise but their use is central to the model. The development of enhanced ICT skills is subordinate and a by-product of the pursuit of knowledge creation in Bridge21. The essential point at issue is that the application of the technology in the learning is premised on a supporting new pedagogy that seeks knowledge creation rather than a more basic use that would focus on information consumption (Fullan & Langworthy, 2013).

A ‘sink or swim’ approach is taken with new applications and techniques assimilated by the participants in the teams with minimal introductory instruction and ‘light touch’ guidance. The participants with the Bridge21 model learn from and teach each other as they explore the potential and capabilities of applications of which they have no previous experience. This resonates with ideas of Mitra on the capabilities of young people to learn for themselves in collaboration with their peers without formal instruction (Mitra, 2015).

Resource sharing is a notable feature in the use of ICT in Bridge21. A team of 4 or 5 members is equipped with 2 computers to encourage collaboration and to avoid individualisation and the ‘lone learner’ that can occur when every student has individual exclusive access to a machine (Mitra, 2012). Sharing of technology was an early-established principle of the learning model to encourage collaborative working. This also tightens the internal team interaction in that they have to work together, scheduling elements of the work, working in pairs within the team on sub-tasks and helping one another overcome problems and challenges.

The Bridge 21 model also adopts a ‘use what’s readily available’ approach in the technology applied. This is both a principled and a practical approach in relation to technology in that the model is asserted to be specific technology neutral and also to be implementable on modest resources typically available in many schools. Additionally, there is a cost saving dividend through the sharing of resources in the teams rather than providing a machine per participant. The general use of freeware such as: Audacity Audio Editor, Windows Movie Maker and Kompozer Web Authoring software, with the model also demonstrates that the model is implementable without recourse to expensive licensed software.

Ready access to the Internet, on preferably a quality broadband network, is a component of the technology element of the Bridge21 model.

The availability of general support technology in sufficiency and on a shared basis to resource the teams in completing their tasks is a component of the technology element of the model. This could typically include: digital cameras, headphones and microphones.

In summary technology is a tool in Bridge21 aligned with the way young people use technology in their social lives and when not under supervision of adults (Resnick & Rusk 1996; Windschitl & Sahl, 2002; Sutherland, 2014) and requires modest readily available access to ICT.

3.3.4 Learning Space

Having a learning space designed to facilitate teamwork is a visible and tangible expression of the commitment of the model to focusing on the team as a vehicle for learning and team-based working requires a learning space that is team-oriented. Utilising learning space to maximise team-based learning is important in encouraging teams to take responsibility for delivering on their tasks.

Bridge21 facilitates the team through providing a dedicated learning space. This space for the team is called a 'team pod'. The team pod should be semi-enclosed to define the team space as their space and to afford a measure of privacy to the team in their work together. The team pods play a role in defining the team and also encouraging collaborative working, team working and technology sharing (see Figure 3.7 and 3.8).

Figure 3.7 Team Working in Team Pods

Figure 3.8 Collaborative Working with Technology in Team Pods

The technology should be available in the team pod with seating to provide comfort, flexibility and to reinforce the sense of the team having important business to achieve in their learning space. Breakout areas are required in the model to allow the team conduct meetings as necessary.

A presentation area is a feature of Bridge21 so that teams can present their work to their peers and mentors. The décor should be stimulating to contribute to creating a learning environment that is encouraging to creativity and team-based working.
In summary, dedicated team-oriented learning space is a critical requirement for team working and a key element of the Bridge21 model. Figure 3.9 shows teams working in the Bridge21 learning space.

Figure 3.9 Teams Working the Bridge21 Learning Space

3.3.5 Structuring the Learning Projects

The Bridge21 model frames the learning though challenges assigned to the teams as projects and the principles of Project-Based Learning were adopted as a key element of the Bridge21 learning model with the team tasks formalised and scaffolded around projects. The approach with the model meets common understanding of Project Based Learning in that the projects are complex and challenging, authentically situated, require autonomous effort, are time-bound, require cooperative working, feature reflection and require the production of an artefact or presentation (Blumenfeld, et al., 1991; Thomas, 1999). Additionally, the approach provides for support but not direction from a mentor (Thomas, 1999). The use of ICT is common in Project Based Learning and is integrated in the Bridge21 model. The projects in Bridge21 are designed and structured so as to engage the team and promote team interaction in meeting the project challenge (Michaelsen & Sweet, 2008).

It became apparent through experience in implementation that the pace of learning and achievement in the team was specific to the characteristics of the particular team and it also became apparent that the learning was asymmetric in that it differed from the sequential and linear progression of learning commonly served and assessed in formal contexts (Carroll, 2000).

The projects typically require a presentation by the team of their finished work to their peers in the other teams. All members of the team were required to be involved in the presentation so as to build confidence, communications skills and to foster team spirit and a collegiate responsibility of all team members for the product produced by their team.

3.3.6 Establishing the Social Learning Environment

Bridge2College presented an out-of-school experience to students. A social learning environment is established for the Bridge21 model to support what is a social and constructivist pedagogy (Blatchford et al., 2003; Dangel et al., 2003; Duit, & Treagust, 1998; Ryan & Deci, 2000). The original intention was to create a relaxed learning environment and a sense of having a taste of college life with less of the constraints and mores inherent in school life. The absence of school uniforms, timetables, the general paraphernalia of the school and also the structured deference to staff is intended to create a dissonance with the students' prior perception of how a learning environment could be and was also intended to encourage student motivation. A friendly open and relaxed atmosphere permeates the environment and the protocols at play are based on trust and responsibilty rather than policing and control. Fostering a relaxed environment included seeking to establish a friendly co-learning relationship between mentors and students. Students are encouraged to address adult mentors by their first names and to see them as co-learners and partners in the activity and not as an authority figure. The noise level with the Bridge21 model is higher than a typical classroom environment as students are encouraged to openly discuss the work at hand with both their peers and the mentors.

3.3.7 Defining the Mentor/Facilitators Role

The relationship between adult mentor/facilitators as co-learners with the student learners forms an important element of the Bridge21 learning model. The role of the adult mentor in Bridge21 is as a guide. The learning takes place in the team and the adult mentor is not a member of the team. The intent is to maintain a 'light touch' mentor/coaching with the adult mentor cautioned to avoid taking a lead in how a team operates through providing support and guidance while respecting the integrity of the team. In this way, the adult avoids taking responsibility for leading the learning and 'steps back' so that the team and its members will 'step up'.

Mentors also provide technical support but instruction is kept to a minimum. Where a team was having difficulties such as personality issues or collaborative working problems the mentor seeks to assist the team in resolving these internal challenges while maintaining a non-directive approach. Figure 3.10 illustrates guiding support external to the team.

In summary, the model places a reliance on the Vygostkian idea of a Zone of Proximal Development (ZPD) and learning with and from peers in the team (Vygotsky, 1987; Blatchford et al., 2005). The adult respects the integrity of the team and the primacy of the team in resolving their own challenges. In this way the team is the vehicle for the transfer of responsibility for the learning from the adult to the participant.

Figure 3.10 Adult Support as a Guide

3.3.8 Team and Individual Reflection

Team and individual reflection was identified as an important component of the Bridge21 learning model. Team reflection in scheduled team meetings supported a plan-do-review cycle (Whitebread et al, 2009) and in this way reinforced the taking of responsibility by the team, planning an approach to the project and task and evaluating the performance of the team and the learning. The team reflection takes place after each challenge to support a plan-do-review cycle and also at the end of the workshop. This team reflection is designed to promote peer learning, to encourage team interaction and to embed the plan-do-review discipline for the team (Cheung & Vogel, 2013; Trilling & Fadel, 2009). The team reflection is supported by a structured questionnaire that guides the team in reflecting on how they work together and deal with the challenges given them.

The individual reflection, or reflective observation as described by Kolb, is applied so as to deepen the learning, promote higher order thinking and encourage metacognition (Dewey, 1986; Kolb, 2014; Schraw, 2001). The personal reflection is facilitated through creating personal space and a time for reflection or 'cave space' as described by Thornburg (Thornburg, 2004). This personal reflection component is scaffolded by a post-activity questionnaire to encourage consideration by the individual student of what the experience has meant for them and what they believe they had learned.

This discipline of individual and team reflection on task and performance is integral to the model and its application. The process of structured reflection also serves to supply useful data for supporting research on the Bridge21 model and assessment of its impact.

3.3.9 Mastery Goal Orientation

The Bridge21 seeks to help participants be "their best" rather than find out who is best. The underpinning philosophy is to encourage personal mastery goals and to avoid normative assessment. Participants do not compete with each other in Bridge21, they work together to learn and achieve. This strategy encourages self-regulatory activity and fosters intrinsic student motivation (Ames, 1992; Pintrich & Schunk, 2002; Ryan & Deci, 2000). While there is a natural inclination for teams to compete, this is downplayed in favour of an ethos and atmosphere of inter-team cooperation. In presentation, the teams encourage, constructively critique and applaud each other. In this way, Bridge21 works to build a shared sense of personal and team achievement and learning.

3.3.10 Transferability and Adaptability of the Model

The model was first trialled in school with a partner school in 2011 with encouraging results that are outside the scope of this thesis. This early deployment in school was coordinated by a teacher who had seen the model work in Oriel House and applied it for a Second Year, Junior Cycle English class. The teacher attempted the implementation of the model with modest adaptation of a standard classroom space (See Figures 3.11 and 3.12). More extensive in-school and teacher development implementations have since been trialled and are supported by extensive and continuing research (Conneely, Girvan, & Tangney, 2012; Conneely et al., 2013; Byrne, Fisher & Tangney, 2015; Storm, 2015).

Figure 3.11 Model Transferred to School Classroom

Figure 3.12 The Team in Classroom

3.4 Summary of the Design of the Bridge21 Model

The Bridge21 model evolved and developed over six successive years as a product of an outreach programme at the author's university (TCD). The essential components of the model were laid down and tested in a large-scale implementation through the programme. The model is defined by eight complimentary elements: Team work, Technology-mediated learning, Learning space, Project based learning, Reflection, Mastery goal orientation, Social learning protocols, Guiding Facilitator/mentor.

Bridge21 is a team based, project oriented, technology mediated learning model (Lawlor, Conneely, & Tangney, 2010). It promotes a shift in control from teacher to student, the development of peer learning, learning with technology and collaborative working (Mistler-Jackson & Butler Songer, 2000; Resnick, 2001). It is designed to embrace learning and evaluation strategies that value effort and personal mastery. This is a deliberate strategy to try to break the performance-ability connection, to raise the students' perceptions of their own ability and to foster intrinsic motivation.

The initial pilot deployment of the learning approach was essentially intuitive. The model was substantially formed when the programme moved to a specially designed team-oriented learning space at Oriel House. The research data gathered over the successive academic years of implementation and reference to relevant literature facilitated the refinement on the model that was eventually retitled Bridge21 in its final version. The model has been implemented in a wide range of learning contexts and its deployment and testing in support of learning and research continues to the present.

3.5 Implementation of the Bridge21 Model

The idea of a learning intervention that would utilise affordances of technology to create an innovative learning experience for young people was borne out of the work of the Centre for Research in IT in Education at Trinity College Dublin and was infused with constructionist ideas about how young people could learn (Papert & Harel, 1991). This intervention was originally called Bridge2College. Chapter 1 (p 6) provided a historic timeline for the establishment of the Bridge2College programme and the attendant development of the learning model.

The title of the Bridge2College programme signals that its original mission was to leverage this learning intervention to serve an outreach purpose for Trinity College Dublin and also encapsulates the idea of bridging to a new way of learning. The programme continues and to-date in excess of 10,000 second-level students have benefited from the learning intervention. The programme and model were both later renamed Bridge21 to reflect the intent for the model to deliver 21st Century Learning and a new and enhanced mission of the programme to seek to influence systemic change in Irish education.

The original intention for Bridge2College was to encourage second level students from schools in areas of disadvantage to consider accessing third level education and particularly Trinity College Dublin and even more specifically to consider studying computer science. This outreach mission focus was a major influencing factor in the implementation of the programme and the impacting constraints.

The Centre for Research in Education (CRITE) at TCD sponsored an out-of-school time, volunteer led, computer clubhouse style learning intervention, that provided a context for the Bridge2College initiative and created expectations for what the intervention would be and also provided a basis and experience for the original implementation of the programme (cf. Proposal for a CRITE 'Computer Clubhouse' Scheme, Appendix 4). This original initiative was led by Bryan Patten, Inmaculada Arnedillo Sanchez, David Coyle and Mark Matthews.

The learning model Bridge21 that is the subject of this work may be considered a product of the Bridge2College programme. The implementation described in this work covers the first three years of operation of the programme.

The Bridge2College programme, later named Bridge21, has since served as the context for a host of implementations of the learning model, both in and out of school.

3.5.1 The Original Identified Need and Mission for Bridge2College

The Bridge2College programme was originally conceived to meet the challenge and opportunity presented by technology and its relationship to learning, that has been recognised as both a factor in widening the gap between the "haves" and the "have-nots", yet also in giving those who are disadvantaged in society the opportunity to realise their potential. There were already in existence a collection of computer outreach implementations ranging from the clubhouse genre, which stands separate rather than seeks to directly engage with formal education, to modest ICT-mediated implementations within the formal school structure.

The Bridge2College (B2C) learning model later to be named Bridge21 was originally developed and implemented by taking a radical approach to collaborative, technology-mediated creative learning, and doing so in contact and in partnership with formal education. Through this approach, the original objective of Bridge2College was to improve the perspective and attitudes towards personal learning, education and third level access of young people from areas of social disadvantage through utilising the potential of technology to mediate a dynamic, creative and cross-curricular learning experience (cf. Bridge2College Foundation Document (2007), Apprndix 4).

The original goals set for the implementation were therefore as follows:

- Create a learning environment where young people can become confident learners and creators through the use of technology.

- Delight the young people who participate and open the possibility of going to college as an option.
- Build a team of mentors who are enthused, able, committed and are inspired and developed by their experience on the programme.
- Build a body of content and a programme that works in a new learning environment.
- Explore the potential of technology to mediate learning across various disciplines and contribute to the body of research in this field.
- Create a model learning project that can be expanded and replicated and can influence change in Irish Education.

It may be seen therefore that the development of a learning model was a natural result of the original stated objectives of the Bridge2College programme and that the progression and evolution of the model was intertwined with the implementation of the programme.

As may be seen from the original goals, the Bridge2College programme had a research dimension from the beginning. This research had a strong focus on tracking the impact of the programme in meeting the social outreach agenda to make third level access more attractive for students from areas of disadvantage. This was paralleled with a requirement to identify the efficacy of the programme in attracting students to Computer Science.

3.5.2 The Participants Considered in This Study

This thesis considers the experience of a total of 1055 participants aged 15-16 years who are Transition year/gap year and fifth year students drawn from 55 second level schools across the country. The data for this research comes from implementation of the 'core' programme (B2C Transition Year Programme) run with 867 students from 15 schools from areas designated disadvantaged who each participated in one of a set of workshops and 188 students from a broader representation of 40 schools who participated in the second set of workshops (CS-TY) with a sharper focus on Computer Science in the team assignments.

3.5.3 The Programme Mentors

The significance of the role of the mentors in the Bridge2College and later Bridge21 programme cannot be overstated. Each workshop had a team of 3 to 5 mentors. The original volunteer mentor team were largely drawn from the college community of undergraduate and post-graduate students from varied disciplines. These were joined by a broader cohort of volunteers including retired and unemployed persons from a wide range of backgrounds and expertise.

The model of mentoring required in the learning approach differs from other approaches where the mentor is more 'hands on'. The Bridge2College mentors were there to guide and support but to avoid giving direct instruction to the students. This requires a particular discipline and adherence to the non-directive approach of the learning model.

The mentors' motivation for engagement was generally altruistic with their continuing commitment based on personal satisfaction, achievement, affiliation and a sense of enjoyment from participation. This profile mirrors the motivation of volunteer youth workers in the non-formal educational sector (Rouse & Clawson, 1992). Having such motivated mentors was of significant advantage to the implementation and affected the perception of the participants who saw the mentors as integral and positive contributors to their experience:

"I loved my teammates, the mentors and the break from school", and

"I felt the course and mentors were amazing"

(Bridge2College Participant Students)

The mentors demonstrate huge commitment to the programme, belief in the learning approach and a capacity to work positively with children. It is particularly gratifying and affirming of the approach that young adults who participated in the early years of the programme have returned to act as mentors in recent years.

3.5.4 The Model and the Programme Implementation

The development of the Bridge21 learning model and the Bridge2College programme progressed in parallel. The interplay between the progress of the programme and the development of the model is a fundamental feature of this thesis. This interplay affected the research undertaken, in that the participants attending the workshops presented an opportunistic cohort and emergent research sample (Suri, 2011). Additionally, the experience from the workshops influenced the refinement of the Bridge21 learning model and this process continued through the period of this study as it focuses on the implementation years from 2007 when the programme was founded to 2010. The context influencing the implementation of the Bridge2College programme also influenced the development of the Bridge21 learning model.

3.6 Factors Influencing Implementation

There was a range of external factors that impacted on the implementation of the Bridge2College programme. These came from the objectives, agendas and missions of the partner stakeholders, the challenge of social disadvantage in education, the constraints of working within school timetables, structures and protocols and perceptions around how the programme might work based on experience of more established learning interventions.

3.6.1 Support and Expectations of Stakeholder Partners

The Bridge2College programme was established in partnership with Suas Educational Development, a not for profit organisation committed to bringing educational opportunities to disadvantaged children and communities in Ireland and overseas. The Suas mission is to give young people the opportunity to realise their full potential in life and the capability to create positive change in their society (Suas, 2015). The programme was also implemented in partnership with TAP (Trinity Access Programme). The mission of the Trinity Access Programme is to widen access and participation at third-level of under-represented groups (TAP, 2015).

Suas provided funding for the programme initially through government grant aid (Pobal funding) and also through staff support and administration. The author was initially employed by Suas to lead the programme. Suas had a number of years' experience in mentoring children in homework clubs in disadvantaged areas. The ideas for the Bridge2College programme benefited from critical consideration and scrutiny against the other Suas programmes. In particular, the approach to mentoring proposed implemented in the Bridge2College programme differed significantly from the one-to-one mentor model deployed by Suas in the homework clubs. This constructive tension was important in testing the ideas being considered for the Bridge2College model and its implementation.

The Trinity Access partnership enabled contact by the Bridge2College team with schools with whom they had a strong relationship. Personal introductions provided by TAP with teachers and principals in the participating schools were particularly important. Additionally, TAP allowed the use of their premises for five weeks to accomodate a pilot programme. While working from these premises, Bridge2College traded on the TAP name and this gave confidence to the participating schools to allow their students attend during school time. It could be said that this initial support by TAP was crucial to getting the programme off the ground.

3.6.2 Targeting Transition Year

The Bridge2College/Bridge21 programme began focussed on second level students, average age sixteen years, in Transition Year in school. The selection of this age range and stage in school life for the programme was largely opportunistic as the transition year in school facilitates flexibility and less demand from the curriculum and so it was more likely that school would release students.

Second level education in Ireland is heavily influenced by two state examinations, the Junior Certificate and the Leaving Certificate in third year and sixth year respectively and the preparation years and programmes for these examinations are termed Junior and Senior cycles (Looney, 2006). The Transition Year (TY) is an optional one-year programme taken after Junior Cycle and before the two-year Leaving Certificate programme designed to act as a bridge between the Junior Certificate and Leaving Certificate programmes. The programme is optional for schools and optional or mandatory for students depending on the school’s policy. In some schools access to Transition Year is competitive with a school based selection process. In excess of 75% of second level schools in Ireland operate Transition Year programmes (Department of Education and Skills, 2015a). Colloquially, students and often parents typically regard Transition Year as a ‘doss year’ (not a serious learning year) (Irish Independent, 2015).

The school designs its own transition year programme based on set guidelines from the Department of Education and Skills (Department of Education and Skills, 2015a). The objective is to have a programme that facilitates a positive challenge for personal development and promotes self-directed learning for students. Work experience and community service are often components of the year’s programme. Assessment in Transition Year is school-based and typically includes projects and portfolios, and hosts or providers of activities may contribute to assessment (Department of Education and Skills, 2014). These might include agencies such as Gáisce – The President’s Award who provide out-of-school extended personal challenge programmes.

Some of the participating schools in the Bridge2College/Bridge21 programme and particularly, those in areas of disadvantage eschew Transition Year out of consideration for trying to mitigate a poor level of school completion. These schools allow their students participate in the Bridge2College/Bridge21 programme in their first year of their senior cycle.

3.6.3 Expectations of the Partner Schools

In providing their students to the programme, the expectation of the schools is worth noting. In general, the schools believed their students were taking part in computer workshops linked to TAP and that they were also getting an opportunity to experience the university campus and that might help raise their educational horizons. On this basis, the schools committed to allowing the students attend over four consecutive school days.

Because of the social context of the schools involved, a higher than average proportion of the students participating were struggling academically, encounter barriers to educational progression and were less likely to progress to third level than children from schools in more socially advantaged areas. Consequently, access to third level from these TAP schools was below national averages (O'Connell, McCoy, Clancy, 2006; Fleming & Finnegan, 2011). Because of this the partner schools saw the placement opportunity with Bridge2College as advantageous in raising students' educational horizons.

3.6.4 Building Partnership with Schools

In the pilot implementation, the relationship with the schools was initially founded on their confidence and positive prior experience with the Trinity Access Programme. When the story of the experience of the students filtered back to their teachers, the demand for participation grew within the participant schools and also spread to other schools. The programme was moving from being promoted and pushed by the project team to being demand led with schools seeking extra places and a process of building partnership with schools began. The partner schools were visited and the principles of the programme and model were explained to teachers and school principals.

3.6.5 The Technology Available and Deployed

Budgetary constraints influenced the technology acquired for the Bridge2College programme. Desktop computers that had been pre-used were purchased. These were equipped with Windows software and a number of freeware packages including Audacity Audio Editor, Windows Movie Maker and Kompozer Web Authoring software.

This use of older machines and freeware became significant in itself in a number of respects. It raised the proposition to stakeholders, and particularly teachers, that leading edge or expensive technology was not essential to creating an effective technology-mediated learning experience and that this model of learning was implementable with modest resources. The students also came to understand that with creativity, older technology can be effective. As one remarked:
"*I learned how to use old computers*". (Bridge2College Participant Student)

3.6.6 The Coeducational Challenge

For historical, social, cultural and religious reasons, Ireland has a high proportion of single gender schools particularly at second level (Smyth, 2010). This is a more pronounced phenomenon in urban areas such as Dublin. Additionally, many of the schools which provided students to the Bridge2College, and later to the Bridge21 programmes, for the years considered in this implementation, were from older areas of the city and are long established and were therefore more likely to be single gender. For this reason, many of the students attending had no previous experience of working in a mixed or coeducational environment in their school. Drawing on the the prior experience of the author from his work in non-formal learning contexts, and on the experience of his colleague Claire Conneely in schools, the decision was made that the learning approach would be coeducational. Consequently, the teams established for Bridge21 would be mixed and as far as possible an equal balance of numbers of boys and girls would be maintained in the programme. Selection of schools for particular weeks and workshops therefore required consideration of the numbers of students from each gender and a balance between students from all boy, all girl and mixed schools. The consequent mixing of schools also had a disruptive effect on the students, though it generally elicited a positive response from the participants:

"I got along better with the people I didn't know even though I thought I wouldn't".
(Bridge2College Participant Student)

The students who were new to coeducational learning, both boys and girls, found the experience of working in mixed teams to be significant and disruptive to their previously formed perceptions:

"I get along well with a group of boys" and *"girls are weird".*
(Bridge2College Participant Students)

It is clear that the issues around gender dynamics and coeducation in Bridge21 are significant and worthy of consideration and research but they are beyond the scope of this thesis.

3.6.7 The Computer Clubhouse Influence on Implementation

At the time of the establishment of Bridge2College in 2007, there were over one hundred Computer Clubhouses supported by Intel in twenty countries across the globe. The Clubhouse approach had proven efficacy and credibility as a learning approach with technology, albeit in an entirely out-of-school context. Moreover, the volunteer led programme that was the forerunner of Bridge2College implementation was based on the Computer Clubhouse initiative. It was inevitable therefore that the learning model applied in Bridge2College and its implementation would draw on the Clubhouse principles and where it was decided to deviate from the Clubhouse model would raise questions and require justification. A highly significant first departure from the Clubhouse model was to implement the Bridge2College out of school but in school time.

3.6.8 Choosing School Time and the Influence of Schools on Implementation

The Bridge2College/Bridge21 programme runs during school hours and in direct partnership with schools. This is a significant difference from the out-of-school approach of the global Computer Clubhouse model, and later, the CoderDojo model (McInerney & Margaria, 2015) and was also a departure from the original proposal for the programme that grew from the early volunteer led initiative (ref Foundations Documents - Proposal for a CRITE 'Computer Clubhouse' Scheme Appendix 4). The reason for this decision was a declared objective for the programme to seek to influence systemic change in Irish education through developing a new model of practice. It was believed that to achieve this required direct engagement with formal structures. This approach was aligned to a Theory of Change model (Gandin & Apple, 2004) as adapted from the Citizen Schools programme (cf. Foundations Documents –Theory of Change Appendix 4).

Early discussions with school principals suggested that to secure their support for the participation of their students, the workshops should run no longer than one school week. The workshops also needed to run for time periods aligned to the school day to meet the staffing and time constraints of the school.

3.6.9 Influence of the School of Computer Science on Implementation

The Department of Computer Science and Statistics at Trinity College Dublin was a key stakeholder in the initiative and the implementation, given that the genesis of the programme owed much to the ideas and commitment of researchers from the Department's CRITE research centre and their commitment to constructionist learning with technology and to technology resources provided by the Department of Computer Science and Statistics. The Department of Computer Science and Statistics has a particular agenda to promote undergraduate study of Computer Science at Trinity College among all second level schools and sought to have the Bridge2College programme run special workshops to support this objective. This influence had the effect of opening the programme to schools outside the Trinity Access cohort and to schools beyond the purely social outreach mission. This had an effect of 'main-streaming' the programme and broadening its influence and also avoided serving the 'ghettoisation' effect that is particularly evident in the Irish school system (Dept of Education and Science, 2005).

3.6.10 Summary on Influences on Implementation

There were strong external influences on the programme from stakeholders and also based on the legacy of the precursor volunteer out-of-school programme. The founding researchers, led by the author, were resolute in their belief of what might work and believed that a Pilot implementation would assist in refining, validating and correcting the learning approach as appropriate.

3.7 Pilot Implementation

A Pilot instantiation of the Bridge2College programme was implemented over a five-week period from 6th November to 7th December 2007 comprising five separate workshops. This involved twenty days of four day workshops working with a total of ninety students from four schools. Eighteen volunteer mentors facilitated the workshops. The projects given to the participants included: building websites, creating robots with lego mindstorms, working with DrumSteps (constructionist music composition tool) (McCarthy, Bligh, Jennings, & Tangney, 2005), animation, digital publishing and video making. The location for the workshops was a standard computer science lab in the Trinity Access Programme premises on the university campus as seen in Figure 3.13.

Figure 3.13 The Pilot Implementation in Action

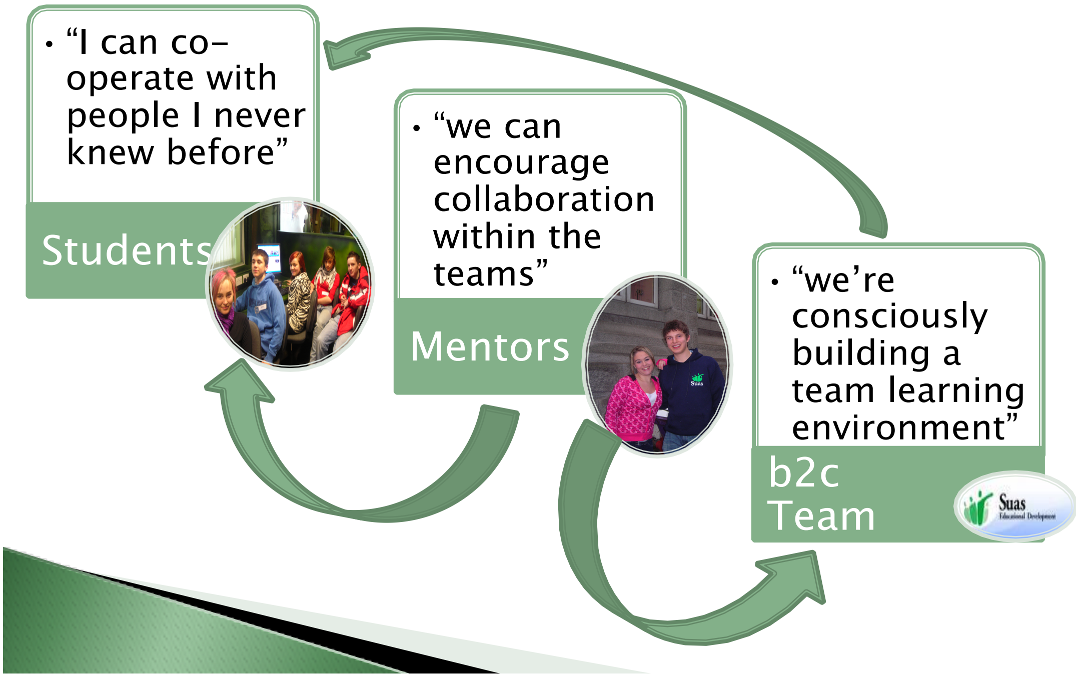
3.7.1 Lessons from the Pilot Implementation

The Pilot implementation was informally evaluated so as to guide the broader implementation. The critical learning from the Pilot while given as general observations was valuable in helping shape the programme that was to follow. The findings (cf. a contemporaneous presentation on the Pilot) were:

- The children enjoyed the programme.
- The teamwork approach was successful and could be further developed.
- The children indicated a more positive attitude to going to college.
- The mentor as ‘guide’ approach was effective.
- Technology and learning and a constructionist pedagogy were facilitated in the approach.
- The projects for the teams would benefit from being carefully scaffolded.
- Appropriate learning space would be important for effective teamwork.
- The engagement with formal education through the schools was positive and the feedback from the schools was encouraging.
- We could confidently prepare for a more ambitious programme.

The positive experience of participating students and mentors is illustrated in the graphic in Figure 3.14 with sample individual quotes, taken from the presentation on the Pilot.

Figure 3.14 The Pilot Experience from Different Perspectives



The Pilot implementation informed the development of the broader implementation that would take place in a specially designed learning space. For the programme team, it became apparent that elements of a nascent, embryonic learning model were emerging, particularly in relation to the use of teamwork, collaborative working and co-operative working, employment of technology on a shared basis and in the development of the mentor role. The success of the pilot and the engagement with formal education also allowed for a more informed dialogue with school leaders on their schools' participation in a broader programme.

"All of the students were extremely positive about the learning experience. Since coming back to school, they've taken the initiative to use their IT skills for various projects... They have all shown new levels of confidence in their ability"

(Teacher in participating school in the Pilot Programme)

3.8 Preparing for a Broader Implementation

Building on the experience of the Pilot implementation, the programme team prepared for a broader and more ambitious programme. This process involved reassessing the original vision and mission for Bridge2College and clarifying the objectives for the programme. To maintain the university access focus, customise a learning space to support the learning approach and crucially to maintain an academic link to support research, it was determined that the programme would be implemented in an out of school context but on the university campus.

The end of the Pilot also coincided with the completion of the new specially designed learning space at Oriel House on the Trinity College campus, which was constructed in parallel with the Pilot implementation.

3.8.1 Development of the Mission, Vision and Aims

The experience and evidence from the Pilot gave confidence for a redefinition and development of the vision, mission and aims of the Bridge2College programme. The emergence of an effective learning model was a key factor in facilitating and encouraging the development of the programme and this new learning model was also called Bridge2College (B2C), later to be renamed Bridge21.

The amended vision for the programme now significantly encompassed "all young people" which was an extension from the original purely social outreach agenda. Additionally, the idea of encouraging young people to "fully realise their educational potential" was added, suggesting an aspiration for a broader impact than only focussing on third level access. Therefore, the new vision for the programme declared for the broader programme was:

Vision

All young people are given the opportunity to raise their educational aspirations and fully realise their educational potential

The mission for the programme was now declared as the creation of a learning model that play a part in influencing systemic change in Ireland. This was an indication of the growing confidence of the programme team in the efficacy of the approach based experience in the initial pilot implementation. The targeting of systemic change in Ireland (ref: Foundations Documents –Theory of Change Appendix 4) reflected the wish of the author to contribute to a change agenda and a belief in the power of the emerging model. Therefore, the mission for the programme was declared as:

Mission

The creation of a quality, values-based & innovative learning model, which can affect systemic change in the Irish education system

(cf. a contemporaneous presentation on the Pilot – April 2008)

The aims for the programme were aligned to give expression to the stated mission and vision and were framed as follows:

Aims

- To utilise the potential of technology to mediate a dynamic, creative and cross-curricular learning experience for young people and encourage them to improve their attitudes towards their personal learning
- To leverage the impact of the learning model to effect systemic change in the Irish education system

Consolidation of the Method

The experience of the pilot implementation also provided a basis for the consolidation of the learning method and the implementation of the programme was structured so that the Bridge2College programme would:

- Positively engage the young people and encourage them to improve their attitudes towards personal learning and education.
- Present a values-based programme content.
- Build an enthused, able and committed team of volunteer mentors that are inspired and developed by their experience.
- Complement and enhance the work of the participant schools.

- Empower children as creators in control of their own learning.
- Emphasise teamwork, problem solving and constructionist learning approaches.
- Support the young people to recognise and develop their talents.
- Present college as a real, attractive and viable opportunity after school.

(cf. a contemporaneous documents on the Pilot –April 2008)

This consolidation and extension of the Bridge2College method was also serving the evolution of the learning model that was to become Bridge21. This crossover between the implementation of the programme and the development of the model was most visibly evident in the building of a learning space to serve the programme and tailored to support emerging the team-based, technology mediated learning model.

Summary of Progression of the Programme Implementation

The implementation progressed from the pilot engagement, focussed on social outreach with a small number of schools, to a nation-wide programme involving 40 schools, in the data considered in this study, and informing the development of the Bridge21 learning model. This progression of implementation is summarised in Table 3.4.

Table 3.4 Progression of Engagement and Implementation

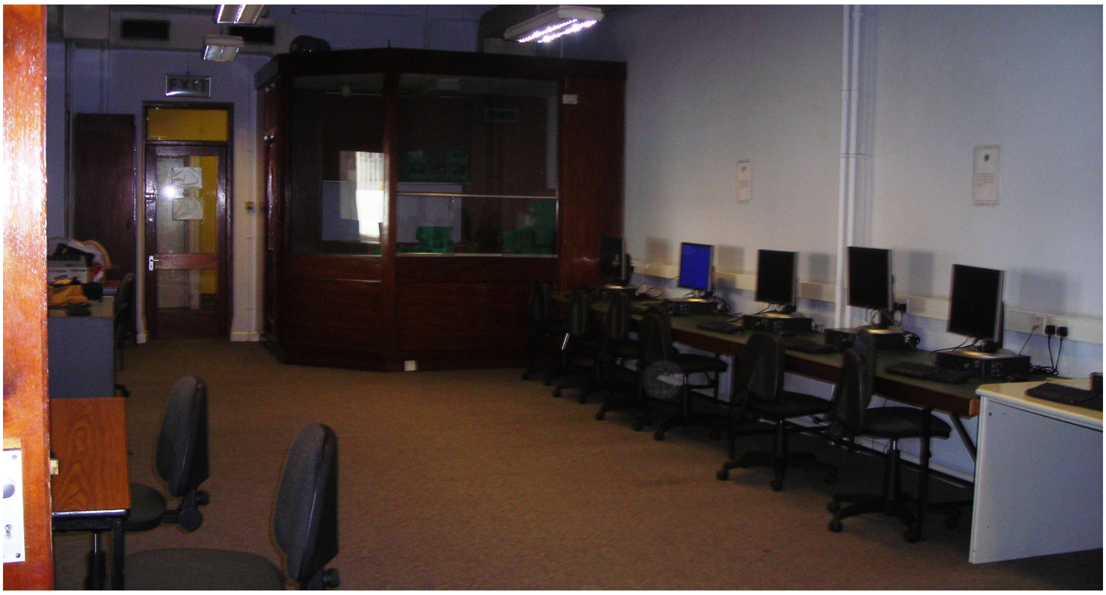
Engagement	Pilot	Bridge2College	Bridge21
Local Schools Designated Disadvantaged	✓	✓	✓
Citywide Schools		✓	✓
Nationwide Schools			✓
Model Building		✓	✓

3.8.2 Building the Learning Space –Design, Evolution and Construction

While the Pilot was in progress, the learning space to support the programme, and was being built. A location had been secured on the university campus at Oriel House in an old computer science lab see Figure 3.15 and Figure 3.16.

Figure 3.15 Front Room Oriel House Pre-Redesign

Figure 3.16 Rear Room Oriel House Pre-Redesign

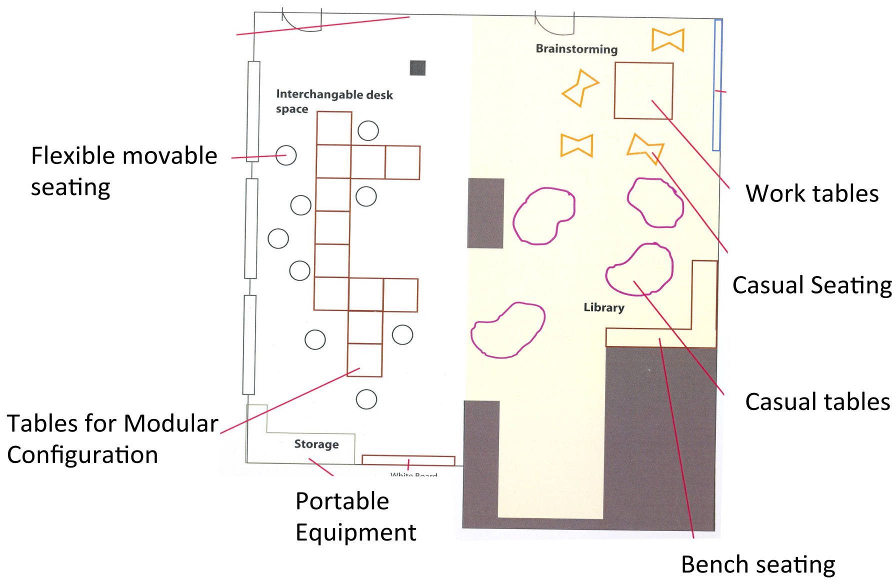


The redesign of this learning space involved incorporating the ideas of the author and the programme team, consideration of relevant literature on learning space and engagement with a professional artist. This engagement created a dialogue moving from the intuitive to the informed, balancing the creative with the practical and the desired with the possible. The design was constrained to fit within the two existing rooms shown in Figure 3.15 and Figure 3.16.

The design was emergent and evolutionary and went through a series of iterations. An example may be seen in Figure 3.17 where the ideas of creating team spaces, flexible furnishings and breakout areas were first explored.

These views on how the learning space could be configured included ideas influenced by JISC (The UK higher education, further education and skills sectors' not-for-profit organisation for digital services and solutions), the work of Nair and Fielding (Nair, 2011), the learning space concepts of Thornburg (Thornburg, 2004) and the method of the World Scout Movement. The influences on learning space for the Bridge21 model itself are treated in more detail in Chapter 2 (Literature Review).

Figure 3.17 First Concepts in Learning Space Layout



The briefing to the designer/artist (Ms. Karen Forde) comprehended the key elements of the learning approach and the attendant influences on learning space. A sense of bridging to something and moving from one learning method to another was also in the mix. The development of concepts also took consideration of the potential impact of the décor and appearance of the learning space on the participants. It was to appear different, disruptive of prior ideas about learning and learning space, team oriented, relaxed and welcoming. The learning space also needed to be functional, to accommodate a sufficiency of students for a workshop (up to twenty-five) and to facilitate the use of computers in the teams. It was also required that one room would accommodate the team use of technology – the 'team room' and the second room would facilitate breakout sessions and presentations – the 'breakout room'.

Samples of the original concept drawings may be seen in Figures 3.18, 3.19 and 3.20. (Artist: Karen Forde)

Figure 3.18 shows the development of the idea of a breakout room with curved lines, soft furnishings and a 'funky' image of the integration of technology in the décor.

Figure 3.18 First Concept of Breakout Room

This idea for the 'breakout room' was further developed to a café style décor as seen in Figure 3.19, with moveable furniture of numerous different designs to allow imaginative configurations that would support creative engagement of students.

Figure 3.19 Cafe Style Room Emerging

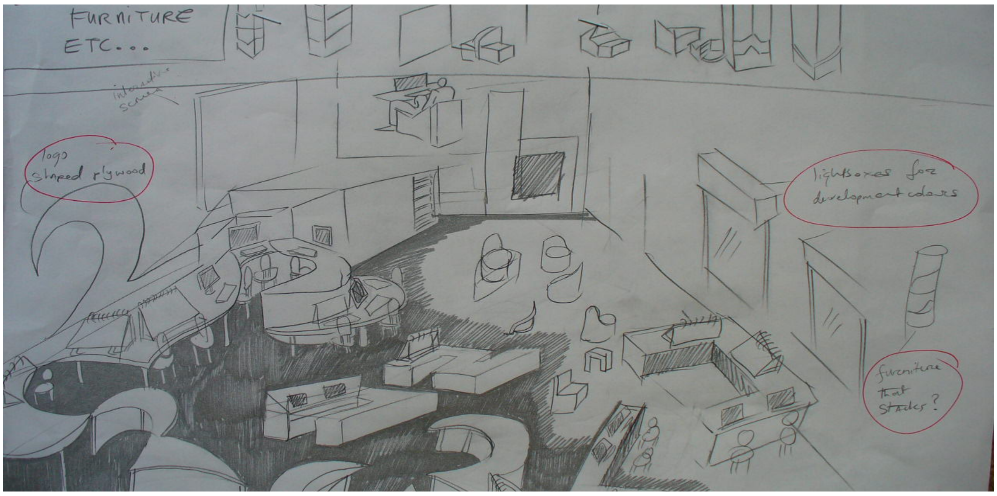


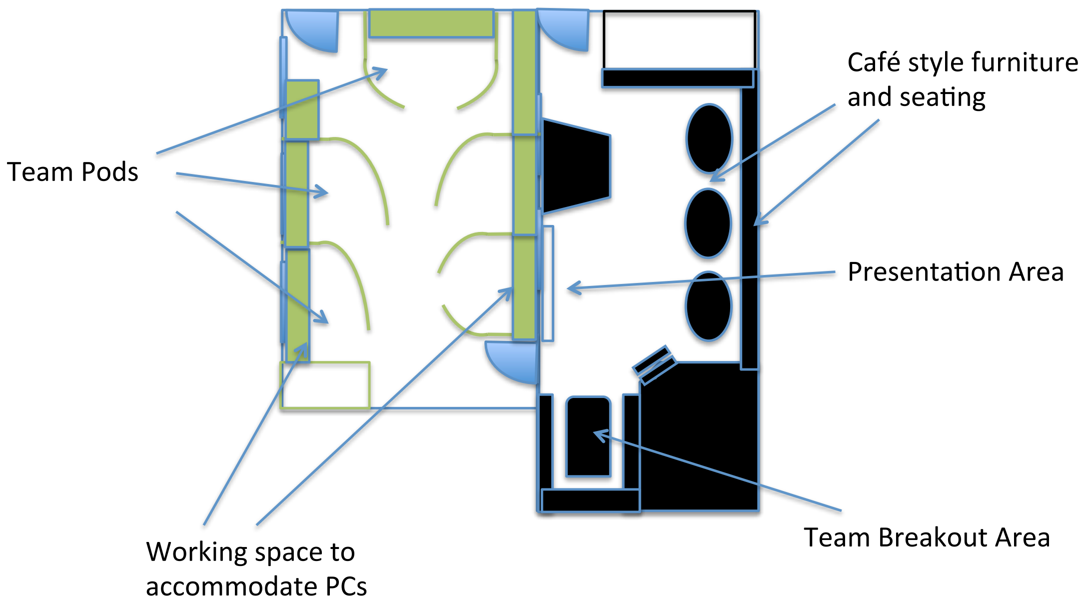
Figure 3.20 illustrates the development of the ‘team room’ with the emergence of the idea of team spaces with technology called ‘team pods’. The pods were to be semi-enclosed, facilitate collaborative working, allow for technology resource sharing and to have desk-space and seating for a team of up to five persons.

Figure 3.20 Team Pod Structure Emerging

Final Design

The final design for the two rooms in the learning space (illustrated in Figure 3.21) emerged through dialogue and constructive tension between the design artist and the programme team led by the author.

Figure 3.21 Final Design of Learning Space Layout



Construction

The build programme for the new learning environment took a period of four months following agreement on the design. It is important to note that the Pilot programme was 'live' in the temporary learning space while the build was in progress and the Bridge2College programme team regularly checked in with the construction team and artist to ensure that what was being delivered for the new learning space was attuned to the lessons emerging from the Pilot. Figures 3.22 and 3.23 show the construction in progress. The final design was innovative and daring and challenged conventional norms in formal learning (Nair, 2011). Securing permission from the relevant authorities for this bold approach was significant as it pushed the boundaries of convention. Even the choice of artificial turf floor covering was emblematic of the wish to challenge the conventional and to encourage the students to 'Walk on the Grass'.

Figure 3.22 Construction of the Team Space

Figure 3.23 Construction of the Ideas, Breakout and Presentation Space

The new learning space was completed and ready for the broader implementation planned following the conclusion of the Pilot programme. The space, built to cater for a maximum of 25 students, consisted of a forest themed room which housed five team pods (seen in Figure 3.24) and a presentation/ breakout room themed in a city café style (seen in Figure 3.25). The learning space had to meet practical as well as more esoteric criteria in accommodating students, facilitating teamwork and enabling the effective use of technology.

Figure 3.24 The Completed Forest Room with Team Pods

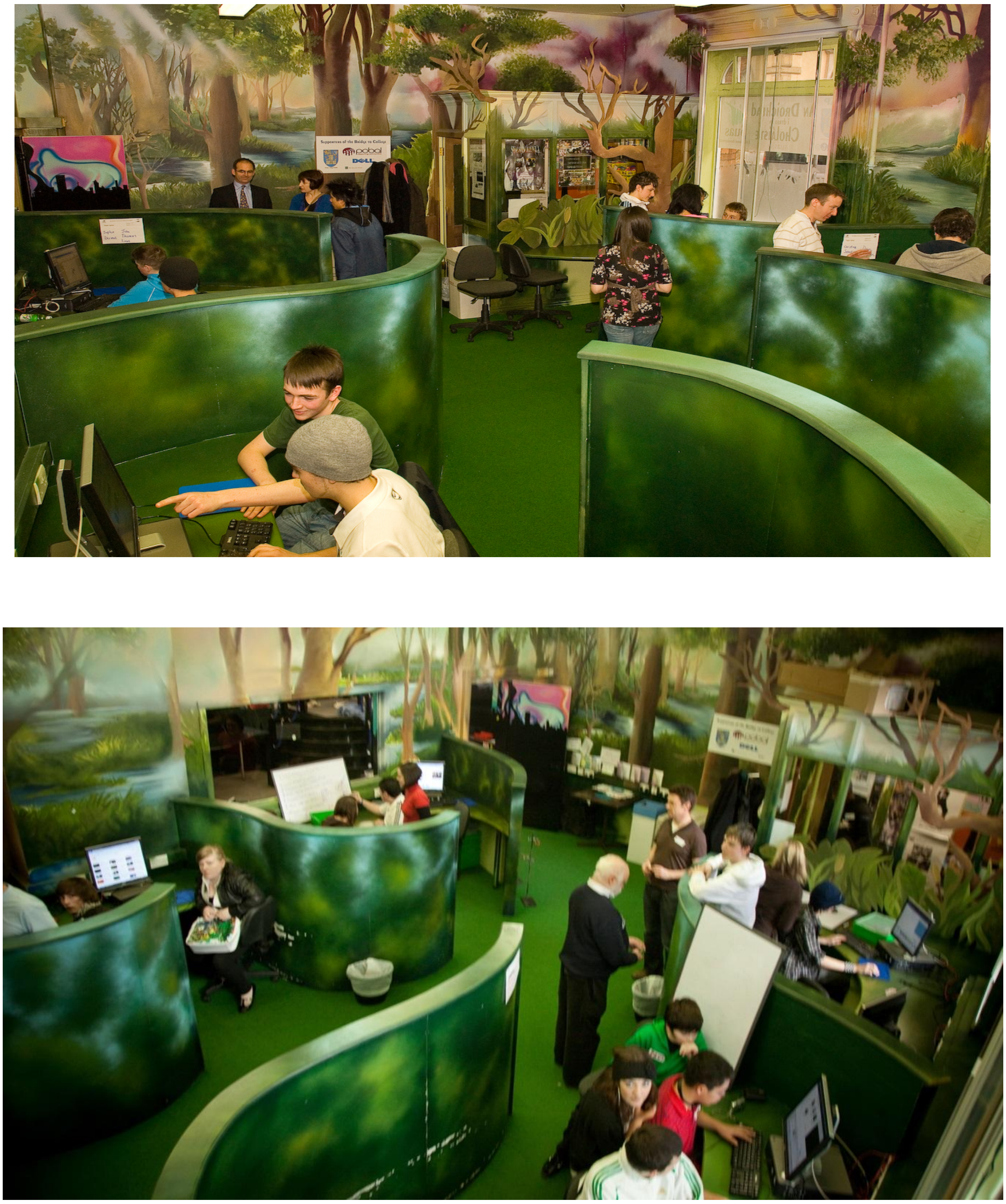


Figure 3.25 The Completed Presentation/Breakout Room

The message that this new learning space proclaimed to any new entrant was that learning was going to be different here and it also laid down a disruptive challenge to perceptions of what a learning place could be.

3.9 Implementing a Broader Programme – Oriel House

The new learning space at Oriel House was ready in early 2008 and the implementation of the broader Bridge2College programme commenced and has run continuously there since. The scale of the implementation grew rapidly in tandem with a consolidation of the learning approach and the codification of the emergent learning model. These developments were fashioned through the rigor of successive weekly workshops with new cohorts of students.

3.9.1 The Programme Implementation Considered in this Study

The Bridge2College programme implementation considered in this study took place throughout three academic years 2007-2008, 2008-2009 and 2009-2010. This implementation period is selected for study because it traces the development of the model, the learning space and the establishment of the programme.

This period comprehended 54*3.5 day workshops spread over each of the three academic years and catering for up to 25 students at each workshop. This included 46 general workshops working with ICT in teams (B2C Transitition Year Programme), and 8 workshops more specifically focussed on promoting Computer Science as a future study option at third level (CS-TY Programme). The workshops took place within school time but in the out-of-school context of the learning space at Oriel House. The students attending each workshop were drawn from three or four schools so as to realise a mix of participants. The implementation is summarised in Table 3.5.

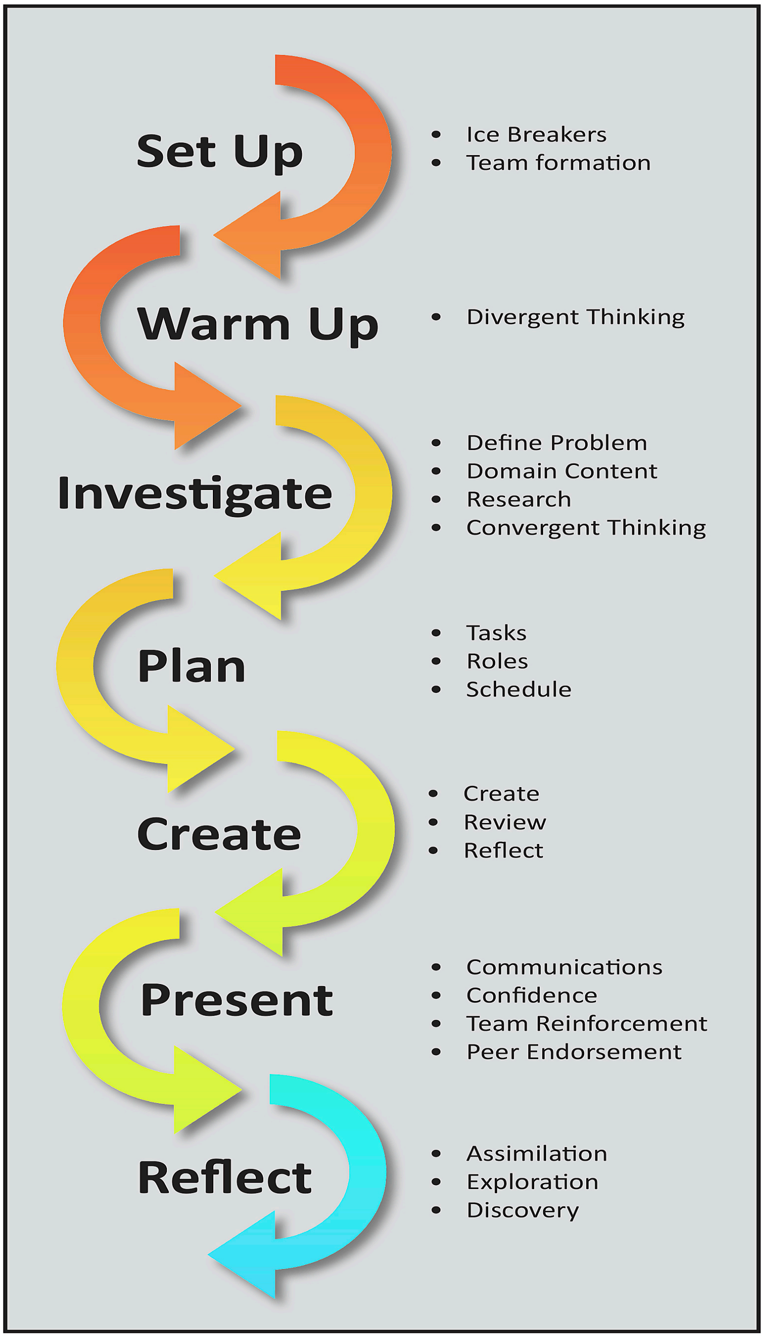
Table 3.5 Implementation in this Study

Year	Activity	Duration Days	Schools	TY Students	Volunteer Mentors
2007-08	B2C Transition Year	52.5	10	280	25
2008-09	B2C Transitition Year Programme	42	13	287	35
	CS-TY Programme	10.5	25	63	15
2009-10	B2C Transition Year Programme	59.5	15	300	25
	CS-TY Programme	17.5	40	125	15
Totals		182	40	1055	35

3.9.2 Structure of Workshops and the Activity Model

The workshops followed a set format and Activity Model subsequently refined and codified by Byrne, Fisher, and Tangney and illustrated in Figure 3.26 (Byrne, Fisher, & Tangney, 2015b). Byrne et al. make the point that while the Bridge21 model defines the ingredients to support a rich 21st Century learning model, it is this Activity Model that brings elements to bear in the programme workshops. The seven activity model components followed in the workshops as described by Byrne et al. are: (1) Set-up; (2) Warm-up; (3) Investigate; (4) Plan; (5) Create; (6) Present; (7) Reflect. The strategies applied in the learning exercises are consistent with the principles for project-based learning and team-based learning considered in the preceding literature review (Chapter 2). The series of tasks given were steadily more challenging and designed to promote cooperation and interaction.

Figure 3.26 The Bridge21 Activity Model (Byrne, Fisher, & Tangney, 2015)



3.9.3 Set-Up Phase

This Set-Up phase comprehends the arrival and induction of the students on the first morning of the workshop. The students encounter a new and visually stimulating learning environment and atmosphere. They are greeted, welcomed and introduced to the programme team and mentors and they meet and mix with students from other schools. The social protocols for working together and the programme for the workshop are explained. An exercise called the 'Sum of All Fears' is undertaken where the students individually and anonymously write down their concerns and fears for the week ahead. It is noteworthy that 'working with strangers', 'appearing stupid' and 'speaking in public' typically feature strongly in this list of concerns. The workshop coordinator then conducts a plenary session where each of the concerns is addressed in a warm and encouraging way. This session is followed by an 'ice-breaker' game devised to demonstrate the importance of working together and communicating effectively and team games and exercises are favoured in the implementation so as to introduce team skills. Following this exercise, the students are allocated to the teams by the workshop coordinator so as to affect the greatest mix possible from the different schools and consistent with Michaelsen and Sweet's injunction, to avoid student selected teams, in their principles for team formation (Michaelsen & Sweet, 2008). Care is also taken to affect a gender balance in the teams so as to support the coeducational approach described previously (Section 3.6.6). The teams selected are maintained throughout the workshop.

3.9.4 Warm-Up Phase

The warm-up activity is intended to encourage divergent thinking and is also the first attempt at getting the teams working together and thinking creatively. This activity comprises a 'brainstorm' on a relevant issue, for example: the uses of computers in everyday life considering the idea of 'inputs' and 'outputs'. Examples often include: house alarms, smart phones, ATMs etc. (Byrne, Fisher, & Tangney, 2015b). Feedback is taken in plenary with a rapporteur for each team.

3.9.5 Investigate Phase

The investigate phase seeks to encourage convergent thinking. An example activity would be that the team are presented with a real-world problem and asked to research the problem, discuss it as a team and make a presentation in a plenary session with the other teams. This exercise establishes a basic pattern for how the students will address more challenging projects as the workshop progresses through the week. It is in this phase of the Activity Model that the team selects its team leader. The activity coordinator communicates to the team through the team leader for the remainder of the workshop.

3.9.6 Plan Phase

In this phase the team is presented with a project to complete, in an appropriate domain that requires them to plan together as a team. Typical projects could be: the creation of a short radio programme or making a short movie to an agreed theme. The team must define the problem and devise a strategy, plan and schedule for the project. The projects require the assignment of roles within the team for example: Director, Editor, Script Writer, Researcher, Actor (ref Appendix 2: Workshop Activity Movie Making Team Roles for Campaign). The projects are team-based, require the engagement of all team members to be achieved, contain both a technical and a collaborative working challenge and require an element of online research. The tasks were time-bound with a requirement to deliver to a deadline with a presentation to the other teams and so incorporate a measure of pressure on the team.

3.9.7 Create Phase

The create phase involves the team working to complete their project. When a team encounters a problem, they are encouraged to review, reflect and take remedial steps where appropriate. Team skills are coached by mentors who adopt an encouraging but 'hands off' approach and respect the integrity of the team by not intruding or leading. The team brainstorms and maps their ideas and plan on whiteboards, as seen in Figure 3.27.

The team can avail of advice and support, both technical and general, from the mentor team but direction, control and responsibility rests with the team. The team must also prepare a presentation of their work. Up to three such projects with successively greater challenge and complexity are undertaken throughout the 3.5 days of the workshop. As the workshop programme progressed these more complex projects have included:

- Creation of Multi-media artefacts
- Computer games making
- Peer teaching of mainstream academic subjects

Figure 3.27 Whiteboards in Team Pods

3.9.8 Present Phase

The team presentation of their work to their peers in the other teams is an important part of the activity model. This is done in a plenary session with each team in turn presenting. The teams are encouraged to involve all team members in the presentation. As observed previously, the young people regularly express a fear of speaking in public at the commencement of the workshop and this exercise in presentation is intended to address any confidence gap and to build communication skills. The presentation also has the effect of reinforcing the team dynamic and securing peer endorsement.

3.9.9 Reflect Phase

Team meetings and reflection are encouraged and facilitated after the completion of each task. The reflection activity is part of each day following the presentation of the project work and also on the completion of the workshop on the last day. This reflection is facilitated at team and individual level with structured questionnaires (ref Appendix 4 Reflection Resource Documents). The learning goals for the reflection are to promote assimilation of the learning and also to encourage personal exploration and discovery through metacognition.

3.10 Further Extending the Implementation

The implementation of the Bridge2College/Bridge21 programme was extended to other schools outside the disadvantaged category and in a range of learning contexts including: Computer Science workshops, Multi Media Training, Language Training, Peer and Team Learning, History, Mathematics Learning and Language Learning. The model and approach has been shown to be effective, flexible and resilient through this range of implementations all of which are supported by separate post-graduate research by this and other researchers. The implementation of the Bridge21 to support undergraduate recruitment to Computer Science – Computer Science Transition Year Programme (CS TY) was a useful test of the efficacy and flexibility of the model (Tangney, Oldham, Conneely, Barrett & Lawlor, 2010).

3.10.1 Computer Science Transition Year Programme (CS TY)

One of the key stakeholders for the programme was the Department of Computer Science and Statistics at Trinity College Dublin. The department annually conducted workshops to encourage second level students to study computer science at TCD. The Bridge2College/Bridge21 programme was commissioned to take over these 'promotional' workshops and they were implemented in accordance with the Bridge21 model.

The intent was to seek to dispel the 'hacker' and 'geek-image' myths prevalent in secondary schools, through an intensive workshop in computer programming so that participants would have the opportunity to engage with one of the core activities of the computer science discipline and so that they would gain insights into what a third-level computer science course might entail. The pedagogy followed was based upon the Bridge21 model (Lawlor et al. 2010). A visual programming language that empowers the user to engage in complex problem-solving and programming activities with only a shallow learning curve, Scratch (Maloney et al., 2008) was chosen as the programming language to be used. The findings from eight workshops over two academic years benefiting 188 students for this Computer Science implementation are considered in this study.

3.11 Implementation Summary

The Bridge2College outreach initiative and programme with second level students provided the implementation opportunity for trialling a progressive learning approach. A pilot implementation gave confidence for a broader implementation in a new learning space customised to support team-based, technology mediated learning. The mission of the programme extended beyond social outreach to supporting and encouraging change in class-room practice in Irish schools through the development of a pragmatic learning model. The broader implementation commenced in 2008 and has continued since. The first three years of implementation as summarised in Table 3.5 provides data for this thesis. The programme and the learning model were both re-titled Bridge21 in 2011.

Chapter 4 - Methodology

4 Introduction

The work in this thesis centres firstly on the development and secondly on the testing of the Bridge21 learning model through an exercise in educational research. The work involved the design and refinement of the learning model and the testing of its effectiveness through consideration of its impact on students. To meet the challenge of delivering meaningful research in this work, consideration was given to a range of approaches before a research methodology was adopted. A factor in addressing the issue of research method was the challenge that the initial data instruments had been defined and the data gathering had started in advance of the author commencing work on this doctoral research in 2008. Valuable experience and data had been gathered and could not lightly be set aside. This influenced the choice of research methodology in that a research approach had substantively evolved before a formal research model had been settled.

It was evident in considering the development of the learning model, and phenomena to be explored through the attendant research questions that whatever method was adopted would have to be capable of addressing complex, context specific questions and be capable of assisting in the evolution and refinement of the model and theory. Additionally, the Bridge21 model is intended to be a useful contribution to educational practice and so our methodology must address and support consideration of practical considerations of implementation.

Bassey suggests three realms of educational research: empirical research, reflective research and creative research (Bassey, 1992). The third of these, creative research describes research that supports the development of novel solutions and the formulation of new ideas by systemic and critical enquiry and the development and testing of the Bridge21 model naturally fits in the creative realm.

Bassey also identifies a category of research worker that seeks to induce beneficial change through creating an understanding of a practical implementation and the author falls into this category of research worker that seeks to improve a practical situation.

4.1 Framing the Research

In the development of an educational approach or learning model it is important to reveal how and why things are happening in addition to what is happening (Creswell, 2013). Additionally, an appropriate framework is required to structure the research. The research in this thesis is bounded by three years of implementation in a specific location. Consequently, the chosen framework for the research is a single Case Study. What is considered the first phase of the work is an Exploratory Analysis Unit of the Case Study, rather than confirmatory with exploratory questions leading this phase of the research and confirmatory questions arising in the process of the investigation rather than in advance of implementation of the model (Nastasi et al, 2010). These confirmatory research questions guide the later Explanatory Analysis Unit of the Case Study.

4.2 The Researcher in the Research – Subjectivity and Reflexivity

The position of the researcher with respect to the research requires consideration and it is impossible to divorce the personality and beliefs of the researcher from the research. The researcher is potentially the greatest threat to trustworthiness of qualitative research (Poggenpoel & Myburgh, 2003). Additionally, bias management is a key challenge particularly in qualitative research where data is gathered from interviews (Chenail, 2011).

Countering this challenge to objectivity requires an acknowledgement of the phenomenon and a process and discipline of self-reflection. This process called reflexivity concerns an understanding of the influence on the research choices and analysis unconsciously exerted by the researcher stemming from his philosophical, social or other beliefs (Morrison, 2015).

In this thesis, reflexive consideration points to the particular position of the author as the designer of the model that is the major contribution of this work with deep personal convictions and experience in teamwork and in the constructivist theory of knowledge. Also, the author was the founding Director of the Bridge2College programme and the designer of the Bridge21 model. Given these facts, one must be cognisant of the potential for researcher bias to impact the work.

It is accepted then, that the choices made on research method and analysis are influenced by the perspective, beliefs and experience of the author. The role of qualitative and quantitative methods and how they are employed is a function of the author's prior belief's, experience and intent for the project.

Maintaining researcher objectivity, against evident personal belief in the method and the model is a challenge that must be recognised and understood. Strategies to deal with this and to provide and maintain integrity in the work include the author working as part of a team overseeing the research and providing for peer oversight. Apart from the discipline of reflexive consideration by the author, the objective attention of peer review in published contributions provides a measure of balance in the assessment of the research.

The focus group interviews were discussed with another researcher in advance of the interviews and a second researcher was present during the interviews. The interviews were semi-structured with the general run of questions determined in advance. A review was conducted with the research team after each interview to gain assurance of fairness, impartiality and truth.

4.3 Consideration of an Appropriate Research Method and Framework

4.3.1 Action Research

Action Research is a methodology where models and/or theory are developed through practitioners working collaboratively with other practioners by problem solving through in an interative cycle of incremental change (Denscombe, 2014). As a method Action Research is also associated with creative research (Bassey, 1992) and studies seeking novel parctical solutions.

At the heart of Action Research is the idea of involving practicioners as active participants integrally involved in research decision making rather than objects in the research and as Heron and Reason described: 'research with rather than on people' (Heron & Reason, 1986). In research involving second level students, teachers are usually the identified practioner's however the work in this thesis does not directly involve the classroom teachers and the author and the team working on the programme are in effect the practioners.

Action Research has as its objective delivering a practical solution to a particular problem rather than delivering a generisable model or theory and hence the focus on working with those who are at the coalface of dealing with the problem in consideration. It is notable that Friere posited a variant of Action Research, Participatory Action Research as a democratic and plualist approach to knowledge making with the student as a co-researcher as well as a co-learner with the teacher (Freire, 1982). This work on Bridge21 references Freire elsewhere in his commitment to the concept of the adoption of the co-learner as a path to liberation for both student and teacher (Lawlor, Marshall & Tangney, 2015a). The focus in Action Research to deliver a solution to a particular problem rather than the development of a generally applicable model suggests Action Research as a methodology is not fully aligned to what is required for the research in this work. A methodology is required that incorporates key aspects of Action Research but allows consideration of a theoretical basis with an intent to inform design and implementation of a generalisable theory and model. What could be described as the family of Action Research includes a branch more aligned to a general conribution to practice, referencing theory and research, to inform design and that is Design Based Research.

4.3.2 Design Based Research (DBR)

Design based research (DBR) is an approach to research focussed on evolving design principles for a theory or model through testing a series of interventions. Design based research has been identified as: "an important methodology for understanding how, when, and why educational innovations work in practice." (Design-Based Research Collective, 2003). DBR is in essence a method to build theory to improve practice (Anderson & Shattuck, 2012). An iterative cycle of design, implementation, analysis and adjustment leads to the formation of new theory (Design-Based Research Collective, 2003). Through this process, Design Based Research has a pragmatic goal to develop learning approaches through creating this synergy between theory and practice. Such research work is founded in a local context and corresoponds to local seetings, circumstance and timings (Design-Based Research Collective, 2003; Wang & Hannafin, 2005). The design-based research paradigm, one that advances design, research and practice concurrently, has been acknowledged to have considerable potential in educational contexts (Wang & Hannafin, 2005). Design Based Research typically embraces a mixed methods approach to facilitate a rich understanding of the results of an intervention and so contribute to design. It contrasts with Action Research in that the researcher seeks to inform practice rather than having the practitioner leading the research.

In summary DBR is a good candidate for work that seeks to design or explore new models for learning praxis that are supported by a strong underlying canon of literature.

In the work in this thesis, elements of a Design Based Research approach have been employed so as to facilitate the generation a new learning model - Bridge21 and the attendant theory that underpins it, however because the model and learning approach had substantively evolved before a formal research model had been settled on, a formal Design Based Research approach is not claimed for the work.

4.3.3 Mixed Methods

Mixed methods research (MMR) facilitates the combination of qualitative and quantitative viewpoints providing a depth of understanding and corroboration (Johnson et al, 2007). The requirement to deliver a picture of the what, why and how of a phenomenon and to provide data about user perceptions typically requires a mixed methods approach (Teddlie & Tashakkori, 2009).

Mixed method research now seen as a distinct methodology, is leading educational research internationally and is used by a growing community of scholars (Creswell & Plano Clark, 2011).

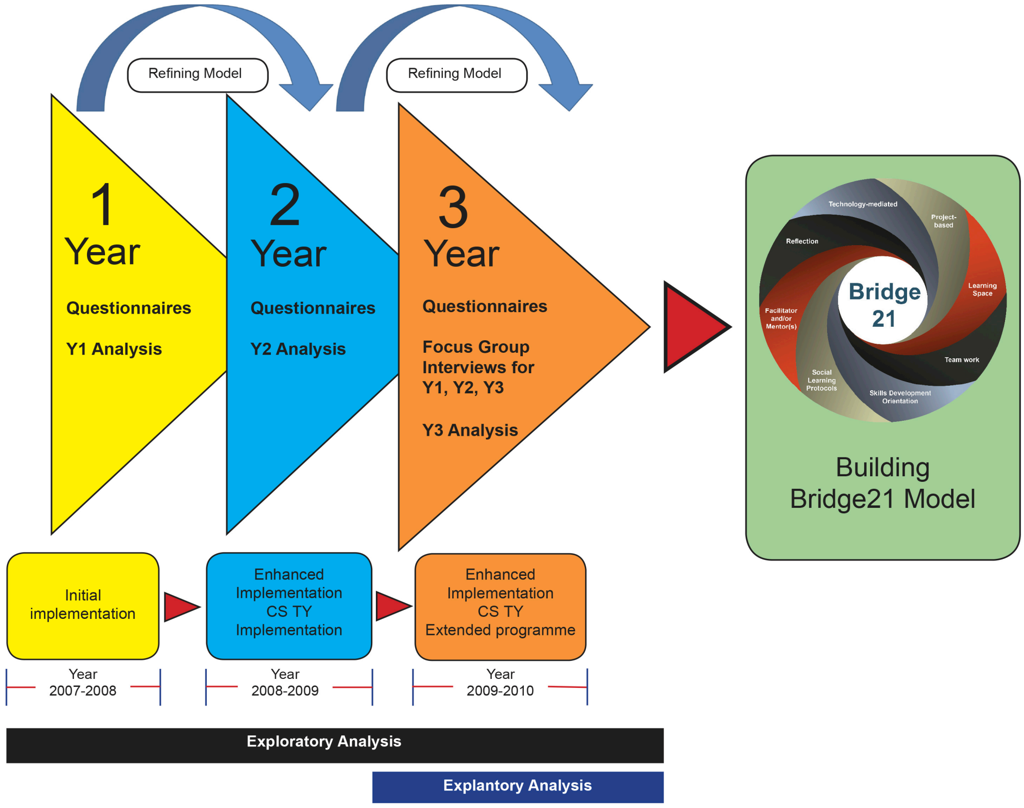
How mixed methods research can be applied offers a range of possible actions. The framework and the research design typology for such a mixed methods approach also required consideration.

A mixed method research methodology was adopted so as to provide a complete understanding of the emerging phenomenon and the mixed methods design was followed with an emphasis on a strongly qualitative approach with embedded quantitative data (QUAL-quan), (Creswell & Plano-Clark, 2011). Qualitative and quantitative approaches are mixed within and across two discrete stages of the research process in that the qualitative and quantitative data is integrated in both the data collection and data analysis processes. The essential purpose of mixed methods research is to integrate the quantitative and qualitative data to draw on the strengths of each and this was the author's intent in adopting an integrated mixed methods approach (Creswell & Plano-Clark, 2011).

4.3.4 Design Typology

Design typology describes phases or strands of research. The design can be mono-strand or multi-strand with either option capable of comprehending a conceptualisation-experiential-inferential process (Teddlie & Tashakkori, 2009). This work considers Bridge21 across three years of implementation (2007-2008, 2008-2009, 2009-2010) and is clearly a multi-strand implementation that requires a multi-strand research typology. This work required a framework to support a sequential mixed methods design across two analysis units of a Case Study (Teddlie & Tashakkori, 2009). The typology is defined by: the phases in the research process, the data types and relative lead and the stages of mixing of the data. The work presented in this thesis is based on a 3-stage process defined by 3 successive years (academic years) of the programme and the Design Typology as illustrated in Figure 4.1.

Figure 4.1 – The Research Design Typology



The three successive years of operation provided a platform to develop the model through reference to literature and the emerging findings from the research. The evolution of the model through this process will be presented in detail in Chapter 6. The research framework follows the abductive development of the Bridge21 model over the three years, referencing understood and accepted theory from literature and developing a set of principles and attendant theory to underpin the Bridge21 model. The research also probes effectiveness and impact of the educational model as it develops and evolves over the three years of operation. The work seeks to evaluate the distinguishing components of the Bridge21 model that contribute to its overall effectiveness. The research also explores the impact of the model on the young people who participate in various instantiations and implementations in each of the three years. Through this process the model is effectively a product of the research.

4.3.5 The Case Study

The Case Study approach provides a methodology that allows for a holistic and in-depth consideration of a phenomenon in a situation that is bounded temporally and spatially. A key strength of Case Study as an approach is its ability to comprehend context and the boundary between the case study and its context is unlikely to be sharply defined (Yin, 2013). The Case Study is concerned with revealing 'the how and why of a complex human situation' (Feagin, Orum, & Sjoberg, 1991; Yin, 2013; Tellis 1997; Creswell, 2013). Case studies generally utilise a mixed methods research methodology to address the phenomenon or intervention at hand. A Case Study requires the collection of data from a variety of sources over an extended time period. Within the temporal and spatial 'box' that defines a Case Study, Yin (Yin, 2013) suggests four potential situations for which case study may be suited:

1. To explain causal links in real-life interventions
2. To describe the intervention context
3. To describe the intervention
4. To explore situations where the intervention outcomes are unclear

Case study research has been categorised by Yin in four basic design types:

Type 1. Single-case, single-unit of analysis

Type 2. Single-case with embedded multiple units of analysis

Type 3. Multiple-case design with a single-unit of analysis

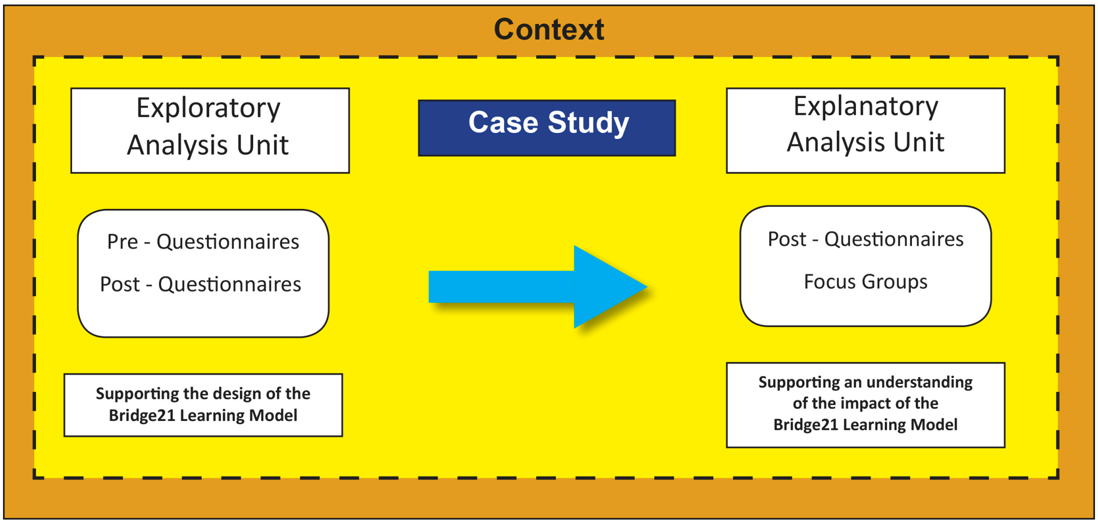
Type 4. Multiple-case design with embedded multiple units of analysis

(Yin, 2013).

The case study methodology can comprehend explanatory and exploratory orientations (Tellis, 1997). An exploratory orientation for a Case Study prepares the ground for future research and surfaces questions for deeper consideration and so can provide a narrative or description of the problem under consideration. An explanatory orientation for a Case Study is aimed at producing an explanation of the phenomenon concerned and goes beyond narrative or description (Bromley 1986, Creswell, 2013).

This work features a single case study but with two embedded units of analysis or Type 2 as defined by Yin. This is because the case is clearly bounded by the years of implementation and the common context. The analysis units share a common data set from the Post-Questionnaires with the focus group data augmenting for the Explanatory Analysis Unit. The embedded units are the Exploratory Analysis Unit and the Explanatory Analysis Unit. The Exploratory and Explanatory embedded units of analysis are employed in sequential phases. The Exploratory unit relies on pre and post-activity questionnaires to deliver qualitative and quantitative data that reveals aspects of the phenomenon of Bridge21 and prompts questions that are addressed in the Explanatory Unit of the Case Study, which in turn draws on focus group interviews and a second pass analysis of post- activity questionnaires to gain a deeper understanding of 'how' and 'what' is happening. Figure 4.2 summarises the use of the two case study approaches as embedded units of a single Case Study.

Figure 4.2 A Combination of Two Embedded Units within the Case Study



4.3.6 Pragmatic Research Paradigm and an Abductive Approach

A pragmatic research approach focuses on actions and consequences. Pragmatism relies on what is practical and works best in answering research questions where particular reference to the context in which the research is situated is important (Feilzer, 2010). As a philosophy and as a research paradigm, pragmatism is practical and practicable. Pragmatism is a research paradigm commonly associated with mixed methods research (Nastasi et al., 2010). Indeed, pragmatism has been proffered as a specific justification for combining qualitative and quantitative methods (Johnson & Onwuegbuzie, 2004).

Doing mixed methods research pragmatically is a strategy to exploit the data flexibly to explore the phenomenon being studied. A pragmatic approach in the context of exploratory research has been described as a commitment to uncertainty with a responsibility on the researcher to be curious and adaptable (Feilzer, 2010). Pragmatism is focussed on the problem at hand and employs what is available to explore the problem and to build knowledge about it. It is not a pursuit of proof but rather a pursuit of what is useful (Rorty, 1999). Pragmatism allows the use of deductive and inductive reasoning referred to as an abductive process (Creswell, 2013). Pragmatism is also associated with a continuous cycle of abductive reasoning. Abductive reasoning denotes a reasoning process where logical connection is made by a researcher between data and theory (Teddlie & Tashakkori, 2012). Morgan describes it thus: 'in abduction researchers move back and forth between induction and deduction-first converting observations into theories and then assessing these theories through action' (Morgan, 2007). The approach taken in this work could be described as abductive in that just such logical connection is made between the theory as surfaced in the literature that influences the design of Bridge21 and the data arising from the implementation of the Bridge21 model (Teddlie & Tashakkori, 2012).

The reliance on substantive theory in the literature to support design of the model and its implementation in a real context is an accepted paradigm of post-positivism and constructivism (Nastasi et al., 2010). This interplay between substantive accepted theory and emerging data is abductive and is essentially a pragmatic research paradigm (Feilzer, 2010; Morgan, 2007).

4.3.7 Summary of Research Method of Choice

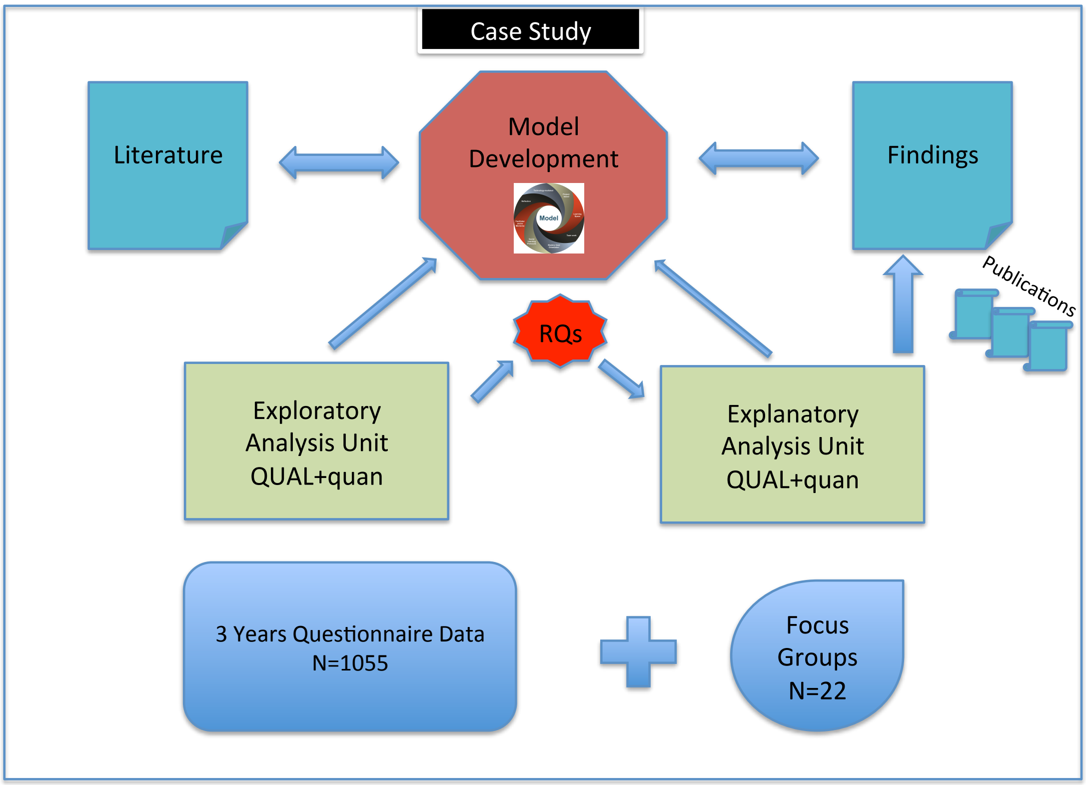
Given the foregoing considerations, the research method of choice may be summarised as a pragmatic and abductive approach referencing accepted theory from literature to support the design and development of a new learning model. Elements of a Design Based Research approach have been employed so as to facilitate the generation the new learning model. The approach relies on a pragmatic, mixed methods strategy, to informing an integrated Exploratory and Explanatory Case Study.

The Exploratory Unit of Analysis seeks to inform the design of the Bridge21 model and the Explanatory Unit of Analysis seeks to understand and examine the credentials of Bridge21 as a candidate learning model for 21C Learning. Table 4.1 and Figure 4.3 provide a schematic and attendant table describing the overall research process employed.

Table 4.1 Summarising the Overall Research Process

Research Element	Description/Purpose
Case Study Exploratory Analysis Unit	Inform the design of the Bridge21 model and prompt research questions for Explanatory Analysis Unit
1st Analysis Qual+quan	Summative content based qualitative analysis supported by quantitative analysis of Pre and Post Questionnaires
3 Years Questionnaire Data	Pre and Post questionnaires with open questions and Likert style questions
Informed Pragmatic Abductive Research	Moving from intuitive design to evidence and literature supported design
Research Questions	Questions probing the efficacy of Bridge21 as prompted by the Exploratory Analysis Unit
Literature	Literature informing the design elements of the Bridge21 model through abductive reference
Case Study Explanatory Analysis Unit	Seeks a deeper understanding of ‘how’ and ‘what’ is happening with the Bridge21 model
Focus Groups	Interviews with groups of students at a remove of 6 months to 18 months to probe residual student attitudes
2nd Analysis Qual+quan	Directed thematic qualitative analysis of Post Questionnaires and Focus Group transcripts combined with abductive reference to literature and supported by quantitative data
Findings	Results from Case Study
Publications	Peer reviewed publications arising from the work

Figure 4.3 Summarising the Overall Research Process



4.4 Data Collection and Analysis Methods

The data collection process was sequential with the questionnaires administered in conjunction with the workshops (pre and post). The focus group interviews were conducted at a time interval of between 6 months and 3 years after the engagement thus allowing consideration of the sustained impact of the experience on the participants. The pragmatic approach of the research model allows the exploration of the experience of the participants from multiple perspectives to provide for a more complete understanding of the research (Teddlie & Tashakkori, 2009; Teddlie & Tashakkori, 2012). Table 4.2 summarises the various data sources accessed in the study.

Table 4.2 Data Sources

Year	Data Source(s)	Participants	Number
2007-08	1. Post Questionnaire	TY students	N= 280
2008-09	1. Pre Questionnaire 2. Post Questionnaire	TY students	N= 350
2009-10	1. Pre Questionnaire 2. Post Questionnaire	TY students	N= 425
	1. Focus Group interviews	Students from 09-10, 08-09 & 07-08	N=22 (from 5 schools)

4.4.1 Quantitative Data Collection

Pre-Questionnaires – Quantitative Data

Pre-Questionnaires (pre-activity) were administered at the commencement of each workshop and Post-Questionnaires (post-activity) at the close 3.5 days later. The pre-activity questionnaires utilising Likert scales were focused on building a profile of the participant cohort and in particular: academic profile, use of computers, attitude to computers, use of social media, attitudes to Third level education and attitudes to computer science. The Likert scales yielded a body of quantitative data.

Post-Questionnaires – Quantitative Data

The Post-Questionnaires (post-activity) featured a Likert question set addressing: attitude to Third level, attitude to team working and learning in a team, attitude to education, confidence using technology, making friends, communications skills and sense of independence. These questions reflected the original mission of the programme in respect of promoting access to third level and the interest of the author in exploring the potential of team-based learning with technology. The Likert scales yielded a body of quantitative data. The questionnaires employed are provided in the appendices.

4.4.2 Qualitative Data Collection

Open questions in the Post-Questionnaires (post-activity) and from Focus Groups yielded qualitative data.

Post-Questionnaires – Qualitative Data

The Post-Questionnaires (post-activity) featured open questions as follows:

Q1. Overall, how would you rate your experience?

Q2. Things I learned about myself?

Q3. Things I learned about college?

The reasons that these open questions were included was as follows:

Q1. To gain qualitative data on how the participants viewed their experience with the programme.

Q2. To encourage the participants to reflect metacognitively and to consider and comment on their learning within a learning context that is “grounded in metacognition” (Tanner, 2012). In other words, we create a learning environment that confronts students with a personal consideration of how they have learned and what they learned and seeks to capture that consideration (Tanner, 2012).

Q3. To gain qualitative data on the participants’ perceptions of third level in serving the social outreach/access agenda and also to consider the potential change in the participants’ educational horizons.

Focus Group Interviews

Focus group is an effective methodology to create an interaction to generate a conversation among a small group, ideally between 4 and 8 participants. Focus groups are particularly useful in reviewing an experience with participants and exploring not only what people think but also how they think and why they think that way. The output of a focus group is potentially more than the sum of the parts due to the phenomenon of interaction where the participants both query and explain themselves to each other. The key strength of focus groups is in providing insight into complex behaviours and motivations (Krueger et al, 2000).

The group situation also allows the researcher to avail of the richness in data revealed in various colloquial dimensions of communications commonly used between people such as interaction, humour, anecdotes and argument (Kitzinger, 1995). An additional strength of focus groups is the facility for the researcher to stimulate comparisons between the participants on their experiences and views (Morgan, 1996).

It has been posited that the conversation analogy is less appropriate than that of a meeting (Agar & MacDonald, 1995; Saferstein, 1995). Kitzinger defines focus groups succinctly thus: "Focus groups are a form of group interview that capitalises on communication between research participants in order to generate data" (Kitzinger, 1995). However, this does not acknowledge the key role of the researcher or moderator. The essential elements of the focus group technique are captured in Morgan's definition: "Focus groups is a research technique that collects data on a topic determined by the researcher" (Morgan, 1996). The effectiveness of the technique hinges on care in the research design to comprehend the role of the group in producing interaction and the role of the moderator in guiding this interaction. The role of the researcher acting as focus group moderator is very vital (Morgan, 1996). Ensuring the participants feel at ease and comfortable with an open conversation on the topic at hand with the group of people is a crucial responsibility of the moderator. Focus groups involve a process of mutual self- disclosure and so must be moderated sensitively (Morgan, 1996). Attention to how the focus group is set-up is also important if it is to be effective in delivering useful data. The moderator must have regard to comfort of the participants, whether they are relaxed and not stressed or tired and the ergonomics of the meeting area must be considered.

It is important to acknowledge that the presence and contribution of the moderator is not benign and is necessarily intrusive in the group interaction in either a constructive or disruptive respect (Saferstein, 1995).

The focus group has been found to be effective as a technique in following-up and interpreting results from prior survey data (Morgan, 1996). Surveys are inherently constrained by the static nature of the questions posed. Focus groups can provide a dynamic tool to explore how the survey respondents feel about the topics surfaced in the survey (Morgan, 1996).

Focus groups were chosen as a research instrument in this work based on the foregoing, and also significantly for their alignment and resonance with the model that they were being employed to study. The participants had experienced Bridge21 in teams and so the focus group research method presents as intuitively appropriate as a technique to attempt to reveal and understand their experience.

The focus groups in this work represent the academic years 2007-2008, 2008-2009 and 2009-2010. The focus group interviews were semi-structured and conducted with 8 groups of students from 5 schools spanning 3 years of the programme and were conducted over a two-week period. The issues explored in the focus groups were prompted by responses to open questions on the experience yielded by the post-activity questionnaires. The focus group prompting questions were conversational so as to encourage an informal environment and to encourage participants to engage in conversation in response (Krueger et al., 2000).

The prompting questions were designed to get the participants to talk about and rate their experience with Bridge21 and to reference the experience with Bridge21 against their school learning experience and also to identify changes in their attitude and perspective on learning, or the development of lasting skills. This formulation of questions was designed to surface the views of the participants on the impact on them of the engagement with Bridge21 so as to inform an assessment of the effectiveness of the learning model.

Examples of the questions include:

- *What did you think was good about your experience at Bridge21?*
- *What did you think was bad about the programme? Can you think of anything that was a downer or anything that you didn't like about it?*
- *You say you learned from each other, can you explain that?*

- *Is that different from the way you would usually learn in school? Tell me why it's different.*
- *Is that anything to do with what you experienced in Bridge21 or do you think you're just getting more mature anyway?*
- *Can you talk to me a little bit about how you look at your personal learning?*
- *Did Bridge21 play any part in terms of you looking at the way you learned that personal sense of responsibility, did it play any part in that? Or were you getting there anyway?*
- *Can you think of things that you did subsequently, either in school or out of school, where you used the skills that you would have picked up through that week, the ones you've mentioned?*

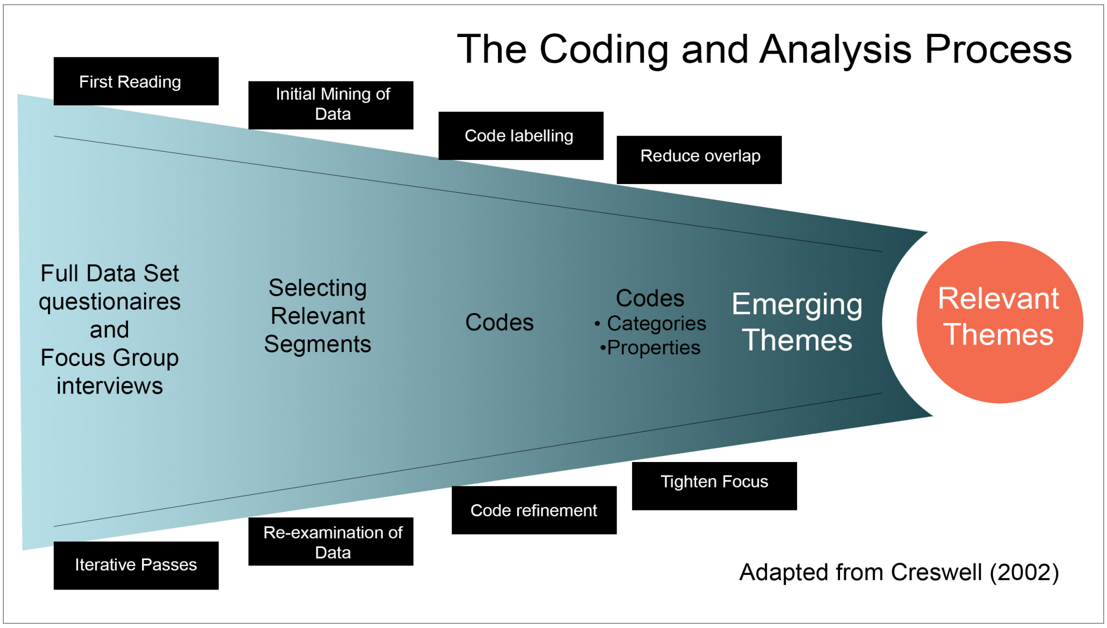
4.4.3 Quantitative Data Analysis

Likert style questions in the post-activity questionnaire provided quantitative data that were coded for analysis. In particular, frequency distributions were obtained for the Likert-style items. Pearson correlations between these items were calculated, and the potential of these items for forming scales was investigated using the Cronbach Alpha coefficient of reliability to determine internal consistency.

4.4.4 Qualitative Data Analysis

Qualitative data was abstracted from Post-Questionnaires (post-activity) and from Focus Groups. The data from both of these sources was analysed in parallel and amalgamated. The data was broken into manageable segments and a first pass of code labels were applied using content analysis, consistent with a conceptual ordering. This process yielded a set of codes that were filtered and refined to select those most relevant to addressing the research questions. These codes were then grouped in categories. The categories suggested themes from the data. This process of consideration and interrogation of the data and assignment and refinement of codes was applied iteratively with successive passes of the data, both focus group transcripts and open questions from post-questionnaires, repeatedly re-examined to identify indicators from the literature relevant to the emerging themes until finally a subset of themes relevant to the research questions were surfaced (Creswell, 2002). This process is summarised in Figure 4.4 below.

Figure 4.4 - The Coding and Analysis Process



Content Analysis

In this work, qualitative content analysis is employed to analyse data from questionnaires and focus group transcripts.

Content analysis has been generally defined as a systematic analysis technique either manual or technology supported for reducing text to a set of content categories based on a defined set of coding rules (Stemler, 2001). Content analysis provides a basis for making inferences from texts to the context within which the text is created (Krippendorff, 2004). This systematic contextualised analysis of text has as its goal the support of valid and trustworthy inferences.

Quantitative content analysis refers to the counting of occurrences of particular codes in text. Qualitative content analysis seeks meanings, themes and patterns in text (Schreier, 2014). Each of these techniques has been employed sequentially in this work, firstly quantitative content analysis followed by qualitative content analysis.

Hsieh and Shannon suggest three distinct approaches to content analysis with each taking a different path to interpreting meaning from text data:

1. Conventional, where content categories are derived from text data.
2. Directed, where analysis works from theory or previous findings
3. Summative, involving a process of counting and comparison based on keywords and then reference to the underlying context.

(Hsieh & Shannon, 2005).

This work draws on all three approaches to content analysis to derive the inferences and themes for building an understanding of Bridge21.

- The conventional approach was used to allow themes to emerge from the data without reference to prior theory and provided a base to allow the summative approach to address emergent topics and themes.
- The summative approach was used to support the Exploratory Analysis of the case study in testing the hypotheses and theories underpinning Bridge21 and to explore early results of the practical implementation of the model.
- The directed approach was utilised to support the abductive process of working back and forth from theory to data in addressing the research questions related to intrinsic student motivation and team-based learning in the Explanatory Analysis Unit of the case study.

Use of Software in Data Analysis

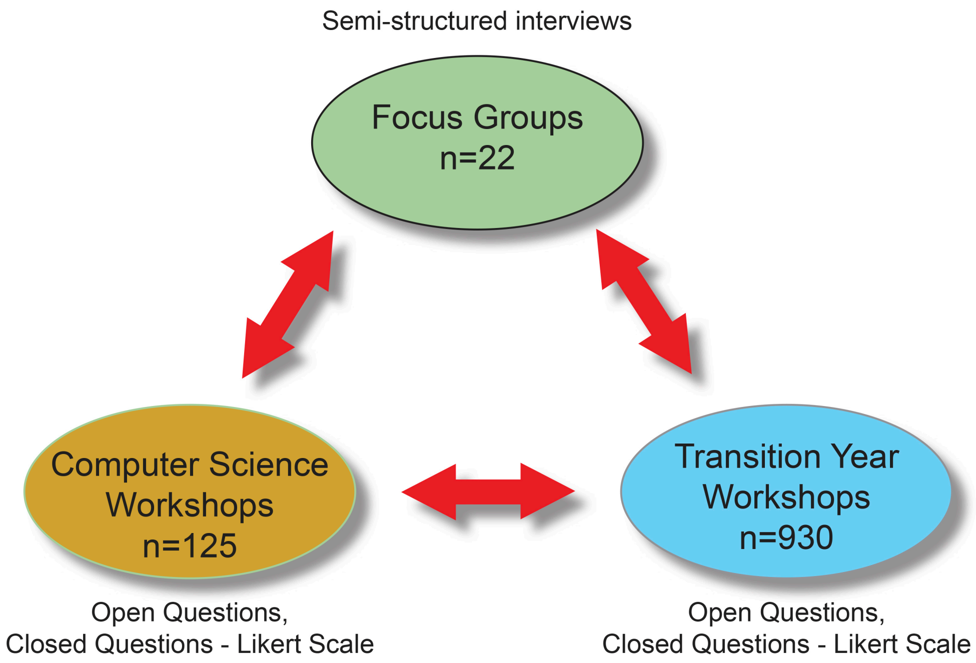
The qualitative analysis process was supported with nVivo8 Computer Aided Qualitative Data Analysis Software (CAQDAS). nVivo facilitated the creation of code labelling and the assignment of instances from text to particular codes. This allowed an open coding approach in the first pass followed by a subsequent directed coding pass.

The quantitative analysis was supported by the SPSS statistical analysis package providing correlation and reliability testing.

4.5 Triangulation for Validation of Data

Triangulation facilitates the validation of results through cross verification from multiple sources: at different times, in different places or from different people (Flick, 2004). The data informing this study is gathered from different cohorts of students across three different academic years and in the context of workshops with different curricular content (Computer Science Workshops and Transition Year Workshops) with questionnaires applied contemporaneously with the workshops and focus groups applied at a time remove (6-18 months) after participation.

Figure 4.5 Triangulation for Validation of Data



4.6 Generalisability of Findings

Determining whether the findings in research are generalisable is a significant threshold to cross in establishing theory based on that research. This work does not, on its own, purport to establish or declare a theory. However, it does seek to contribute to the body of theory around team-based learning, student motivation, learner responsibility, 21C Learning and to present a model that may be employed in other constructivist interventions in learning, both in formal and non-formal contexts and opens up avenues for further research in implementing the model in such particular contexts. In this way, the work lays claim to generalisability. To advance such claims of generalisability reliant on a single case study could be problematic, however it can be argued that if the research is sufficiently comprehensive in examining the phenomena evident in the case study, then the conclusions based on examination of the case study unit may speak validly to the broader domain to which the case study is relevant (Cohen et al., 2007).

This research features a study of integrated exploratory and explanatory analysis units of the Case Study examined as framed in three successive years of implementation with 1055 students. The depth and extent of this work lends weight to its claim in generalisability. Additionally, the fact that this work is building on previously established and accepted theory from literature, improves confidence in the generalisability of the results (Yin, 2015).

There is an acknowledged uncertainty in generalising results from case study research. However, it has been argued as overly positivist to deny generalisability in case studies in educational research where a practical solution has been arrived at against a complex set of variables (Bassey, 2001). Educational researchers typically have the problem that there are many variables in the case in question and the best that may be claimed is that in similar circumstances, similar results may arise. This is consistent with the concept of 'fuzzy logic' – X may produce Y. This fuzzy generalisation or prediction was identified by Bassey as a way of generalising the results of educational research (Bassey, 2001).

The author points to relevant parallel research by other researchers employing the Bridge21 model in other learning contexts to lend weight to its claim for generalisability of the findings and supporting the more general efficacy of the model developed and the theoretical contribution (Conneely, Girvan & Tangney, 2012; Conneely, et al., 2013; Sullivan, Marshall & Tangney, 2015; Byrne, Fisher & Tangney, 2015b; Bray & O'Donovan, 2015).

4.7 Ethics Consideration and Compliance

The research approach and method in this study complies with the ethical requirements of Trinity College Dublin and its school of Computer Science and Statistics. The research permission was obtained under the umbrella of the Bridge2College programme and student and parental permission was obtained for participation both in the workshops and in the attendant research. Permission was also obtained from the principal of each participating school. All participant contributions were anonymised to protect identity. The selection of students for participation in focus groups was made on an opportunistic basis by the year head in each school.

4.8 Summary of Methodology

The research methodology in this work is adopted firstly to explore the phenomenon emerging in the process of the design and development of a new learning model and then to examine the efficacy of the model. A pragmatic mixed methods strategy with a strongly qualitative lead was applied to inform an integrated Exploratory and Explanatory Case Study. The research is of significant scale, comprehending three successive years of implementation with a total of 1055 participants, to allow a credible claim for the veracity of the findings. The application of focus groups at a significant time remove from the participant experience of the workshops lends insight to the effectiveness and lasting impact of the model.

Chapter 5 - Analysis of Data

5 Analysis

The implementation of the Bridge21 model as described in Chapter 3 provided a research opportunity through the eyes and experience of the participants.

Chapter 4 described the methodology that underpins the research and the relationship between the design of the model and the research that sought to assist its design through a single case study with two embedded units of analysis named the Exploratory Analysis Unit and the Explanatory Analysis Unit (Yin, 2013).

The Exploratory Analysis Unit informs the design of the Bridge21 model and the Explanatory Unit through consideration of participant experience seeks evidence of Bridge21's credentials as a candidate model for 21C Learning. The Explanatory Analysis Unit follows the Exploratory Analysis Unit and re-examines the data emerging from the questionnaires with the addition and integration of data from a series of post-activity focus groups and seeks evidence through consideration of participant reflection on their experience, to address research questions framed to challenge the credentials of Bridge21 as a candidate model for 21st Century learning.

The Exploratory Analysis Unit seeks to inform the design and development of the model and its impacting elements through examining data from pre and post-activity questionnaires and also identifies relevant research areas/questions for consideration in the Explanatory Analysis Unit.

This chapter examines, analyses and presents the data gathered through the first three years of implementation of the Bridge21 model, from data instruments including pre-activity questionnaires, post-activity questionnaires and focus groups.

Both analysis units in the case study are supported by mixed methods approaches with a qualitative data lead supported by quantitative data (Qual+quan).

Research Questions

The research questions addressed and explored in this thesis examine the effectiveness of Bridge21 in lifting student motivation, its effectiveness as a model of team-based technology mediated learning and the validity of Bridge21 as a model for 21^{st} Century Learning. Consequently, the research questions are as follows:

RQ: What are the credentials of Bridge21 as a candidate model for 21st Century Learning?

> **Sub-RQ (a):** What is the effectiveness of the model in encouraging intrinsic student motivation?
>
> **Sub-RQ (b):** What is the effectiveness of the model in facilitating team-based, technology mediated learning?

5.1 Circumstances and Context of Student Participation

It is appropriate that the circumstances and context of the participation of the students in the programme should be noted as these influence the responses of the participants in respect of their experience. The students took part in Bridge21 during school time but in an out-of-school location and in a particularly stimulating environment and context. Being out of school was in itself a disruptive factor and would have affected motivation and attitude. Placing them in teams not of their choosing and with other students that they did not know was a challenge to them and took them out of their comfort zone. They were asked to choose and work with a team leader from among their peers and which was generally a new experience and additionally the heavily team-structured emphasis was bound to significantly impact on their experience and their consequent responses. The application of focus group interviews, at a significant time remove (6 months to 18 months) from their participation, as part of the Explanatory Analysis Unit of the Case Study was a measure to mitigate the effect of emotional immediacy on results as seen in responses from the post activity questionnaires.

In summary, the participant encounter with Bridge21 represented a unique learning encounter for the students participating and a different frame of reference for their learning from any previous experience of theirs. The intervention stands alone as do their reactions to their experience and so comparison with more formal or school based learning is facile.

5.2 Exploratory Analysis Unit of the Case Study

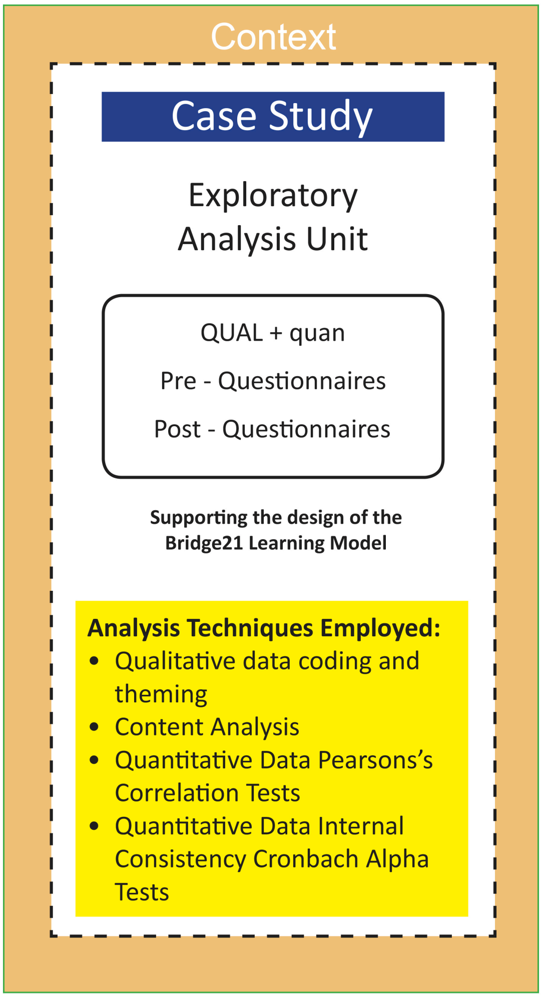
The initial design and deployment of the model was in part intuitive and informed by the experience of the author and literature in the field. The purpose of the Exploratory Analysis Unit of the Case Study (Figure 5.1) is to reveal aspects of the experiential phenomenon of participants in large scale learning interventions applying the Bridge21 model and to assist in the design definition and refinement of the model. The identified objectives for this unit of the case study are therefore:

a. Surface significant themes emergent from the implementation of the model and identify issues and themes that could be further explored in the Explanatory Analysis Unit of the Case Study.

b. Inform the design and evolution of the Bridge21 model.

This unit of the case study relies on pre and post-activity questionnaires to deliver qualitative and quantitative data so that the contributing elements of the model may be explored. The analysis techniques applied include: Qualitative data coding and theming, Qualitative content analysis, Quantitative Pearson's correlation and Cronbach Alpha consistency tests (Bonett & Wright, 2015).

Figure 5.1 Exploratory Analysis Unit of the Case Study



5.2.1 Workshop Interventions

The Exploratory Unit of the Case Study for Bridge21 was implemented with reference to a series of workshops, as described in Chapter 3, conducted with 1055 second level students in weekly cohorts of 25 young people, aged 15 to 17 years, from three consecutive academic years of implementation of the model during school time in a specially designed out of school learning environment.

5.2.2 Data Sources Supporting the Exploratory Analysis Unit of the Case Study

The data sources supporting the Exploratory Analysis Unit of the Case Study are pre-activity questionnaires (n= 285) from the first year of implementation and post-activity questionnaires (N=1055) drawn from three years of implementation of the model as summarised in Table 5.1 below. These instruments may be seen in

Appendix 1. The pre-activity questionnaire was used for general profiling purposes was administered at the beginning of the workshop as part of the participant induction process and before the students had engaged in the workshop activities. The first year of data was considered in this study to inform a general profile of the student cohort. The post-activity questionnaire was administered four days later at the conclusion of the workshop and as part of the reflection process before the participants left the Bridge21 environment.

Table 5.1 Data Sources for Exploratory Unit of Case Study

Student Pre Questionnaire	Students Post Questionnaire	Students Post Questionnaire	Students Post Questionnaire
Students 07/08 n=280	Students 07/08 n = 280	Students 08/09 n =350	Students 09/10 n = 425

5.2.3 Pre-Activity Data Analysis – Team Based Learning Experience

In order to gain a sense of what prior understanding of teamwork, which the participants brought to the experience of Bridge21 model, the pre-activity questionnaire featured a question to probe previous participant experience of team working in either formal or non-formal learning contexts. Table 5.2 summarises responses from participants in one academic year (2007-2008, n=280). It should be noted that some respondents cited membership and/or team experience in multiple organisations or contexts. This set of responses will be considered when exploring the participants' responses to teamwork as experienced in the implementation of the Bridge21 model. It is notable that a minority (38%) cited a team experience in school and that sport featured strongly (56%) in their previous team experience. Those participants citing team experience in Scouts or Guides (10%) is high when considered against the percentage of the relevant (6 years-16 years) youth population (cf. 5.35%- Source Scouting Ireland) that are members of these organisations. This could be explained by the fact the young people in this study are from urban areas, which would have higher youth participation in Scouts and Guides. It does suggest that a high proportion of those that have experience of Scouts and Guides identify it as a team-based activity.

Table 5.2 Team Experience Pre-Activity Questionnaire (2007-2008, n=280)

Q: What is your previous experience of working in a team?

Activity	Total	Percentage
Drama	5	2%
School	107	38%
Scouts/Guides	29	10%
Sport	158	56%
Youth Club	74	26%
Dancing	11	4%
St John's/Order of Malta	5	2%
Music/Choir/Band	4	1%
None	17	6%

It should be noted that a total of 393 responses indicates multiple reported experieces of teams by participants.

5.2.4 Pre-Activity Data Analysis – Propensity to Seek Third Level Learning

The primary original motivation for the Bridge to College programme, within which the Bridge21 model was developed, was to encourage second level students from schools in areas of disadvantage to access Third level education. For this reason, the pre-activity questionnaire featured a question to probe participant attitude to going to third level college or university. The results are summarised in Table 5.3 for a single academic year (2007-2008, n=280)

Table 5.3 Pre-Activity Participant Inclination to Third Level (2007-2008, n= 280)

Q: How important is it to you to go to Third level after school?

Very Important	Important	Slightly Important	Not Important
128	105	36	11
46%	38%	13%	4%

This set of responses and the participant post activity propensity to go to college will be considered when exploring the participants' attitude to educational horizons, motivation and propensity to access third level college or university after their engagement with Bridge21.

5.2.5 Treatment of Post Activity Qualitative Data – Coding and Theming

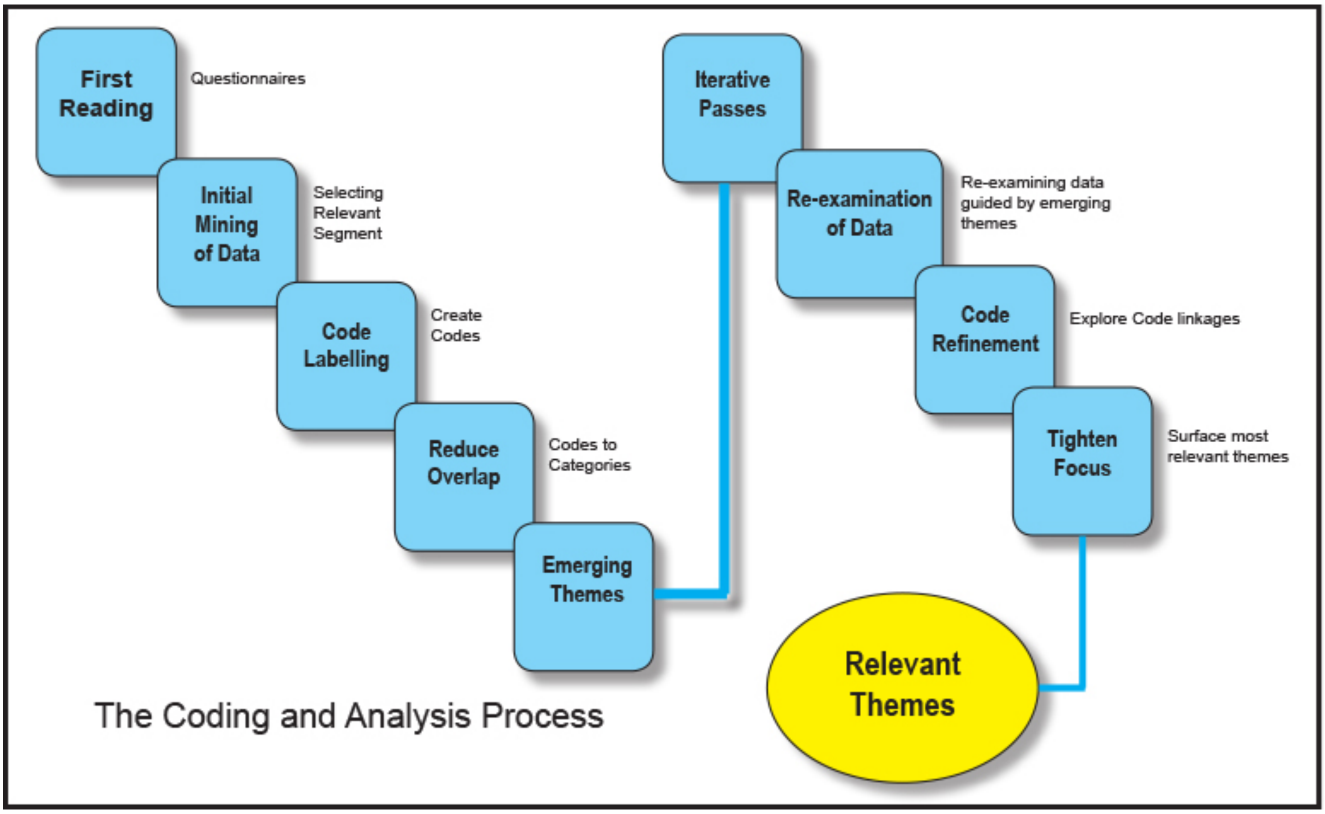
Data from the questionnaires were analysed through a process, as detailed in Chapter 4, of open coding based on conceptual labels (Strauss & Corbin, 1998) followed by categorisation and theming (Creswell, 2002). The data texts were broken into manageable segments and a first pass of code labels were applied consistent with a conceptual ordering. This process yielded a set of codes that were filtered and refined to select those most relevant.

5.2.6 Treatment of Post-Activity Qualitative Data - Content Analysis

The Exploratory Analysis Unit of the Case Study was intended to guide the development of the Bridge21 model, to test the initial hypotheses and to explore the results of the practical implementation of the theories on which the model is based. Systematic content analysis techniques as described in Chapter 4 were applied to consider the Post-Activity Qualitative Data in support of this unit of the case study. Initially conventional content analysis was applied deriving codes and code categories directly from the text. Summative content analysis was subsequently applied to data (N=1055) from the post-activity questionnaires through counting occurrences of keywords and text instances matching particular codes and these were counted to provide weight and meaning to the patterns emerging and to facilitate an interpretation of the underlying context.

The codes were classified in categories and sub-categories. Table 5.4 below summarises the outputs of this process. This process of consideration and interrogation of the data and assignment and refinement of codes was applied iteratively with the data repeatedly re-examined to identify indicators relevant to the emerging themes until finally a subset of themes most relevant to the research was surfaced (Creswell, 2002).

Figure 5.2 Coding and Analysis



5.2.7 Content Analysis - Themes Revealed in Exploratory Analysis of the Case Study

The Exploratory Analysis Unit of the Case Study sought to guide the development of the Bridge21 model and to test the theories on which it is based through a practical implementation that would reveal an initial set of themes to guide the further development of the model and to surface questions that might usefully be explored in the Explanatory Analysis Unit of the Case Study.

Table 5.4 Summary Outputs of Content Analysis (N=1055)

	Codes	Occurrences	Category	Sub-Category
1.	Personal Ability	n=383	On a Learning Journey	1. I can do more 2. Technical Skills 3. General Skills
2.	Teamwork	n=333	Working with Others	1. Liking Teamwork 2. Disliking Teamwork 3. Interesting about Teamwork
3.	Personal Development	n=34	On a Learning Journey	1. Proved to myself 2. Getting more mature
4.	Team Leader	n=46	Working with Others	1. Me as a team leader 2. Picking a leader 3. How a team leader works
5.	It's about me	n=6	On a Learning Journey	1. It's up to yourself 2. It's changed me
6.	Peer Learning	n=61	Working with Others	1. Peer to peer versus teacher to student 2. More expert other
7.	People Positive	n=77	1. Social Learning 2. Working with Others	1. Helping others 2. Being helped by others 3. Learning together
8.	Meta-Cognitive Reflection	n=100	On a Learning Journey	1. Generalised thinking about learning 2. Personalised thinking about learning
9.	Compare to School	n=14	Showing Personal Insight	1. Positive comparisons 2. Negative Comparisons 3. General observations
10.	Making Friends	n=14	2. Social Learning 2. Working with Others	1. Learning as fun 2. Learning Together
11.	Technical Learning	n=42	On a Learning Journey	1. Personalised thinking about learning
12.	Fun Way to Learn	n=12	1. Social Learning 2. On a Learning Journey	1. Generalised thinking about learning 2. Personalised thinking about learning

The qualitative analysis process was supported with nVivo8 Computer Aided Qualitative Data Analysis Software (CAQDAS). Figure 5.2 summarises the coding and analysis process employed.

The themes revealed in the Exploratory Analysis Unit of the Case Study that would inform the Explanatory Analysis Unit are summarised in Table 5.5:

Table 5.5 Themes Emergent in Exploratory Unit of the Case Study

	Theme
1.	An increased sense of personal responsibility for learning and improved propensity to self-directed learning
2.	An improved attitude to technology and its place in their learning
3.	A positive response to the team experience and its role in their learning
4.	Improved intrinsic student motivation
5.	Skills transference to the school and other learning contexts
6.	A personally perceived gain in confidence

These themes also informed the research questions that guide the Explanatory Analysis Unit in testing the efficacy of the model.

What follows in the Explanatory Analysis Unit is a re-analysing of data as a result of thematic analysis in the Exploratory Analysis Unit with the augmentation of the data set from the focus groups.

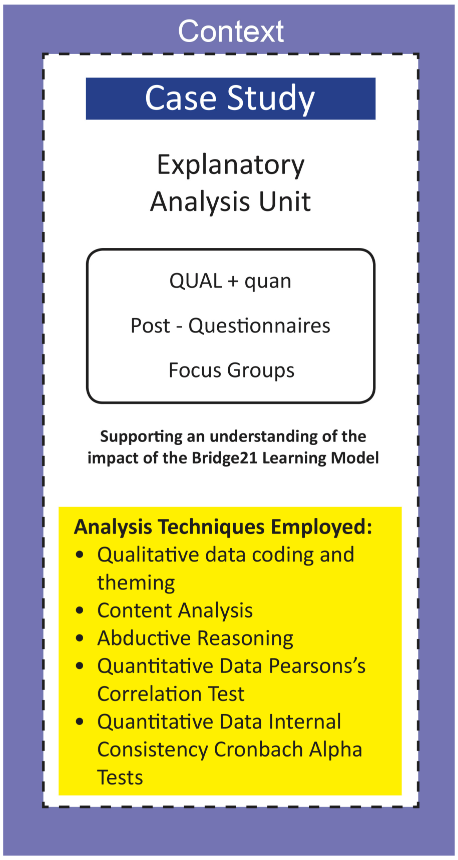
5.3 Explanatory Analysis Unit Case Study

The purpose of the Explanatory Analysis Unit of the Case Study (Figure 5.3) is to examine the effects of the model on participants and to seek evidence of Bridge21's credentials as a candidate model for 21C Learning. This case study relies on a re-analysis of post-activity questionnaires and the parallel analysis of focus group interview transcripts to deliver qualitative and quantitative data so that the effects of the Bridge21 model on participants may be explored and particularly to address the research questions:

RQ: What are the credentials of Bridge21 as a candidate model for 21st Century Learning?

> **Sub-RQ (a):** What is the effectiveness of the model in encouraging intrinsic student motivation?
>
> **Sub-RQ (b):** What is the effectiveness of the model in facilitating team-based, technology mediated learning?

Figure 5.3 Explanatory Analysis Unit of Case Study



5.3.1 Workshops and Focus Groups

The Explanatory Analysis Unit of the Case study was implemented with reference to a series of workshops, as described in Chapter 3 over a single academic academic year (09-10) supported by a series of focus groups conducted at an interval of between six and eighteen month after participation.

5.3.2 Data Sources Supporting the Explanatory Unit of the Case Study

The data sources supporting the Explanatory Case Study are pre-activity (N=425) and post- activity questionnaires (N=425) for a single year (09/10) of implementation and Focus Groups (N=22) drawn from three years of implementation (07/08, 08/09, 09/10) of the model as summarised in Table 5.6 below. The pre-activity questionnaire was administered at the beginning of the workshop as part of the participant induction process and before the students had engaged in the activities of Bridge21. The post-activity questionnaire was administered four days later at the conclusion of the workshop and as part of the reflection process before the participants left the Bridge21 environment.

A sample from a focus group transcript may be seen in Appendix 2.

Table 5.6 Data Sources for Explanatory Unit of the Case Study

Student Pre-Questionnaire	Students 09/10	n = 425
Student Post Questionnaire	Students 09/10	n = 425
Focus Group Interviews	Students 07/08, 08/09, 09/10	n=22

5.3.3 Treatment of Post Activity Qualitative Data – Coding and Theming

Coding and analysis of qualitative data from two sets of data (1) the questionnaires and (2) the focus groups, took place in parallel so that the emerging themes could draw from and be affirmed or challenged by both sets of data and to provide a measure of triangulation as illustrated in Figure 4. This was a directed content analysis approach informed by the themes surfaced in the Exploratory Analysis Unit: Personal Responsibility, Attitude to Technology; Team Experience; Intrinsic Motivation; Skills Transference; and Confidence. The approach used an abductive process of working back and forth from theory to data in addressing the research questions and conceptual code labels were applied to quotes arising from the open questions in the post-activity questionnaires and from the focus group transcripts. These were grouped and categorised (Creswell, 2002; Strauss & Corbin, 1998). This process yielded three separate sets of themes. Those relevant to: a. **Team-Based Learning**, b. **Intrinsic Motivation** and c. **21C Learning**

5.3.4 Team-Based Learning Themes

Themes relevant to considering the impact of the team-based learning experience on the participants are listed in Table 5.7:

Table 5.7 Themes Relevant to Team-Based Learning

	Theme
T1	Working and learning together
T2	How their team performed
T3	Their contribution to the team
T4	Problems in their team
T5	Need to deliver on their projects
T6	Promoting a sense of responsibility and control over the learning,
T7	Team determination to meet their goals
T8	A sense of enjoyment in the work
T9	Interactions within the Team regarding Task
T10	Working with others not their friends
T11	Personal growth in learning to work with others.
T12	Critical of group work in school
T13	Advocating Bridge21 method for school
T14	Bridge21 as liberating in their learning
T15	Students not optimistic for change
T16	Identification with the Bridge21 model.
T17	Revealed abilities as leader
T18	Leading to achieve objectives
T19	Experience of leadership was personally affirming,
T20	A new-found confidence in leadership

5.3.5 Intrinsic Motivation - Themes

In exploring evidence for Bridge21's effectiveness in encouraging intrinsic motivation, the application of the analysis process initially gave rise to 25 codes, subsequently refined to 18, which were assigned to 6 categories demonstrating 9 properties. The themes emerging included 6 relevant themes. Themes relevant to exploring the effectiveness of the Bridge21 model in encouraging intrinsic student motivation are listed in Table 5.8:

Table 5.8 Themes Relevant to Intrinsic Motivation

	Theme
T21	Indications of an increased sense of personal responsibility for learning and improved propensity to self-directed learning
T22	Indications of mastery and skills development
T23	A positive response to the team experience and its role in their learning
T24	An improved attitude to technology and its place in their learning
T25	Metacognitive consideration of learning
T26	A sense of enjoyment and fun in the learning

5.3.6 21C Learning - Themes

Themes relevant to 21C Learning skills abstacted from references by the participants are listed in Table 5.9:

	Theme
T27	Indications of improved communications skills
T28	Indication of a new propensity to working in teams
T29	Indication of interest in taking Initiative
T30	Indication of new or improved problem solving ability
T31	Evidence of being curious
T32	References to being Imaginative and creative
T33	Indication of new or improved skill in peer working

Table 5.9 Themes Relevant to 21C Skills Development

This data analysis process was supported by nVivo8 Computer Aided Qualitative Data Analysis Software (CAQDAS).

5.3.7 Treatment of Post Activity Quantitative Data

The post activity questionnaires also provided quantitative data from a Likert question set that were analysed with the SPSS statistical package. The data from this question set is summarised in Table 5.10 below. The Likert-style items yielded frequency distributions and Pearson correlations were undertaken on items relating to the overall student experience and teamwork

Table 5.10 Likert Set - Post-Activity Questionnaire (N=425)

Question	Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree
Improved my attitude as part of a team	2.4%	0.0%	4.9%	26.8%	65.9%
Improved my attitude to education	0.0%	2.4%	14.3%	61.9%	21.4%
Increased my confidence using technology	0.0%	2.4%	7.1%	50.0%	40.5%
Made me feel that I would learn better in school as part of a team	0.0%	2.4%	12.2%	56.1%	29.3%
Allowed me to make new friends	0.0%	4.8%	2.4%	42.9%	50.0%
Improved my communication skills	0.0%	0.0%	4.8%	40.5%	54.8%
Increased my independence	0.0%	4.9%	14.6%	48.8%	31.7%

Additionally, a Likert style question on how the participants rated their overall experience provided a universally positive response as evidenced in Table 5.11. It should be noted that this response was gathered from the participants at the end of the workshop, following four days of intense activity, working in close proximity and in teams with other students who they were about to be parted with and therefore may be influenced by the emotions of the moment.

Table 5.11 Likert Question - Post-Activity Questionnaire General Experience (N=283)

Q: Overall, how would you rate your experience (at Bridge21)?

1=Very Good	2 = Good	3 = Average	4 = Fair	5 = Poor
225	55	2	1	0
80%	19%	1%	0%	0%

5.3.8 Quantitative Data Related to Team-Based Learning

Analysis of quantitative data (N=283) for the year 09/10 (B2C Core Programme only and excluding the CS-TY data set which is treated separately), indicates a very positive experience for the participants, with 80% rating their overall experience as excellent, 19% rating it as good, with only 1% stating it was average (0% fair and poor ratings). Qualitative analysis of the open-ended question (Why do you feel this way?) that proceeded this rating scale suggests that the participant’s positive experience was linked to how they felt about the team-based learning experience, directly referencing how their team worked and learned together (T1) and team performance (T2) in their answers.

Pearson's correlation tests were conducted to further explore participants' overall experience and their reported attitudinal and skill developments. Table 5.12 presents coefficients for the correlation between participant's overall experience and their reported attitudes to teamwork (r = .290, p = .000) and to education generally (r = .143, p = .018), along with self-reported improved communication skills (r = .168, p = .005) and increased confidence levels using technology (r = .171, p = .004).

Table 5.12 Correlation Matrix: Participant's Overall Experience

Variables	1	2	3	4	5
1. Overall experience	-				
2. Attitude to teamwork	-.290**	-			
3. Increased confidence using tech	-.171**	.230**	-		
4. Improved attitude education	-.143*	.282**	.222**	-	
5. Improved communication skills	-.168**	.350**	.220**	.184**	-

** p<0.01 * p<0.05 level

5.3.9 Quantitative Data Related to Intrinsic Motivation

In relation to data related to Intrinsic Motivation quantitative data was extracted from Likert scales in post activity questionnaires to seek evidence in relation to key markers for intrinsic motivation. The data from the post-activity questionnaire were coded and entered into the statistical package SPSS for analysis. In particular, frequency distributions were obtained for the nine Likert-style items/questions. Pearson correlations between these items were calculated, and the potential of these items for forming a scale was investigated using Cronbach Alpha. The creation of such a scale is beyond the scope of this work. The responses from the Likert scales present an internal consistency with a Cronbach α coefficient = 0.76.

Table 5.13 shows a tentative match between individual markers and the nine statements, together with the percentage of students responding positively to (agreeing or strongly agreeing with) each statement. The positive results indicated are gathered through combining **Strong** and **Very Strong** responses.

Table 5.13 Summary of Quantitative Data Relevant to Intrinsic Motivation (N=425)

Key Markers	Likert Question	Positive Result
Control and Personal Responsibility for Learning	Gain in sense of independence in learning?	82%
Achievement, Self Confidence and Mastery of Skills	Improved Communications Skills?	95.3%
Achievement with peers in a Team	Improved attitude to working as part of a team? Learn better in school as part of a team?	93% 85%
Students' attitude to ICT in their Learning	Increased confidence using technology?	90.5%
Meta-cognitive consideration of learning	College more achievable? Going to Third level important?	90% Post 90% Post 80% Pre
A sense of fun and enjoyment in the learning and social connection	Allowed me to make new friends? My experience on the programme?	93% 99%

5.3.10 Post-Activity Data Analysis – Propensity to Seek Third Level Learning

The post activity questionnaire featured a question to revisit participant attitude to going to third level college or university. The data (B2C Core Programme only and excluding the CS-TY data set) are summarised in Table 5.14 comparing the post activity result with the pre-activity questionnaire result.

Table 5.14 Post Activity Participant Inclination to Third Level (N= 241)

Q: How important is it to you to go to Third level after school?

	Very Important	Important	Slightly Important	Not Important
Before	108	85	37	11
	45%	35%	15%	5%
After	132	84	20	5
	55%	35%	8%	2%

This apparent lift in inclination to access third level education will be considered when exploring the participants' attitude to learning, their educational horizons and their sense of motivation after their engagement with Bridge21.

5.3.11 Analysis of Data from Exemplar Implementation-Computer Science Workshops

The model was deployed in support of a series of workshops to encourage second level students to consider computer science as an option for their university course and this study is an exemplar implementation of the Bridge21 model. This exemplar implementation, in turn provides useful data in support of the Exploratory Analysis Unit of the Case Study. This series of workshops and their effectiveness is described in: Pedagogy and Processes for a Computer Programming Outreach Workshop—The Bridge to College Model (Tangney et al., 2010). An empirical evaluation was undertaken to evaluate to what extent the model was successful in:

1. Giving the participants a deeper understanding of what studying a computing degree and working in the computing profession entails; and
2. Increasing their interest in pursuing a third-level qualification in a computer-related area.

The study involved two instances of the three and-a-half-day programming workshops. Questionnaires were administered at the beginning and end of each workshop. The questionnaires sought to measure changes over the course of the workshop in key attitudes, including the students' intention to attend third level, the range of courses of study they were considering, and their understanding of what a

CS degree involves. Additionally, in the pre-questionnaire, general demographic information was collected, and participants, in all, 39 students participated: 16 in week 1, and 23 in week 2. All students were aged either 15 or 16, 19 were male and 20 female, and they came from 11 different schools.

5.3.12 Data from Exemplar Computer Science Workshops

The data from this exemplar Computer Science Workshops implementation relevant for this work are in relation to the participant overall attitude to the experience and also any change in their attitude to working in Groups. The participant response to Likert style questions probing the workshop experience indicates positive results and is summarised in Table 5.15, in which a response of 1 means "not enjoyable" and a response of 5 "very enjoyable". Similarly, with regard to a specific Likert style question on whether or not their attitude toward working in groups had changed during the week, the responses show a majority developed a more favourable attitude. Table 5.16 summarises responses to this question where 1 indicates "become much more negative" and a response of 5 indicates "become much more positive."

Table 5.15 Overall Computer Science Workshop Evaluation (N=39)

Workshop Evaluation	1	2	3	4	5
What was your overall rating of the week?	0	0	3	7	29
	0	0	8%	18%	74%
Did you enjoy working in a group?	1	1	1	12	24
	2.6%	2.6%	2.6%	31%	62%

Table 5.16 Attitudes to Groups (N=39)

Groups	1	2	3	4	5
Change in attitude to Groups	1	0	14	21	3
	2.6%	0	36%	54%	8%

5.4 Summary of Analysis

This chapter analysed and presented the data gathered through three years of implementation of the Bridge21 model, from data instruments including pre-activity questionnaires, post-activity questionnaires and a data set from focus groups added for consideration in the Explanatory Analysis Unit. The treatment of data supporting the Exploratory and Explanatory Analysis Units in the Case Study was presented as supported by a mixed methods approach with a qualitative data lead supported by quantitative data (Qual+quan). The Exploratory Analysis Unit produced themes that informed the development of the learning model and presented topics for examination in the Explanatory Analysis Unit. The explanatory analysis addressed research questions testing the efficacy of the model in relation to 21C Learning, Intrinsic Student Motivation and Team-Based Learning.

Table 5.17 summarises the data and analysis tables considered. Discussion of the significance of these analyses and findings follows in Chapter 6.

Table 5.17 List of Data and Analysis Tables

Table 5.1	Exploratory Case Study Data Sources
Table 5.2	Team Experience Pre-activity Questionnaire (N=280)
Table 5.3	Pre Activity Participant inclination to Third Level (N= 241)
Table 5.4	Table Summary Outputs of Content Analysis (N=715)
Table 5.5	Themes Revealed in Exploratory Case Study
Table 5.6	Explanatory Case Study Data Sources
Table 5.7	Themes relevant to Team-Based Learning
Table 5.8	Themes relevant to Intrinsic Motivation
Table 5.9	Themes relevant to 21C Learning
Table 5.10	Likert Set - Post-activity Questionnaire (N=425)
Table 5.11	Likert Question - Post-activity Questionnaire General Experience (N=283)
Table 5.12	Correlation Matrix: participant's overall experience
Table 5.13	Summary of Quantitative Data Relevant to Intrinsic Motivation (N=425)
Table 5.14	Post Activity Participant inclination to Third Level (N= 241)
Table 5.15	Overall Computer Science Workshop Evaluation (N=39)
Table 5.16	Attitudes To Groups (N=39)

Chapter 6 - Discussion of Findings

This chapter is a discussion of the findings of the work as evidenced in both the Exploratory Unit of the Case Study and the Explanatory Unit of the Case Study. The chapter first examines and discusses the findings from the Exploratory Unit of the Case Study and considers how this unit of the case study assisted in the design of the Bridge21 model and surfaced aspects of interest and relevancy to the efficacy of the model for 21st Century Learning arising from the evidence of impact of the model on a sizable cohort of students over three years of implementation. The Exploratory Unit of the Case Study informs the hypothesis for the research questions addressed in the Explanatory Unit of the Case Study. The Explanatory Unit of the Case Study presents, challenges and explores Bridge21 as a pragmatic model for 21st Century Learning through teamwork and technology, in a specific learning domain and semi-formal context.

6.1 Exploratory Unit of the Case Study - Objectives

The Exploratory Unit of the Case Study seeks to inform the design and refinement of the Bridge21 model and to suggest relevant research question for the Explanatory Unit of the Case Study. The identified objectives for the case study are:

a. Surface significant themes emergent from the implementation of the model and identify topics and themes that could be further explored in the Explanatory Unit of the Case Study.

b. Inform the design and evolution of the Bridge21 model.

6.2 Explanatory Unit of the Case Study - Research Questions

The discussion of the Explanatory Unit of the Case Study addresses the challenges of the research questions:

RQ: What are the credentials of Bridge21 as a candidate model for 21st Century Learning?

Sub-RQ (a): What is the effectiveness of the model in encouraging intrinsic student motivation?

Sub-RQ (b): What is the effectiveness of the model in facilitating team-based, technology mediated learning?

6.3 The Exploratory Analysis Unit of Case Study

In its treatment of the data, the Exploratory Unit of the Case Study relies on content analysis of qualitative data emerging from post- activity questionnaires administered in workshops over three years of implementation of the model. A series of open questions in these post- activity questionnaires provides the text for analysis:

1. Three things I learned about myself and how I learn during the programme
2. Three things I learned about college during the programme
3. Any other comments?

As described in the methodology Chapter 4, a summative approach was taken with instances of the codes emergent from the text arising from the open questions. The codes were then mapped to categories with subcategories. This approach supported the emergence of a set of themes through the mapping process as illustrated in Figure 6.1.

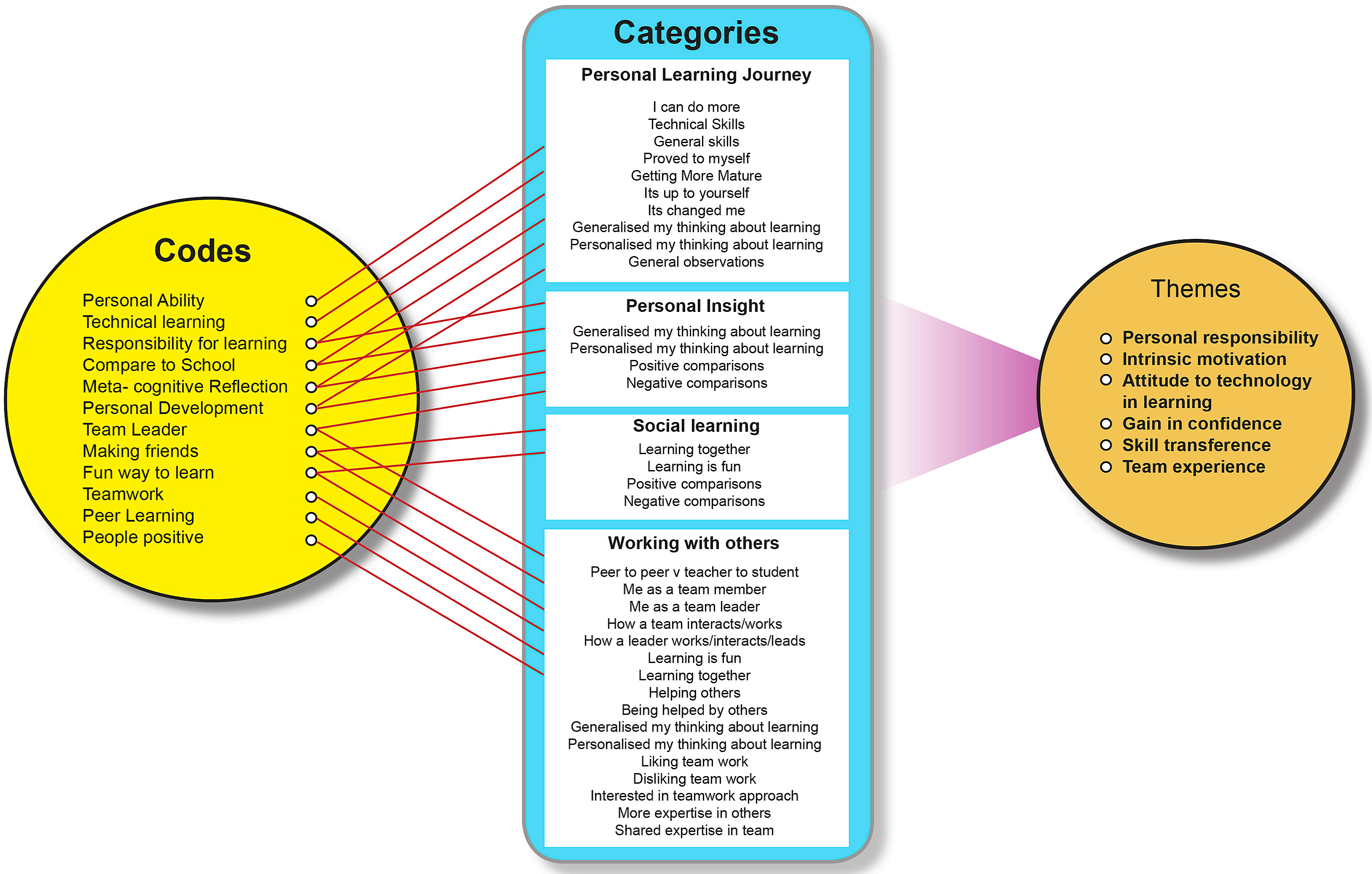


Figure 6.1 Codes, Categories, Sub-Categories and Themes (N=1055)

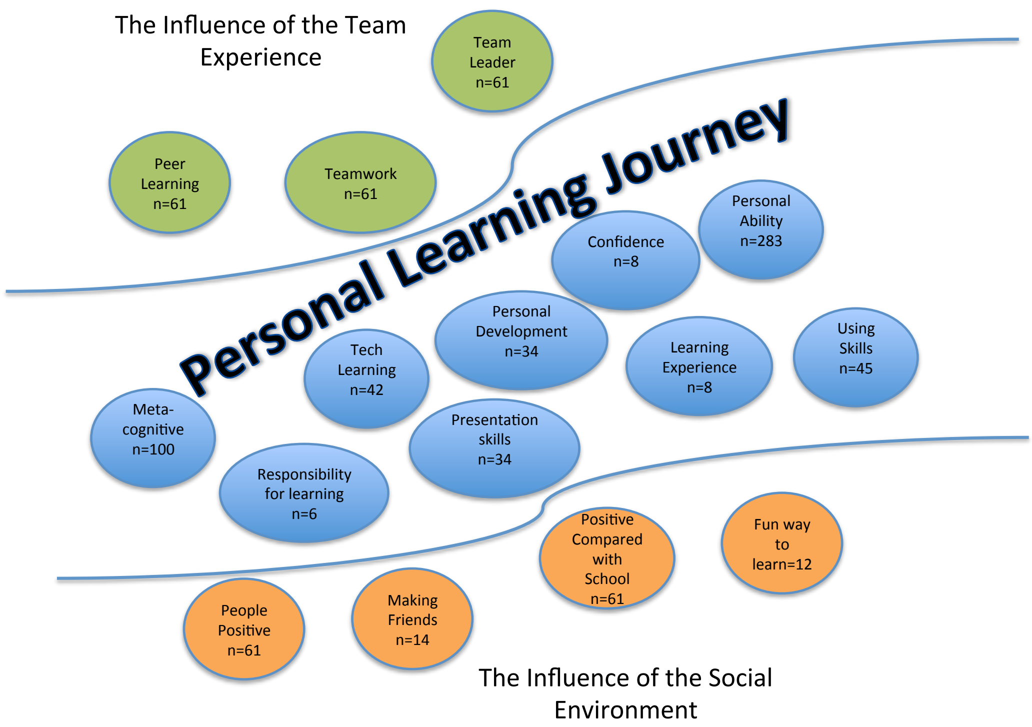
6.3.1 Emergent Themes – Exploratory Analysis Unit of the Case Study

The themes that surfaced in the Exploratory Analysis Unit of the Case Study are: (I) An increased sense of personal responsibility for learning and improved propensity to self-directed learning; (II) An improved attitude to technology and its place in their learning; (III) A positive response to the team experience and its role in their learning; (IV) Improved intrinsic student motivation; (V) Skills transference to the school and other learning contexts; (VI) A personally perceived gain in confidence.

This Exploratory Unit of the Case Study is led by the qualitative data and therefore the discussion that follows is framed by consideration of the qualitative themes. The discussion seeks to identify what is most interesting about Bridge21 to facilitate its examination as a candidate model for 21st Century Learning and thus to set up the subsequent Explanatory Unit of the Case Study.

The concept of a learning journey for the participants provides a discussion framework when considering the qualitative content analysis data, as abstracted from post-activity reflections on their experience with the Bridge21 model, This **Personal Learning Journey** discussion framework reflects an expressed sense of deep and longer lasting impact by the participants, beyond the time spent in the Bridge21 workshops, rather than a discrete intervention that merely interested and entertained while the workshops were in progress. It is also apparent that both the team experience and the social environment encountered by the participants through the Bridge21 learning model were very significant in how they viewed and reacted to the experience. The impact of the team experience was reflected in code instances referencing Teamwork, Peer Learning and Team Leader. The impact of the social environment was reflected in code instances referencing Making Friends, being People Positive, Positive Comparisons to School and Fun Way to Learn. These phenomena will be explored on detail in the succeeding sections and will be recurrent affecting factors when examining results in the Exploratory Analysis Unit of the Case Study. Figure 6.2 illustrates the Personal Learning Journey concept with the attendant influence of the team experience and the social environment.

Figure 6.2 The Learning Journey (N=1015)



6.3.2 Supportive Quantative Data

In the Exploratory Unit of the Case Study the qualitative data is supported by quantitative data derived from Likert style questions in the pre and post activity questionnaires. These questions probed particular areas of relevance for this Exploratory Unit of the Case Study as follows: attitude to working as part of a team; attitude to education; confidence using technology; learning as part of a team; making new friends; communication skills; sense of independence; attitude to accessing Third level; view on the overall experience.

6.3.3 Increased Sense of Personal Responsibility for Learning and Self-Directed Learning

The theme of an increased sense of personal responsibility for learning and improved propensity to self-directed learning is derived from codes referring to Personal Ability, Personal Development, Responsibility for Learning, Meta-Cognitive Reflection and Technical Learning. These codes were mapped to a category called Learning Journey intended to encompass the idea of the participants seeing they were travelling a learning journey through their engagement with the Bridge21 learning model. This category in turn suggested the ten sub-categories: (i) I Can Do More, (ii) Technical skills, (iii) General Skills, (iv) Proved to Myself, (v) Getting More Mature, (vi) It's Up to Yourself, (vii) It's Changed Me, (viii) Generalised Thinking About Learning, (ix) Personalised Thinking about Learning and (x) General Observations. The concept of a Learning Journey reflects the commonly stated reflections of participants regarding how their experience with the Bridge21 learning model had affected their outlook on their capability, their personally perceived technical skill level, their attitude to education and how they signal a progression in their thinking about their learning. Table 6.1 summarises the codes and category supporting the formulation of the theme and provides examples of student comments relevant to an increased sense of personal responsibility for learning and improved propensity to self-directed learning.

It is apparent from the participant comments that there is a developing realisation and meta-cognitive consideration of their personal responsibility for their learning and the need to make things happen for themselves. The understanding of students of their responsibility for their own learning is a key indicator for student motivation (Ames 1992). This suggests that consideration of how Bridge21 affects intrinsic student motivation is worthy of further examination in the subsequent Explanatory Case Study.

Table 6.1 Codes, Category and Student Quotes on Personal Responsibility and Self-Direction

Theme: Increased sense of personal responsibility for learning and improved propensity to self-directed learning		
Code	**Category**	**Example Quotes from Questionnaires**
Personal Ability	Learning Journey	I can work to deadline
Personal	Learning Journey	I learned to get along with my classmates
Responsibility for Learning	Learning Journey	I found being given freedom is great for expanding your learning boundaries
Meta-Cognitive Reflection	Learning Journey	You have to work hard to achieve what you want

There is clear supportive evidence from the qualitative data that the engagement of the participants with the Bridge21 model has positively influenced their stated inclination to access Third level education. The students improved attitude to Third level may be seen as an indication of an elevated interest in their own education and an inclination to continue learning and possibly provides an indicator for taking more responsibility for their next step in formal learning and a positive change in their educational horizons. This effect can be seen in a sample (n=241), considering the importance of going to Third level as Very Important or Important at 80% to Pre-Activity questions and those indicating Very Important or Important at 90% to Post-Activity questions. Correspondingly, those who considered going to Third level as unimportant declined from 5% to 2% in what they answered Pre and Post activity respectively. This important indication of the potential of Bridge21 to lift educational horizons provides a basis for further examination of this effect in the Explanatory Unit of the Case Study. Additionally, by taking in tandem the indications of a growth in a sense of personal responsibility for their learning and an indication of an improvement in openness to consideration of progress to Third level suggests an improvement in self-direction which is an accepted element for 21st Century Learning (Ravitz et al., 2012). This suggests that Bridge21 could bear further examination for its efficacy as a 21st Century learning model and that will be specifically addressed in the subsequent Explanatory Unit of the Case Study.

6.3.4 An Improved Attitude to Technology and its Place in their Learning

The theme of an improved attitude to technology and its place in their learning is derived from codes referring to Personal Ability, Meta-Cognitive Reflection and Technical Learning. These codes were mapped to the category **Learning Journey** expressing progress that participants referenced with regard to their sense of their technical aptitude, their ability and new skills which they believe they have acquired as evidenced in their responses to the open questions in the Post-Activity Questionnaire. This category in turn suggested the six sub-categories: (i) I Can Do More; (ii) Technical skills; (iii) General Skills; (iv) Proved to Myself; (v) Generalised Thinking About Learning; and (vi) Personalised Thinking about Learning.

The sub-categories comprehend code instances from text as follows:

(i) I Can Do More - where students referenced feeling affirmed in their personal aptitude and ability in working with technology.

(ii) Technical skills - where students referenced technical skills that they had learned. e.g. Moviemaking.

(iii) General Skills – where students referenced more technical general skills that they had acquired e.g. How to download videos.

(iv) Proved to Myself – where students spoke of gaining new confidence with technology.

(v) Generalised Thinking About Learning – where students made general observations on technology in learning.

(vi) Personalised Thinking about Learning – where students made observations on their learning with technology.

It is worth noting that a 50% of students in pre-activity questionnaires (N=290) indicated **no use** of computers in their school work and 80% indicating less than one hour in a week in a Likert response to the question: When using a computer during the past week, how much time did you spend on the following activities? Their engagement with computer technology is largely centred outside formal learning with 52% indicating in excess of 5 hours' weekly engagement with applications such as: social media, gaming, messaging and downloading music and video. Therefore, it is reasonable to argue that the students' pre-activity view and experience with reference to computers and technology in school was not aligned to considering technology as integral to their learning. Therefore, for the participants, the learning journey with technology as encountered in the Bridge21 model was a very new experience and was clearly provocative, revelatory and developmental based on the richness of the reflections as evidenced in their responses to open question: *Three things I learned* about myself and how I learn, in the post activity questionnaires. This qualitative evidence of the positive impact of the Bridge21 model in improving personal perceptions of capability with technology is reinforced by the response to a post-activity Likert style question where 93% of students (N=283) **agreed** or s**trongly**

agreed that their engagement with Bridge21 had increased their confidence using technology.

Table 6.2 summarises the relevant codes and category supporting the formulation of the theme and provides examples of student comments relevant to an improved attitude to technology and its place in their learning.

Table 6.2 Technology and Its Place in Their Learning

Theme: Improved attitude to technology and its place in their learning		
Code	**Category**	**Example Quotes from Questionnaires**
Personal Ability	Learning Journey	Understanding technology and what is expected from me. I learned I am skilled on the computer
Meta-Cognitive Reflection	Learning Journey	I can do more on a computer than I thought I could. The movies that we did. I never imagined I would be capable of doing things like that. I learned that computers aren't as hard as they look.
Technical Learning	Learning Journey	I learned a lot about stuff on computers I can use a computer good now. I can use the computer properly now.

In summary, this emergent theme suggests a significant impact of the Bridge21 model in influencing student attitudes to the role of technology in their learning, in building their confidence with technology and in teaching technical skills. It was also evident that the students discovered through Bridge21 that computers could provide a rich range of knowledge building and skills beyond a basic use of technology for information consumption or social media access (Fullan & Langworthy, 2013). This evident potential of the Bridge21, for learning with technology, advances its case as a candidate model for 21st Century Learning which is typically defined as requiring the use of technology as a tool for learning (Ravitz et al., 2012) and this will be further examined in the subsequent Explanatory Analysis Unit of the Case Study.

6.3.5 A Positive Response to the Team Experience and its Role in their Learning

The theme of a positive response to the team experience and its role in their learning is derived from codes referring to Teamwork, Team Leader, Peer Learning and Fun Way to Learn. These codes were mapped to three categories: **Working with Others**, **Social Learning** and **Learning Journey**.

The category **Working with Others** gathers and comprehends a wide and rich set of references covering collaborative and cooperative working, peer learning, in-team interaction and team dynamics. These references indicate that the participants' team experience with the Bridge21 model had a significant impact on them and the responses also reveal interesting aspects of the working of the team structure in the Bridge21 model. A deeper consideration of the efficacy of the Bridge21 model for team-based learning will be addressed in the subsequent Explanatory Analysis Unit of the Case Study.

It is clear from the participant reflections, as gathered in the category **Social Learning**, that the team structure provided a social setting for the learning and as one participant observed: "Because we did loads of activities and it was fun. We worked together as a team." How Bridge21 and the team system functions as a social learning context will be addressed further in the Explanatory Analysis Unit of the Case Study.

The participants reflected on learning within their team and from other team members. These code instances were assigned to the Learning Journey category and indicated good evidence of Vygotskian peer learning in a social context (Vygotsky, 1987) that would merit examination in the Explanatory Unit of the Case Study.

Table 6.3 summarises the relevant codes and categories supporting the formulation of the theme and provides additional examples of student comments relevant to the participant response to the team experience and its role in their learning.

Table 6.3 Team Experience and its Role in their Learning

Theme: Positive response to the team experience and its role in their learning		
Code	**Category**	**Example Quotes from Questionnaires**
Teamwork	Working with Others	Its important to listen to team members' ideas
Team Leaders	Working with Others	I'm a good leader
Peer Learning	Working with Others	I can work well with others.
Fun Way to Learn	Social Learning Learning Journey	I had good fun with the team Because it was interesting, fun, made new friends, learned to work in a group and communicate better

In summary, this emergent theme suggests that Bridge21's team-based learning model is highly effective in engaging students and in facilitating peer learning and collaborative working. These affordances of the model will be explored further in the Explanatory Unit of the Case Study.

6.3.6 Improved Intrinsic Student Motivation

The theme of an improved intrinsic student motivation is derived from codes referring to Personal Ability, Personal Development, Responsibility for Learning, People Positive, Meta-Cognitive Reflection and Making Friends. These codes were mapped to three categories: **Learning Journey, Social Learning** and **Working with others.**

The **Learning Journey** category covers a significant body of participant reflection on what they believe they personally gained from their workshop experience with Bridge21 and how it affected their attitude to learning and what they would take forward to other learning contexts.

The **Social Learning** category captured code instances that could be important indicators of the efficacy of Bridge21 in encouraging individual student motivation. As an example, one participant observed: "*Before Bridge21 I didn't really like TY* (Transition Year)*, I was really shy and had few friends. Now I'm totally ok with public speaking, love teamwork (big change!) and made loads more friends."*

The **Working with others** category covered code instances that flagged reflections on how students saw working with others as a positive learning experience.

The confluence of these reflections, as captured in the described three categories, suggests that the Bridge21 model should be explored further in the **Explanatory Unit of the Case Study** with reference to its merits in encouraging intrinsic student motivation.

Table 6.4 summarises the relevant codes and categories supporting the formulation of the theme and provides additional examples of student comments relevant to intrinsic student motivation.

Table 6.4 Intrinsic Student Motivation

Theme: Improved intrinsic student motivation		
Code	**Category**	**Example Quotes from Questionnaires**
Personal Ability	Learning Journey	I'm better with computers than I thought
Personal Development	Learning Journey	I feel this way because I really enjoyed myself and I learned a lot about a lot of people and about myself
Responsibility for Learning	Learning Journey	You have to work hard to achieve what you want
People Positive	Social Learning Working with Others	I get along better with the people I didn't know even though I thought I wouldn't I work better in a team than I do on my own
Meta-Cognitive Reflection	Learning Journey	…helped me realise that you could do lots of things in this life
Making Friends	Social Learning Working with Others	I'm always the first person to make new friends There is always help if you get stuck, people are very helpful
Fun Way to Learn	Social Learning Learning Journey	I can learn while having fun I learn better in a relaxed environment

In summary, this emergent theme suggests that Bridge21 has a positive impact on intrinsic student motivation and that this is an impact factor for the model that would justify further study.

6.3.7 Skills Transference to the School and Other Learning Contexts

The theme of skills transference to the school and other learning contexts is derived from codes referring to Teamwork, Personal Development, Responsibility for Learning, Peer Learning, Meta-Cognitive Reflection, Compare to School, Technical Learning, Fun Way to Learn. These codes were mapped to four categories: **Working with others**, **Learning Journey**, **Showing Personal Insight** and **Social Learning**. It is evident from the numbers of codes and instances and the richness and depth of the reflections that the students believed that they would take forward many lessons and skills from their engagement with Bridge21.

The **Working with others** category contains code instances that suggest the participants, following their experience with Bridge21, have formed views of learning in teams and learning with others that they would be inclined to take forward to future learning contexts including school. These stated attitudes were generally but not universally positive to working with others, as the opposite views of two participants demonstrate: *"I learned that working in a team is better than working by myself."* and *"I learned not to rely on others but to do things myself*." Some students saw a place for both types of learning*: "I can work in a team and work independently."* This formulation by the learners of a view on working with others compared to working on their own is an important learning outcome (Panitz, 1999).

The **Learning Journey** category covers code instances that indicate that the participants will take forward, to future learning contexts, skills and ideas picked up through their encounter with Bridge21. This effect would suggest that there is potential for long-term effect on students from the learning intervention with the Bridge21 model.

The **Showing Personal Insight** category covers code instances that indicate that the students were comparing and contrasting their learning experience with Bridge21 with other learning, particularly at school, and demonstrating insight in how they experienced the model: *"It was a different way of learning."*

The **Social Learning** category covers code instances that show students see they were learning in a social learning context that was positive for them and different to their common experience with formal learning at school. *"I learned a lot of new skills, new friends and got to work in a way that was more enjoyable and easier to learn."*

Table 6.5 summarises the relevant codes and categories supporting the formulation of the theme and provides additional examples of student comments relevant to skills transference to school and other learning contexts.

Table 6.5 Skills Transference

Theme: Skills transference to the school and other learning context		
Code	**Category**	**Example Quotes from Questionnaires**
Teamwork	Working with Others	I'm not too good working with friends in the team
Personal Development	Learning Journey	Because I learned many things and skills. I also learned that I can work in groups and be always positive and confident.
Responsibility for Learning	Learning Journey	I can work under a deadline and work to a standard.
Peer Learning	Working with Others	It's harder to work in a group than I thought
Meta-Cognitive Reflection	Learning Journey	I'm much more confident than I thought.
Compare to School	Showing Personal Insight	You really work with ideas unlike secondary school where you do homework
Technical Learning	Learning Journey	Will always remember the new skills
Fun Way to Learn	Social Learning Learning Journey	It's not like secondary school, it's more fun and great meeting different people. It's more relaxed than school

The sum of these reflections, as captured in the described four categories, suggests that the Bridge21 model might usefully be explored in the **Explanatory Analysis Unit of the Case Study** with reference to its potential as a new learning model attuned to the 21st Century.

6.3.8 A Personally Perceived Gain in Confidence

The theme of a personally perceived gain in confidence is derived from codes referring to Personal Ability, Personal Development, Responsibility for Learning, Meta-Cognitive Reflection and Technical Learning. These codes instances were mapped to the category Learning Journey expressing strong participants' references to greater personal confidence across a range of learning dimensions as captured in the sub-categories: (i) I Can Do More; (ii) Technical skills; (iii) General Skills; (iv) Proved to Myself; and (v) Personalised Thinking about Learning.

The sub-categories comprehend code instances from text as follows:

(i) I Can Do More - where students referenced feeling more able and stated confidence. e.g. *"Being given the opportunity has meant a lot to me and really boosted my confidence."*

(ii) Technical skills - where students identified a new confidence with technical challenges. e.g. programming

(iii) General Skills – where students express new confidence with general skills e.g. *"confidence to speak in front of others."*

(iv) Proved to Myself – where students spoke of gaining new confidence from achieving an objective.

(v) Personalised Thinking about Learning – where students made observations on self-confidence and their personal learning. e.g*. "I increased my confidence in my ability."*

Table 6.6 summarises the relevant codes and the category supporting the formulation of the theme and provides additional examples of student comments relevant to a personally perceived gain in confidence.

Table 6.6 Gain in Confidence

Theme: Personally perceived gain in confidence		
Code	**Category**	**Example Quotes from Questionnaires**
Personal Ability	Learning Journey	I can do anything I put my mind to
Personal Development	Learning Journey	I gained a bit of confidence from speaking in front of others
Responsibility for Learning	Learning Journey	I have the confidence to just be myself in different situations
Meta-Cognitive Reflection	Learning Journey	I was really nervous at the beginning because I hate public speaking, I hate being centre of attention. But everything was grand.
Technical Learning	Learning Journey	I'm able to do more on the computer than I realised

In summary, this emergent theme suggests that the encounter with the Bridge21 model has positively affected the participants' sense of confidence in their ability, their learning, and their interactions with others in what was a challenging social context.

6.3.9 Summary of Exploratory Analysis Unit of Case Study - Discussion

The foregoing Exploratory Analysis Unit of the Case Study discussion has presented and explored a range of themes emergent from the participant reflections on their experience with Bridge21. These themes, touching on a gain in confidence, new skills acquired, a lift in student motivation, a sense of personal responsibility for learning, a new attitude to technology in learning and overall a positive disposition toward the team experience provide a rich ground for further study and exploration. It is evident that the learning intervention was disruptive for the participants and their immediate responses to the experience as gathered in the post activity questionnaires on the last day of the workshop show strong evidence of a positive learning experience. These results suggest that the Bridge21 model, insofar as the limitations of the Exploratory Unit of the Case Study allow, exhibits impact characteristics consistent with what is generally described as 21st Century Learning. Therefore, further study should examine Bridge21 as a candidate model for 21st Century Learning. Additionally, the model's potential for positively affecting intrinsic student motivation is worthy of more in-depth consideration. Bridge21 has a highly structured team-based approach and this study has indicated that the team system facilitates a highly effective implementation of technology in the learning. This integration of technology and teamwork in the Bridge21 model merits further study.

In conclusion, the confluence of these reflections, as captured in the described discussion of the Exploratory Analysis Unit of the Case Study, suggests that the Bridge21 model might usefully be explored further in the Explanatory Analysis Unit of the Case Study through research questions directed to examining the credentials of the model for 21st Century Learning and further exploring the areas of teamwork and student motivation.

"The whole experience was brand new, team building, growing with each other and individually. I've learned too much to put down. I made new friends and am not as shy."
(Participant student of Bridge21)

6.4 The Explanatory Analysis Unit of the Case Study

The Explanatory Analysis Unit of the Case Study follows the Exploratory Analysis Unit of the Case Study and the research questions are informed by the earlier study. Thus, the Explanatory Unit is focussed on addressing the research questions:

RQ: What are the credentials of Bridge21 as a candidate model for 21st Century Learning?

> **Sub-RQ (a):** What is the effectiveness of the model in encouraging intrinsic student motivation?
>
> **Sub-RQ (b):** What is the effectiveness of the model in facilitating team-based, technology mediated learning?

6.5 The Effectiveness of the Model in Encouraging Intrinsic Student Motivation

The learning model was structured and the implementation workshops were conducted with an objective of motivating the students. The research through the

Explanatory Unit of the Case Study seeks evidence that this objective has been achieved and the extent of its achievement. The research question addressed and particularly relevant to 21st Century Learning is whether Bridge21, with its team based, technology mediated approach, is effective in promoting intrinsic student motivation. In seeking evidence of the effectiveness of a learning model, the literature directs us to some key markers in the learner experience which indicate intrinsic motivation: (Maehr & Midgley 1991; Ames 1992; Martens et al., 2007; Wentzel & Wigfield, 2009; Dweck 2009; Valentin et al., 2013). These are: (a) sense of control and personal responsibility for learning; (b) identification of achievement, self-confidence and the acquisition of skills; (c) sense of achievement with peers in a team; (d) positive change in attitude to the use of ICT in the learning; (e) meta-cognitive consideration of learning; (f) sense of fun and enjoyment in the learning.

As detailed in the previous section codes emerging from the data were assigned to the following categories: (i)Social Learning, (ii)Skills Acquired, (iii)Personal Insight, (iv) Peer Learning, (v) Learning Journey, (vi) Working with Others. These categories exhibited a set of properties. The relevant concept properties emerging from the data include: (A) Student Autonomy, (B) Learning Insights, (C) Improved Attitude to Third level, (D) Communications Confidence, (E) Learning Confidence, (F) Skills Confidence, (G) Peer Confidence, (H) Enjoying Learning, (I) Positive Educational Horizon.

These emergent indicators from the data (including the themes listed earlier) are placed in reference to key markers for intrinsic motivation as supported by literature, shown in Table 6.7.

Table 6.7 Markers for Motivation from Literature against Emerging Themes

Key Markers for Motivation	From Literature	Emerging Themes
A Sense of Control and Personal Responsibility for Learning	(Ryan & Deci, 2000; Claxton, 2007. 2009; Drexler, 2010; Ford et al., 1998; Dweck & Master, 2009)	Increased sense of personal responsibility for learning and improved propensity to self-directed learning.
Identification of Achievement and Mastery of Skills and Self Confidence in the Acquisition of Skills	(Ames, 1992; Covington, 2000; Pintrich et al., 1994)	Indications of mastery and skills development New confidence and indications of skills transference to the school and other learning contexts
A Sense of Achievement with Peers in a Team	(Blatchford, Galton, Kutnick & Baines, 2003; Mitra, 2015)	Learner stated sense of achievement with peers in a team
Attitude to the Use of ICT in the Learning	(Martens, Bastiaens & Kirschner, 2007; Dinter, 2006; Resnick & Rusk, 1996)	Learner stated positive change in attitude to the use of ICT in the learning
Meta-Cognitive Consideration of Learning	(Ford et al., 1998; Wirth & Perkins, 2007; Leat & Lin, 2003)	Learner stated meta-cognitive consideration of learning
A Sense of Fun and Enjoyment in the Learning.	(Aubusson, Schuck & Griffin, 2006; Husman & Lens, 1999)	Learner stated sense of fun and enjoyment in the learning.

Quantitative data extracted from Likert scales in post activity questionnaires (N=425) provides supporting evidence in relation to key markers for intrinsic motivation. The positive results indicated are gained through combining **Strong** and **Very Strong** in the Likert responses. These include: Gain in sense of independence in learning 82%, Achievement, Self Confidence and Mastery of Skills 95%, Improved Attitude to Working as Part of a Team 93%, Belief in Improved Learning at School Through Teamwork 85%, Increased Confidence Using Technology 90.5%, Believing College More Achievable 90%, Belief that Going to Third Level is Important 90% (80% Pre), Facilitated Making New Friends 93% and Overall Positive Experience on the Programme (99%).

6.5.1 Control and Personal Responsibility for Learning

The issue of control in the learning and the student perception of who is driving the learning bears significantly on student motivation and their engagement with learning experiences (Ames, 1992). Participants in Bridge21 workshops evidenced a growth in a sense of personal responsibility for learning with this emerging as a strong theme from the data and students made explicit references to personal responsibility for learning and understood that the learning model moved responsibility to them and to their colleagues. A typical comment from a student illustrates the point: *"It pushes responsibility on you"* - *"You're responsible for yourself and your own work"*. Participants were conscious of a deliberate shift in the control of the learning and the need for such a shift. As one student observed: *"We need to control it ourselves and if we want to do well we have to learn it ourselves".* In identifying this need in their learning they were unconsciously validating the Vygotskian maxim: *"What children can do together today, they can do alone tomorrow"* (Vygotsky, 1987). This declaration of independence in their learning is an important step for learners and a shift in focus of their motivation from the extrinsic to the intrinsic (Meece, Anderman, & Anderman, 2006).

A high proportion of participants (82%) indicated a perceived gain in their sense of independence in their learning in post activity questionnaires. The reported new sense of responsibility and independence was also accompanied by many references to gains in self-confidence.

6.5.2 Achievement, Self Confidence and the Mastery of Skills

Intrinsic motivation is strongly linked with mastery goal orientation and a perception in the learner of having developed new skills or capability (Pintrich et al., 1994). New self- confidence, self-efficacy and a sense of achievement are also fruits of a rise in intrinsic motivation. Conversely building learner confidence is vital in improving motivation (Keller, 1987), (Bandura, 1977). The theme of new confidence emerged clearly from the data. The young people regularly referenced such a rise in confidence. For example, one student referred to a new-found level of ability: *"I can do more things if I put my mind to it."* These mastery experiences have been shown to drive self-efficacy and motivation (Bandura, 1993). Students linked their general confidence with an improvement in communication skills. As one student put it: "*I think I learned a lot about confidence and communicational skills."* Students spoke of a new confidence with speaking in public, for example: *"I knew that I had confidence now. I was able to talk in front of people I didn't know and strangers and that I'd be able to talk in front of anybody"*. It is notable that this perceived improvement in communication skills was indicated by 95% of participants in their post activity questionnaires.

6.5.3 Achievement with Peers in a Team

Given that the learning experience was heavily team structured it is, perhaps not surprising, that participants strongly referenced teamwork in their responses to questionnaires and in focus groups and a theme of achievement in the team and with peers was clearly emergent. It is evident that the team experience in itself had a significant positive impact on the participants and in post activity questionnaires. 93% indicated a more positive disposition to teamwork after the workshop. Sceptics regarding group-work and teamwork sometimes point to the danger of a student hiding within the team and group work not being appropriate for certain students (Galton & Hargreaves, 2009). Interestingly, after the experience 85% of participants believed that they could learn more in school through teamwork. In this study the participants saw that the individual was elevated rather than submerged in the team. One student observed: *"I think that everyone was made feel that they were important and needed."* Within the teams there was strong evidence that an internal learning dynamic was facilitated and peer learning was evident, consistent with the Vygotskian idea of learning from a 'more able other' (Vygotsky, 1987). As an example, one student offered the observation:

"Cos you know the teachers are a lot smarter than you, at least with a friend he knows something more than you about one thing, you might know something more than him about another thing and you can teach him that while he teaches you".
Students also spoke of affirmation of their own ability and self-esteem through helping their peers. One student offered the personal insight:

"I was like: Oh God, I feel really special now I'm passing my skills on to somebody else and that's good".

The students did not see participation in the team as a softer option than their normal classroom experience and believed that they were under pressure and had to work hard on the programme, students felt compelled to contribute and engage and that they were under a measure of pressure to do so. This compulsion to contribute can be linked to the peer pressure within their team, the wish for their team to be successful and the energy stimulated through the social context of the learning experience. This combination gave rise to a high level of student engagement. As one participant remarked:

"...you had a timeframe to have things completed by and if you hadn't got it completed well then obviously your project or your video, whatever you were doing, wasn't going to be as good as the other team."

It is clear that identification with the team experience and working with peers is integral to how the participants viewed the experience.

6.5.4 Students' Attitude to ICT in their Learning

The programme shows evidence of improving the students' attitude to technology in their learning, with 90.5% of participants indicating an increased confidence using technology.

The sharing of ICT resources within the team is a key part of the Bridge21. In the implementation in this study each team of five participants had two networked and internet enabled PCs. The intent was to encourage sharing, collaboration and peer learning. The data shows evidence of significant collaborative working and peer learning with and around the technology. As an example, one participant observed:
"I didn't know much about computers and there was a person in my group that knew a lot about computers and she was showing me how to ... like edit the music and all stuff like that."

This use of ICT in the team context was integral to the programme and the students saw the use of ICT in this context as part and parcel of the learning.

It is noteworthy that 50% of the students indicated that they did no school work on computers and 80% indicated that they did one hour or less a week of school work on computers. For this reason, comparisons with their use of ICT in school could be described as facile as their school environment in general treated the use of ICT as ancillary to the learning whereas the Bridge21 experience treated ICT as integral to the learning. The cohort of students also indicated that they made significant use of social media, email, gaming, downloading music, searching and multimedia in their personal, or what they saw as their 'non-learning', lives. Students identified this use of technology in their learning at Bridge21 as more relevant and aligned to their needs and as one student said:

"....in Bridge21 we're thinking 'yeah this can help me' because it's computers and it's working in teams and you're focussing on modern things instead of focussing on things that, books that have been written 2 years previous or 5 years previous."

This sense of alignment of the learning with the reality of their lives, in this case through the use of ICT, can be taken as a marker for a lift in motivation

6.5.5 Meta-Cognitive Consideration of Learning

Evidence of meta-cognition i.e. how students think about their learning, their strategies for learning, how their thinking is changing, their personal assessment of their own understanding and their sense of progress on their learning goals is a significant indicator for intrinsic student motivation (Wirth & Perkins, 2007). There is evidence, from the data, of students thinking about and reappraising their learning. In open questions in the post-activity questionnaires, a significant number of participants made reference to thinking about how they learn. Additionally, this phenomenon of thinking and talking about their learning was a strongly emerging theme both from open questions in the questionnaires and from interviews. As an example, one participant spoke of reappraising the way they work:

"I was real lazy at getting things done but now like I'd rather get it done and out of the way and look at different ways of doing it, rather than just the obvious."

There are indications that the intervention led to a positive re-evaluation of the participating students' educational horizons as was seen in their responses to a question on the importance to them of going to Third level. 90% indicated that they felt college was more achievable following their participation in the programme and 90% indicated that going to Third level was important or very important to them post activity as against 80% in pre-activity responses. The development of such a Future Time Perspective(FTP) and the specificity of a goal such as accessing a Third level course has been shown to be an important indicator of student motivation (Simons, Vansteenkiste, Lens, & Lacante, 2004; de Volder & Lens, 1982).

In focus groups participants described how the experience of Bridge21 challenged their previous understanding of how they learned. For example, one participant spoke of a realisation that her peers could help with her learning:

"Yeah before Bridge21 I thought I was a lone wolf ..... and I'd got my grades by myself and nobody else had told me what to do or told me how to do it.......But then I realised that .... 'I need help in my education now' not just from teachers but from other people in my class."

This reflection on learning can be seen as a personal affirmation of commitment to learning which is in essence evidential of intrinsic motivation.

6.5.6 A Sense of Fun and Enjoyment in the Learning and Social Connection

Some of the things that make learning enjoyable and fun are: interest; competence; curiosity; relatedness and autonomy (Husman & Lens, 1999; Kinchin, 2004) and as Fink argues the feelings of the student are central, rather than ancillary, to motivated learning (Fink, 2006). This link between learning and enjoyment was well made by one student: *"In the Bridge21 you have a choice, either sit back and don't speak up or, and you won't have any fun, or speak up and learn new stuff and enjoy it."* It is noteworthy that students were surprised that learning could be fun and as a student put it: "*Learning can be fun instead of boring."* Students contrasted their previous experience of learning with this approach to learning and highlighted the fun element.: *"I'd hit the books sometimes the night before a test cos I'd be able to get it stuck into me head but while I was working as a team I'd be able to remember it more because we were having fun."* The sense of social connectedness in the learning is also important in growing motivation (Pyle, 1995) and there is strong evidence in the data of students making friends and building social connections: *"It was good to get the opportunity to mingle and mix and make loads of new friends".* In post questionnaires 93% of students saw the programme as important and effective in making friends. It is also clearly evident that the students thoroughly enjoyed the experience and this enjoyment influenced their perception of their learning in the process.

6.5.7 Summary on the Effectiveness of the Model in Encouraging Intrinsic Student Motivation and in Promoting Student Responsibility for the Learning

The evidence from the data indicates a positive effect on participants' intrinsic motivation. The experience affected their perceptions of their relationship with learning: their sense of responsibility for their learning, their sense of mastery of skills, how they can learn with and from their peers, their attitude to technology in their learning and their enjoyment of the learning experience. These results echoed the concepts and principles for motivational learning in Deci and Ryan's Self Determination Theory including the critical components autonomy, competence and belongingness (Ryan & Deci, 2000). The students also showed an increased inclination to think and talk about their personal learning and their learning goals. This facilitation of students thinking about their learning has been linked with growing confidence, understanding and self-esteem (Leat & Lin, 2003).

These emerging themes map directly onto the well-understood markers for improved intrinsic motivation. The focus group interviews conducted at a time lapse of, from 6 months to 3 years from their participation (depending on the student cohort) affirm the results from the data gathered at the end of the intervention and suggest a lasting positive memory of the programme and a significant residual effect on the student attitude to learning as a result of the programme. This study therefore indicates that the Bridge21 model of team-based, technology mediated learning as applied in an out of school environment is effective in stimulating intrinsic learner motivation. The model through its structured team-work approach offers a vehicle for the transfer of control of the learning from the teacher to the learner and in this facilitates the critical characteristics of learning necessary to encourage intrinsic motivation and in particular in promoting student responsibility for the learning.

6.6 The Effectiveness of the Model in Facilitating Team-Based, Technology Mediated Learning

This work explores the effectiveness of the Bridge21 model in facilitating team-based, technology mediated learning. The section following examines key elements of team-based learning and how Bridge21 facilitated such learning.

6.6.1 Effectiveness of the Teams

Team effectiveness as perceived by the participants is a good indicator of the effectiveness of the Bridge21 learning model in supporting team-based learning and so is a topic relevant for consideration. In discussing team effectiveness, the author examined how the team worked and learned together from the perspective of the participants; objective considerations, such as the team outputs or products or opinions delivered from a viewpoint external to the team, were not factored into the analysis.

There is evidence from the data to show that participants had forthright opinions on how their team performed. They typically saw their own team as highly effective in achieving their objectives and in learning together and this was an emerging theme from both the questionnaires and focus groups. Team Effectiveness and Collaborative Learning is referenced in four emerging themes: T1. Working and learning together; T2. How their team performed; T3. Their contribution to the team, T4. Problems in their team.

Table 6.8 summarises the themes emerging relevant to Team Effectiveness and Collaborative Learning and examples of student comments relating to this topic. Students generally reflected on their contribution to the team and its success, and their comments pointed to a strongly collaborative experience during the workshops.

Table 6.8 Themes and Sample Quotes for Team Effectiveness and Collaborative Working

Theme	Examples from Focus Groups and Questionnaires
T1 – Working and Learning Together	I think the team and I did a good job on the programme. We learned the importance of teamwork and working in harmony on tasks on time
T2 – How their Team Performed	I think the team and I did a good job on the programme. We learned the importance of teamwork and working in harmony on tasks on time. We all just got into teams and settled down to work with every task that we were given.
T3 – Their Contribution to the Team	I think I shared leadership during the week
T4 – Problems in their Team	Working individually is better for me. I tend to do my own thing in a group. Learning in a team setting can be stressful at times but in the end it is very rewarding.

Meeting the challenge of working collaboratively or within a team structure for students who are not naturally inclined to this way of working of learning points to a need for a sensitive and supportive approach for these students. It is evident from their declarations that students were not passive within their teams and generally they had formed strong views on the team effectiveness and the factors impacting that effectiveness.

6.6.2 Team and Task

The participants saw the need to deliver on their projects and the pressure on the team as key to their experience and learning at Bridge21, so the topic of Team and Task was considered. There is good evidence that the model was effective in promoting a sense of responsibility and control over the learning. Students heavily referenced their contribution and role in the team.

Some students expressed surprise by their team's determination to meet their goal. The focussed "work ethic", referenced by the students, went hand in hand with a sense of enjoyment and fun in the learning activities. The relationship between Team and Task is touched upon in four emerging themes: T5. Need to deliver on their projects; T6. Promoting a sense of responsibility and control over the learning; T7. Team determination to meet their goals; T8. A sense of enjoyment in the work. Table 6.9 summarises the themes emerging and examples of student comments relevant to Team and Task.

Table 6.9 Themes and Sample Quotes for Team and Task

Theme	Examples from Focus Groups and Questionnaires
T5 – Need to Delivery on their Project	… we learned the importance of teamwork and working in harmony on projects
T6 – Promoting a Sense of Responsibility and Control Over the Learning	I helped my team to do all the tasks that were given to us. … I can work under a deadline and … to a standard and can adapt to other people working with me.
T7 – Team Determination to Meet their Goals	I didn't expect my teammates to work so hard on our task
T8 – A Sense of Enjoyment in the Work	I can have a laugh while working. I can work hard with new friends and not get distracted

These results resonate with the contention in the literature that effective teams take responsibility for their work (Fandt, 1991; Katzenbach & Smith, 1993; Peterson, 1997; Pyle, 1995). It is clear that the majority of students believe that their team was well applied to the task and that the Bridge21 model was conducive to eliciting in the teams a sense of responsibility to deliver on that task.

6.6.3 Team Interactions and Peer Working

The Bridge21 learning space is a noisy learning environment when compared with the teacher-directed second level classroom and excited conversation, discussion and sometimes argument are part and parcel of the experience. The data supports a finding that personal interactions within the team were very significant in the learning and that substantial peer learning took place. The topic of Team Interactions and Peer Working is therefore considered.

Results resonate with the Michaelsen and Sweet's team formation guidelines where the teams are picked by the mentor/facilitator (Michaelsen & Sweet, 2008). Students accepted the arrangement of teams and spoke of discovering that they could work with others who were not their friends in a team. The worry or perceived challenge of working with people with whom they were not previously acquainted was in general successfully addressed through the model and scaffolded learning activities. Students saw the experience of working with people that they did not know as personally developmental. Analysis of a question in the post-questionnaire, which examined students' perceptions of what they learned about themselves and their learning style (n=287) revealed 77% of participants made reference to their team or team issues in relation to their learning experience. Furthermore, there is a significant correlation between participant's reported improved attitudes to working as part of a team and perceived improved communication ($r = .350$, $p = .000$) – an essential skill in interacting with peers and team-mates in a collaborative learning environment.

Three themes spoke to the topic of Team Interactions and Peer Working: T9. Interactions within the Team regarding Task; T10. Working with others not their friends; T11. Personal growth in learning to work with others.

The richness of the interactions regarding their fellow team members, as evidenced by the quotes in Table 6.10, gives testimony to high levels of team interaction and peer working during the workshops.

Table 6.10 Themes and Sample Quotes for Team Interactions and Peer Working

Theme	Examples from Focus Groups and Questionnaires
T9 – Interactions within the Team Regarding Task	I've learned how to listen to other people's opinions and gained more experience of working in a group. Listening to each other and being given a chance to express their idea.
T10 – Working with Others who are Not their Friends	I learned that I can work well in a team. I learned that I can get on easily with people. Working with new people wasn't as scary as I thought it would be.
T11 – Personal Growth in Learning to Work with Others	I was able to work in a team with people I never met before.

6.6.4 Comparisons with Formal Experience and Group Work at School

Data analysis revealed that participants made frequent references to and comparisons of their learning experience in Bridge21 with their learning experiences in formal classrooms. Participants were, perhaps unsurprisingly, universally critical of the methods employed in school and referred to teachers being very directive and controlling in their approach. They also spoke of a lack of peer interaction and a lack of properly applied team (or group) work at school. The participants' comments are indicative of their strong convictions that the application of the Bridge21 model in school would deliver better learning outcomes. Further, statistical analysis revealed a significant correlation between student's self-reported improvement in attitude to teamwork and their agreement with the statement that they would learn better in school as part of a team ($r = .383$, $p = .000$). It should also be noted that the generally stated dearth of previous team-based learning experience in a formal context left the participants with no real comparative experience against which to measure their encounter with Bridge21.

Table 6.11 Themes and Sample Quotes for Comparison with Formal Experience

Theme	Examples from Focus Groups and Questionnaires
T12 – Critical of Group Work Employed in Schools	.. in school now, our class is divided up into, is it 4 or 5 groups? … we don't work as well as we do here … There's basically no element of teamwork in it. Never.
T13 – Advocating Bridge21 Method for School	… if they'd [teachers] just realise that we'd learn more from being in teams, than being taught individually.
T14 – Bridge21 as Liberating in their Learning	I suppose it was a different type of learning. It wasn't your typical day… you weren't so uniformed I suppose … you can express yourself more. I thought the fact that we work in teams was great because the formalised way of education was left at the door.
T15 – Students Not Optimistic for Change	We're probably not going to be able to experience our way of learning like, as a team, cos the teachers might say "no you'll do this by the book, your [Examination] is coming up soon and you have to get it done, we need the course finished or you're goanna fail …
T16 – Identification with the Bridge21 Model	… our way of learning

Students identified the learning in Bridge21 as different from school and in particular identified the model as liberating in their learning. Students were not optimistic that they could influence their teachers to try a more Bridge21 style approach in the formal classroom. Five themes are considered in relation to Comparisons with Formal Experience: T12. Critical of group work in school; T13. Advocating Bridge21 method for school; T14. Bridge21 as liberating in their learning, T15. Students not optimistic for change; T16. Identification with the Bridge21 model. Table 7.11 summarises the themes emerging and examples of student comments relevant to Comparisons with Formal Experience. It is noteworthy, as may be seen from the sample quotation for T16, that some students had embraced the Bridge21 model as "our way of learning".

6.6.5 Team Leadership

The idea of having a team leader from among their peers was novel to most of the participants but analysis of their responses indicates that this approach was generally accepted and approved by them. They made insightful comments on how they dealt with leadership issues or challenges that arose and how the team progressed through these challenges. Participants also identified their own skills and talents for leadership and showed evidence of identifying particular leadership styles. Those participants that took on the team leader role were inclined to reference this experience in the post-activity questionnaires and it was also a matter they referred to in the focus groups. The team leaders typically spoke of their revealed abilities as leaders and a self-awareness in how they could be effective in helping their team achieve its objectives.

There is evidence to suggest that the team leaders found their experience to be personally affirming, particularly based on the reaction of their peers, and many spoke of discovering their own leadership abilities and strengths. This perceived success in a leadership role established a new confidence that could be carried forward beyond the Bridge21 workshop. The concept of having a leader drawn from among their peers is largely absent from school-based implementations of group work and is consistent with the general lack of a structured approach fostering effective groups or teamwork (Blatchford, Galton, Kutnick, & Baines 2005). This contrasts with the learning model of the World Scout Movement as implemented in their Patrol System which places a reliance on growing leadership in the team as central to the learning (Vallory, 2012).

The element of Team Leadership in the model is addressed in four themes: T17. Revealed abilities as leader; T18. Leading to achieve objectives; T19. Experience of leadership was personally affirming; T20. A new-found confidence in leadership. Table 6.12 summarises the themes emerging and examples of student comments relevant to Team Leadership.

Table 6.12 Themes and Sample Quotes for Team Leadership

Theme	Examples from Focus Groups and Questionnaires
T17 – Revealed Abilities as Leader	I learned that I am capable of managing and controlling a team.
T18 – Leading to Achieve Objectives	I learned that even a very daunting task is achievable if you put your mind to it and have a good team backing you up.
T19 – Experience of Leadership was Personally Affirming	I can lead a team well. I was elected team leader and the rest of my team told me that I led them well.
T20 – A New-Found Confidence in Leadership	I'm a good leader, I should have the confidence to put myself as official leader

6.6.6 Summary on the Effectiveness of the Model for Team-Based, Technology Mediated Learning

In summary, these topics of team effectiveness, collaborative learning, team and task, team interactions and peer working, comparisons with formal experience and team leadership discussed above collectively validate Bridge21 as a learning model that is effective in scaffolding teamwork and in leveraging the affordances of team-based learning and moreover provides a basis for developing the skills of collaborative working which has been identified as a component for learning models that facilitate 21st Century Learning (Ravitz et al., 2012).

6.7 Bridge21 as a Pragmatic Model for 21st Century Learning

This work presents Bridge21 as a pragmatic model for 21st Century Learning. Bridge21's claim to be a model for 21st Century Learning is founded on the evidence of the participants in how they relate their experience and how they speak of changes in their perspective and learning skill-set following their experience with the Bridge21 model. The claim to pragmatism is supported by the practicality of the model, its ease of implementation, its robustness and its flexibility in different learning contexts.

6.7.1 Practicality of the Model

The Bridge21 model is practical under a number of headings: ease of implementation, moderate demand on ICT resources, due to sharing in teams, low training threshold for mentors and educational facilitators and ease of understanding of the model for participants.

Ease of implementation of infrastructure

Arranging the physical learning space is a challenge for team-based learning but is not unduly problematic given a suitable area and flexible furnishings that can be arranged around the teams. The Bridge21 model suggests that the furnishings should be set up so as to create team pods as semi-enclosed team spaces affording a measure of privacy to the team in their work together. The furnishings required are relatively simple with a table or worktop and movable individual seating required for each team and preferably some form of screening and distance between teams. The team pods for the Bridge21 model in the implementation described in this work are equipped with 2 standard PCs or equivalent as a team resource for a team of 5 students. The principle at issue is that the technology is a shared resource for the team and 'individualising' on machines is avoided. A simple presentation space with a projector or display facilities to allow teams present their work to peers in the other teams completes the infrastructural requirement.

Moderate on ICT resources

The Bridge 21 model works on a principle of resource sharing within the teams to ensure collaborative working and does not require a computer for every student and so makes a relatively moderate demand on ICT resources. The model requires adequate broadband network access to allow for internet searching and downloading data including images, video and audio with sufficient bandwidth to support the number of teams in the implementation.

Low training threshold for mentors and facilitators

The role of mentors and educational practitioners with the Bridge21 is different from that of a didactic or teacher led learning intervention. The role of the adult mentor in Bridge21 is to act as a guide and facilitator. The learning takes place in the team and the adult mentor is not a member of the team. The adult provides support and where required troubleshooting either in relation to technical or team problems that arise but does so while respecting the integrity of the team and the responsibility of the team in resolving their own challenges. Understanding this and acting accordingly is the main challenge for adults supporting the model. This can be addressed through a modest (1 day) training investment followed by working with the model and learning by doing with a post activity review.

Ease of understanding of the model for participants

It is evident from the data that the participants understood, readily adapted and identified with the Bridge21 model. This is an interesting finding considering their generally stated lack of previous knowledge of a learning experience that was strongly team-based.

6.7.2 Robustness and Flexibility in Different Learning Contexts

The Bridge21 model has been shown to be flexible in a range of learning contexts and domains, with different age ranges, varied curriculum material and diverse learning objectives.

The model has been successfully applied with second level students of different age ranges: 12-14 years in their junior cycle (in research outside the scope of the findings presented in this work) and with students in the 15-17 year old age range in their transition/gap year between junior and senior cycle. It has also been used effectively in workshops with primary school children.

The implementations of the model, in work beyond this thesis, have explored a broad domain of curricula and learning contexts, both in and out of school including: project based learning, language learning, mathematics, computer science and programming, values based learning, multi-media and history and has shown itself to be effective in supporting learning interventions in all of these disciplines and in teacher development (Conneely, Girvan & Tangney, 2012; Conneely, et al, 2013; Sullivan, Marshall & Tangney, 2015; Byrne, Fisher & Tangney, 2015; Bray & O'Donovan, 2015).

6.7.3 Discussion of an Exemplar Implementation - CSTY

An intervention to promote Computer Science provides a specific particularised exemplar implementation of the Bridge21 model. The model was deployed in the earning space at Oriel House in support of a series of workshops to encourage second level students to consider computer science as an option for their university course. This series of workshops and their effectiveness is described in: *Pedagogy and Processes for a Computer Programming Outreach Workshop—The Bridge to College Model* (Tangney et al., 2010). Participants engaged in a series of programming activities based on the Scratch visual programming language, and the Bridge21 model provided the pedagogical scaffold for the learning.

Participants were not required to have any prior programming experience.

An empirical study was undertaken to evaluate to what extent the model was successful in:

(1) Providing a deeper understanding of what studying a computing degree and working in the computing profession entails.
and
(2) Increasing their interest in pursuing a third-level qualification in a computer-related area.

The study involved two instances of the three and-a-half-day programming workshops. The purpose of the study was to investigate the extent to which the workshop experience could give the participants a deeper level of insight into what the field of computing involves, thus enabling them to make a more informed decision about whether or not they would pursue a third-level course in the discipline.

Questionnaires were administered at the beginning and end of each workshop. The questionnaires sought to measure changes over the course of the workshop in key attitudes, including the students' intention to attend third level, the range of courses of study they were considering, and their understanding of what a CS degree involves. Additionally, in the pre-questionnaire, general demographic information was collected, and participants. In all, 39 students participated: 16 in week 1, and 23 in week 2. All students were aged either 15 or 16, 19 were male and 20 female, and they came from 11 different schools.

Findings

The findings relevant to this work are as follows. The overall response to the workshop experience was very positive, as indicated in Table 6.13 in which a response of 1 means "not enjoyable" and a response of 5 "very enjoyable." The only negative responses came from two participants who did not enjoy the strong group work aspect. With regard to a specific question on whether or not their attitude toward working in groups had changed during the week, the responses show a majority developed a more favourable attitude. See Table 6.14, in which a response of 1 indicates "become much more negative" and a response of 5 indicates "become much more positive."

Table 6.13 Overall Workshop Evaluation

	More -ve				More +ve
Workshop Evaluation	**1**	**2**	**3**	**4**	**5**
What was your overall rating of the week?	0	0	3	7	29
Did you enjoy working in a group	1	1	1	12	24

Table 6.14 Attitude To Groups

	More -ve				More +ve
Groups	**1**	**2**	**3**	**4**	**5**
Change in Attitude to Groups	1	0	14	21	3

An interesting effect was the rapidity of transfer of knowledge built in one team to others. New ideas were incorporated rapidly, and it was observed that within the time span of the workshop, the students assimilated the full range of core skills, originally designed for delivery over an extended timeframe in the classroom, in material prepared by the Irish Software Engineering Research Centre. During the workshops, students were required on the final day to redevelop their applications from the very beginning. The speed with which such work was performed pointed to the genuine knowledge building that had occurred over the previous days. Thus, the first goal of the workshop model was achieved, and the participants did engage deeply in challenging problem solving and programming tasks. Furthermore, as shown in Table 6.13, the participants enjoyed the experience. This is an instance of what Papert referred to learning as “hard fun” (Papert, 1993). Table 6.14 suggests that participants responded very favourably to the emphasis on group work, which is too often missing from the school classroom, but is crucially important in the engineering profession.

The challenge for the teams involved significant computer programming. Programming is a much more complex task than most of the participants have engaged with on a computer before and it is an indicator of the overall success of the learning experience and the effectiveness of the Bridge21 model that the participants achieved a high level of self-efficacy. Furthermore, a new level of maturity in this self-assessment was evident, after engaging in a very challenging task that all to often at the undergraduate level results in students becoming somewhat discouraged if not disillusioned with programming.

The conclusion of the research based on these workshops is that the application Bridge21 model, in this context, with its emphasis on collaborative project work, creativity, problem solving, and programming using a visual programming language, is a potentially powerful way in which to introduce students to the reality of computer science (Tangney et al., 2010).

6.7.4 Development of Generalisable Skills - 21st Century Learning (21C) Skills.

There is good evidence from the data that participation in Bridge21 workshops facilitated the development of generalisable skills commonly referred to as 21st Century Learning skills including communication skills, working in teams, taking initiative, problem solving and being curious and imaginative (Wagner, 2014). Claxton's suggests that students should be enabled as 21st century explorers: adventurous, creating ideas, discussing with peers, questioning things, working with others, being active, imagining possible solutions, showing initiative, taking responsibility and self-evaluating (Claxton, 2002). The learning journey of the participants with Bridge21 demonstrates the development of many of these skills and attributes and 21C skills development is illustrated in seven emerging relevant themes: T27 Communications skills; T28 Working in teams; T29 Taking initiative; T30 Problem solving; T31 Being curious; T32 Being imaginative and creative and T33 Peer working.

Table 6.15 Themes and Sample Quotes Showing 21C Skills Development

Theme	Examples from Focus Groups and Questionnaires
T27 – Communications Skills	I learned a lot about a lot of people and about myself. It helped me with my communication skills. I gained a bit of confidence from speaking in front of others. I learned how to communicate with people, being separated from people I know wasn't so bad.
T28 – Working in Teams	I also learned that I can work in groups and be always positive and confident.
T29 – Taking Initiative	We need to control it ourselves and if we want to do well we have to learn it ourselves.
T30 – Problem Solving	I learned that even a very daunting task is achievable if you put your mind to it.
T31 – Being Curious	I loved doing all the projects, learning how to do new things
T32 – Being Imaginative and Creative	I enjoyed learning about computers and creating things. I learned how to be creative …
T33– Peer Working	You would open your mind more like. You would speak the ideas … more and talk …to your friend .. I learned how to share ideas …

Communications skills

Participants strongly referenced an improvement in their communications skills and cited examples of this in their dealings with others in their team and in presenting their work to the larger group. Participants linked this improvement in communications skills with a rise in self-confidence based on their work in the Bridge21 model. *"It improved my communication and socialising skills. It helped me face up to my fears of public speaking."*

Working in Teams

The theme related to the participant experience of working in teams (T22) was perhaps inevitable given the construct of the model and its insistent focus on teamwork. *"Because I learned a lot about teamwork when I wouldn't have liked to work in a team before."* However, what was less predicable was the ready adoption of the team model by the participants and their often-stated post-activity conviction that this is an effective way to learn. *"The whole experience was brand new, team building, growing with each other and individually. I've learned too much to put* *down."* Thus, the team working in Bridge21 may be viewed as delivering on this generally accepted cornerstone of 21C learning (Wagner, 2014).

Taking Initiative

Personal initiative is a common element of definitions of 21C learning (Trilling & Fadel, 2009; Ravitz et al, 2012) and is linked with a sense of personal responsibility and a responsibility to contribute for the team as described in theme T6 in section 8.2.2 above. Taking Initiative (T23) emerged as a strong theme in the post-activity data. Participants understood and responded to the need to 'step up to the plate' and act on their own impetus. *"So it is really about you thinking for yourself and you knowing what you want to do and doing ... things independently."* The paradox in the experience of the participants is revealed in their acceptance of the need for personal initiative as experienced in a model where the team promotes a collective responsibility. As one participant succinctly put it: *"I can work in a team and work independently."*

Problem Solving

The challenges typically presented to the teams in the implementation workshops required a substantial amount of problem solving. The problem-solving theme emerging (T24) is an important marker for 21C learning.

This problem solving took place in the context of the Bridge21 team being presented with a project to complete. The projects offered are designed to require the application of the talents and efforts of all the team members. The activity process required the team to: a. consider the challenge, b. make a plan, c. implement the solution with all its sub-tasks distributed among members, d. present the work and e. review the outcome as a team (cf. Activity Model Chapter 3). This classic plan-do-review cycle encouraged the development of problem solving skills across the team. The participants recognised this development and acknowledged it in their post-activity feedback. *"I had so much fun and learned lots of new skills that will help me in the future."*

Being Curious

Curiosity is an important attribute for a 21C learning explorer (Claxton, 2007) and stimulating learning curiosity is a key requirement for any model aspiring to deliver a 21C Learning experience. The Being Curious theme (T25) emerged from the post-activity and focus group statements of the participants where they were obviously engaged by the material that they were working on and pertinently for this work, by the learning journey facilitated by the Bridge21 model and the possibilities for learning in the future. "*You shouldn't be afraid to try new things"*. They spoke of new experiences and interests and a new personal educational horizon. *"I want to go to college even more now".* This theme of Being Curious and stimulating learning curiosity in participants clearly resonates with the capability of Bridge21 to encourage intrinsic student motivation as discussed in Section 7.5. Thus, Bridge21 can reasonably claim to foster the 21C learning attribute of curiosity.

Peer Working

The ability to work with and learn from peers, in a Vygotskian spirit of proximal development, is a principal component of 21C Learning (Trilling & Fadel, 2009). In expanding the learning circle to peers, the dependency on an adult to provide the answers through a didactic relationship is broken and the possibility of mutual learning is facilitated. *So, it's not all just book, focus on the teacher, take down notes. It's learning differently*. Participants strongly referenced how they learned with and from their peers:

"*With a friend, he knows something more than you about one thing, you might know something more than him about another thing and you can teach him that while he teaches you".*

It is evident that the team-based approach of Bridge21 presents a fertile field for 21C Learning requirement of Peer Working.

6.7.5 Bridge21 as a Candidate Model for 21st Century Learning

In summary, the case for Bridge21 as a candidate model for 21C learning raises on two pertinent questions: 1. Is the model pragmatic? and 2. Does the model deliver 21C learning?

In the foregoing sections, this work laid out the case for Bridge21 as a pragmatic model based on its practicality, ease of implementation, robustness and flexibility as demonstrated in a range of learning contexts.

The Bridge21 model has been shown to deliver on the development of generalisable skills, commonly featured in lists of 21st Century Learning skills and indications of the development of these skills emerges as strong themes in the data. These include: communications skills, working in teams, taking initiative, problem solving and being curious. Theses themes are summarised with sample quotes from the participant data in Table 6.15 above.

In addressing these two questions, this work reasonably claims that Bridge21 has been shown to be easily deliverable in a non-formal setting and pragmatic, well received by students in delivering on what is generally understood as key elements of 21C learning.

6.7.6 Summary of Discussion of the Case Study

The Exploratory Unit of the Case Study examined the Bridge21 model as it developed and raised themes that informed the refinement of the model. These themes were: (I) An increased sense of personal responsibility for learning and improved propensity to self-directed learning; (II) An improved attitude to technology and its place in their learning; (III) A positive response to the team experience and its role in their learning; (IV) Improved intrinsic student motivation; (V) Skills transference to the school and other learning contexts; (VI) A personally perceived gain in confidence.

These emerging themes informed relevant research questions for the Explanatory Unit of the Case Study which sought to test Bridge21's efficacy for 21C Learning.

The discussion of the results from the Explanatory Analysis Unit of the Case Study explored the evidence from the data that addressed the research questions:

RQ: What are the credentials of Bridge21 as a candidate model for 21st Century Learning?

> **Sub-RQ (a):** What is the effectiveness of the model in encouraging intrinsic student motivation?
>
> **Sub-RQ (b):** What is the effectiveness of the model in facilitating team-based, technology mediated learning?

The model has been examined in relation to its efficacy in encouraging intrinsic student motivation, its facilitation of team-based learning and its credentials as a 21st Century Learning model. Within the limitations of this study and in particular in the context of an out of school study in a specific context, it is clear that Bridge21 is effective in the key areas identified in the research questions and that the Case Study underlines the strength of Bridge21 as a model for 21st Century Learning.

Chapter 7 - Contribution and Conclusions

7.1 Introduction

The pursuit of 21st Century Learning presents significant challenges, and particularly finding learning models that will facilitate such learning. There is a strong demand on the education sector from economic and societal lobbies to develop learners with generalisable skills, rather than regurgitive knowers of information who can deliver to the test but cannot work collaboratively, problem solve or act creatively. Formal educational systems and practice struggle to comprehend let alone meet this demand (Voogt & Pelgrum, 2005, Fullan & Langworthy, 2013). This challenge is reflected in a dearth of implementable learning models for 21st Century Learning.

The main product and contribution of this thesis is the design and development of the Bridge21 learning model and its extensive testing. This model was developed through the work on the Bridge2College outreach initiative at Trinity College Dublin. This programme was built with the support of the Trinity Access Programme (TAP) and in partnership with Suas Educational Development (an NGO committed to social development through education).

The concluding chapter of this thesis supports the proposition that the research contributes to teaching and learning and to the field of technology and learning through the design and implementation of the Bridge21 model and seeks to summarise what was learned in this work. The chapter reflects on the findings in relation to the research questions addressed in the work to show the efficacy of the Bridge21 model and draws conclusions highlighting how this work and Bridge21 represents a contribution to learning and to practice in learning and to the use of technology in learning. The chapter goes on to examine the broader contributions of the work. Application of the Bridge21 model to different learning contexts and challenges and its numerous and varied implementations has stimulated a considerable catalogue of publications and conference papers with this researcher as lead author and also publications where this researcher worked in collaboration with other researchers. Other research with Bridge21 is examining how the model might be used to support varied subject disciplines in the secondary school curriculum, how the model might be deployed in school, how teachers and teaching might be developed with the model and how Bridge21 might assist in better integrating technology in formal learning. Additionally, the model is currently employed to support courses and learning at both second and third levels.

7.2 Research Questions

Research Questions were framed to explore the efficacy of the Bridge21 learning model in particular with reference to the important requirement to encourage intrinsic student motivation, its efficacy in team based, technology mediated learning and to explore Bridge21's credentials as a model for 21st Century Learning. The research questions were framed in the Exploratory Analysis Unit of the research and addressed in the Explanatory Analysis Unit as comprehended in single Case Study bounded by three successive academic years of implementation of the model. The research questions are as follows:

RQ: What are the credentials of Bridge21 as a candidate model for 21st Century Learning?

> **Sub-RQ (a):** What is the effectiveness of the model in encouraging intrinsic student motivation?
>
> **Sub-RQ (b):** What is the effectiveness of the model in facilitating team-based, technology mediated learning?

This work relies on these research questions to validate the Bridge21 model as a significant contribution in the field of technology and learning. The research questions have been evidentially addressed and the author argues that Bridge21 is an effective learning model and a material contribution to teaching and learning and to technology in learning and 21st Century Learning.

7.3 Contribution – The Bridge21 Learning Model

This thesis presents the Bridge21 learning model as its major contribution. The evidenced based approach, through the research and through peer reviewed publications has shown Bridge21 to be an effective learning model and it has also been shown to support and deliver 21st Century learning.

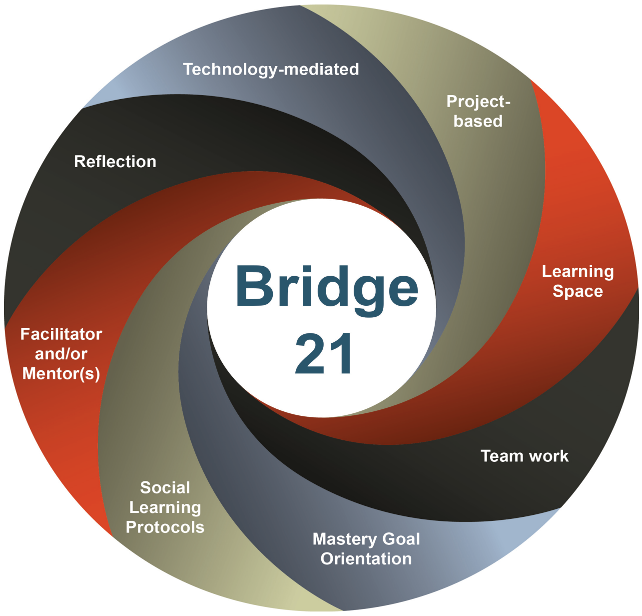
Bridge21 is an innovative learning model that is robust and flexible, has withstood examination by this researcher, and by other researchers in different learning contexts. The model has been well received by students and has been shown to have provided them with a personally enriching learning experience with a lasting effect. It is reasonable therefore to claim Bridge21 as a significant contribution to 21st Century Learning.

7.3.1 Design of the Bridge21 Learning Model

Bridge21 was designed and implemented based on a confidence and faith in a constructionist approach to learning and in the potential of team-based learning. The design of the Bridge21 model moved from the initial intuitive approach, informed by the author's experience, to the refined model informed by the literature and tested in the implementation.

The initial deployment was based on the non-formal educational experience and intuitive belief of the author that a team-based model could effectively deliver learning and that the use of technology in the learning could be successfully and effectively integrated through such a model. The design of Bridge21 was influenced by the constructionist educational ethos of the Centre for Research in IT in Education at Trinity College Dublin and drew heavily on the learning method of the World Scout Movement and a robust model was developed and refined and then consistently applied based on well-understood and previously applied principles catalogued in the literature. The integration of ICT in the learning was effected so as to be consistent with the team model and the technology was provided as a shared resource for the team. Paradoxically there is nothing new in Bridge21 but everything is new about the model in its systematic and consistent application of its elements in what could be called a 'jazz ensemble' of collaborative improvisation. Figure 7.1 presents once again the Bridge21 ensemble.

Figure 7.1 The Bridge21 Model



It is evident from the literature, as seen in Chapter 2, that there is a dearth of learning models that pragmatically support the principles of what is generally described as 21st Century Learning. While the ideas underpinning Bridge21 are common in other innovative learning interventions, the Bridge21 learning model is distinct in its approach and application. For example, there is clear consistency and parallels for the approach in Bridge21 with the ideas for self-directed learning behind Mitra's philosophy for Self-Organised Learning Environments (Mitra & Dangwal, 2010) while the Bridge21 deployment of structured teamwork is particular to the model.

Establishing the principles and theory for the model drew on the literature and experience of practice with successive implementations and subsequently the efficacy of the model has been demonstrated through large-scale implementations with second level students from many different schools over eight successive academic years.

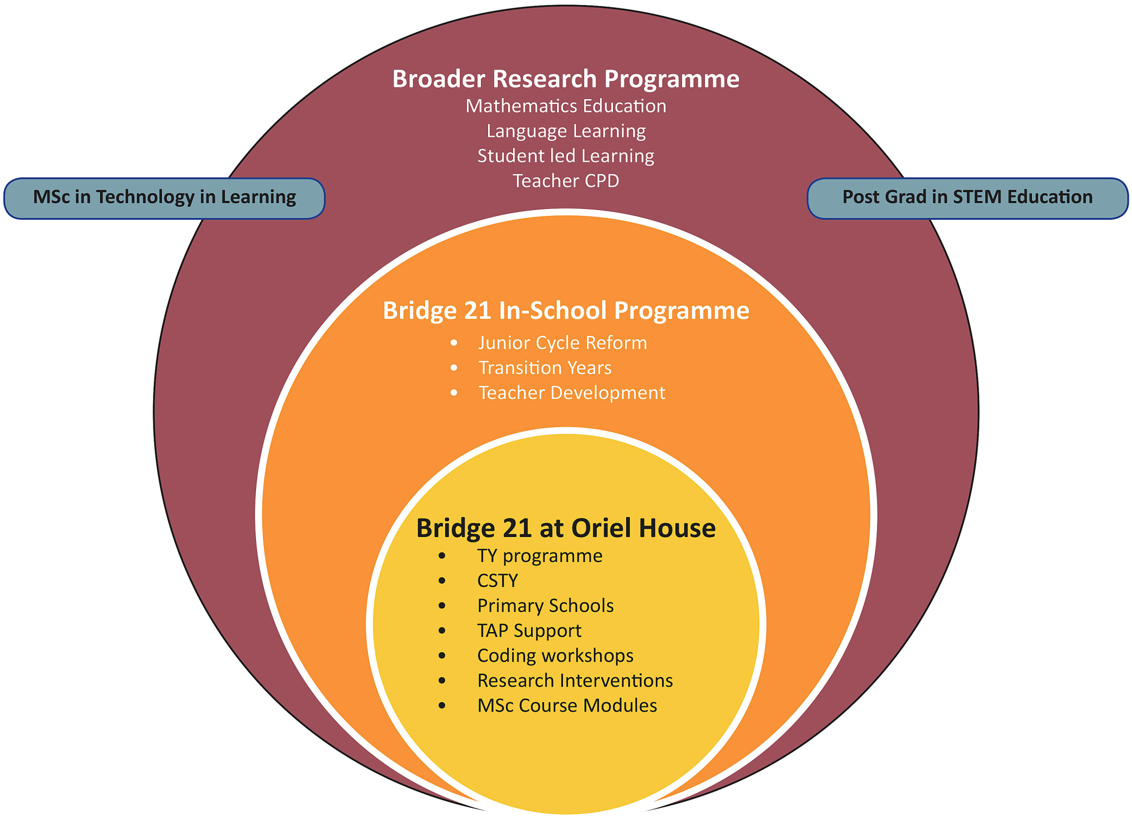
7.3.2 Implementation of the Model and its Impact

The implementation of Bridge21 was primarily as an educational intervention and initially as an outreach initiative with second level students. The research potential became apparent when the profound impact on the students became evident. The enthusiastic response of the students was readily apparent. Research on the impact of the Bridge21 model on the participants revealed the worth of the model is in its practical efficacy in achieving both general and specific learning goals. Skills were learned, attitudes were positively affected and educational horizons were raised.

The facility of the model to support a broad range of research projects emerged as the model matured and was tested in different contexts and against different learning challenges. The field of implementation of the Bridge21 model has extended to embrace in-schools' application and a broader research programme as illustrated in Figure 7.2 below.

It would not be unreasonable to describe what has evolved with Bridge21 as a vibrant learning community with typically positive and in many cases, extraordinary reactions from those who have been involved with the implementation, students, teachers and mentors, since its inception in 2007, as may be seen from the project blog: http://www.bridge21.ie/category/students/.

Figure 7.2 The Broader Field of Impact of Bridge21



7.4 Addressing the Research Questions – Efficacy and Impact of Bridge21

The research questions as informed by the work in the Exploratory Analysis Unit of the Case Study were explored in the subsequent Explanatory Analysis Unit of the Case Study. These questions sought to probe the effectiveness of the model in: encouraging intrinsic student motivation, facilitating team-based, technology mediated learning and Bridge21 as a candidate model for 21st Century Learning.

7.4.1 Bridge21 - Encouraging Intrinsic Student Motivation

The evidence from the data indicates a positive effect on participants' intrinsic motivation. The experience affected their perceptions of their relationship with learning: their sense of responsibility for their learning, their sense of mastery of skills, how they can learn, with and from their peers, their attitude to technology in their learning and their enjoyment of the learning experience. The students also showed an increased inclination to think and talk about their personal learning and their learning goals. These emerging themes map directly onto the accepted indicators for improved intrinsic motivation. The focus group interviews conducted at a time lapse of from 6 months to 3 years from their participation (depending on the student cohort) affirm the results from the data gathered at the end of the intervention and suggest a lasting positive memory of the programme and a significant residual effect on the student attitude to learning as a result of the programme. This study therefore indicates that the Bridge21 model of team-based, technology mediated learning as applied in an out of school environment is effective in stimulating intrinsic learner motivation. The model through its structured team-work approach offers a vehicle for the transfer of control of the learning from the teacher to the learner and in this facilitates the critical characteristics of learning necessary to encourage intrinsic motivation and in particular promoting student responsibility for the learning.

7.4.2 Bridge21 Facilitating Team-Based, Technology Mediated Learning

It is clear from the results that the team experience had a significant impact on the participants. While in the main this level and intensity of team working was new to them, it would be reasonable to conclude that the students saw the experience as energising, challenging and enjoyable. Bridge21 was explicitly designed to be reliant on a team-based approach to scaffold the learning experience. The design draws heavily on the learning method of the World Scout Movement and a robust model was developed and consistently applied based on well-understood and previously applied principles as described in the literature.

Results from both qualitative and quantitative data suggest that the team experience had a significant impact on the participants. While in the main this level and intensity of team working was new to them, it would be reasonable to conclude that the students found the experience to be energising, liberating in their learning, challenging and enjoyable. There is significant residual evidence (from the focus groups) that they also believe that they have grown and learned through the experience, that they will carry the learning to future work and that they have formed a positive view on the merits of working in teams.

The integration of ICT in the learning was applied on a resource-sharing basis so as to support and maintain the integrity of the team model. This approach to integrating ICT in the learning proposes an important cornerstone in the delivery of 21C learning.

The results show that the model and its focussed teamwork approach is a candidate vehicle for transference of ownership of the learning to the learners with evidence to suggest that, with this scaffolded approach, the teams and team members take responsibility for tasks and achievement for the team through combined personal contributions. The data also show that Bridge21 is a pragmatic model for effective 21C team-based learning with the potential to be of significant value in other learning contexts that seek to meet the challenge of promoting what is generally described as 21st Century Learning.

7.5 Impact on Participating Schools

This programme required the building of a close partnership and establishing trust and confidence with the teachers and principals in the schools concerned. The impact of the contact with Bridge21 for participating schools is worthy of research but beyond the scope of this work. It is notable that a number of the original participating schools in the original outreach programme have made substantive changes in their approach and practice, including in one example, the deployment of a student designed Bridge21 influenced learning environment. The longer-term impact of the outreach programme on particular students would merit examination beyond the scope of this work.

7.5.1 Effective in Furthering Outreach

Bridge21 was first developed and implemented in the context of Trinity College Dublin’s ‘Bridge to College’ outreach programme in association with the Trinity Access Programme. In this programme, the model provided a cornerstone and method for assisting in raising the educational horizons of children from schools in areas of disadvantage. In particular, the model was shown to be effective in improving student propensity to seek Third Level Learning. The potential for the

Bridge21 as a learning model that could address broader educational challenges became evident and merited further exploration and research.

7.5.2 In-School Programme

The reaction of students to their experience of engagement with Bridge21 on the university campus at Oriel house has provided a basis to get school leaders to agree to commit to an extensive in-school programme. This programme involves Junior Cycle (1st and 2nd year students) and transition year students and also involves teacher development, changes in learning space and changes to practice. The programme is currently in progress and is the subject of parallel research described in Section 7.8.

7.6 Limitations and Self-Critique

This work represents an overview of the implementation of the Bridge21 model over three successive academic years and confines itself to examination of data from those years only. The model has been implemented for eight consecutive years and a broader study could add to understanding and insight in its impact.

This work does not provide for any control group or 'placebo' and so the case must stand on its own merits. It can be argued that the overwhelmingly positive reaction of the participating students to their experience with Bridge21 would suggest that caution and deeper insight is required to understand the reasons and factors that might explain this enthusiastic response. A further study could try to elucidate any such causal factors.

The author designed the model based on deep personal convictions and experience with team-based learning. Maintaining researcher objectivity, against this personal belief in the method, is a challenge that I have worked to address in this thesis. The objective consideration of peers will be the test of success in this struggle against any personal bias.

7.7 Reflection on my Learning Journey

This section represents my personal reflection on my learning journey in this work and adopts a personal writing style that is distinct from the rest of the thesis. The learning journey that I travelled in pursuing the work in thesis was personally challenging, complex and diverse. I commenced that journey with convictions based on life experience and some academic formation. I believe that I have learned a great deal in the process of this work about how I work, how my personality and biases affect my choices in research and I believe that I have developed new skills in research methodology, a greater discipline and skill in how I write academically and a deeper understanding of mixed methods research.

My Writing Style

My personality is extrovert and my communications inclination in writing and in presentation is to tell a story and that style has served me well throughout my career and particularly with my commercial business career. My writing style reflected this personal allegorical inclination and in some measure lacked the discipline required for academic writing. I believe that I improved my writing through the guidance of my supervisor, working with coauthors and meeting the requirements of reviewers on papers that were subsequently published. However, the old habits die hard and a recent reviewer took me to task for using non-scientific phrases like 'light touch guidance', 'no blame no shame basis' and 'sink or swim approach'. The process of preparing this thesis has given me more discipline in writing but I suspect the weakness for colourful and perhaps overly rhetorical statements will always be there.

Scouts and Scouting

The Scout educational method is a structured approach to learning in which I've been immersed since I was eleven years old. I therefore came to academic work with a lifetime experience and training in this method and more pertinently a belief in its power and efficacy in developing young people. There is a paucity of academic work on the Scout Method and this is in itself remarkable, given the global impact of the Scout movement over the last one hundred years. My learning in this work was therefore also an exploration and testing through formal research of what I believed to true about the efficacy of Scout method and its potential in broader learning.

How young people learn

In the course of my work for my Master degree in technology and learning I was introduced to theories and ideas in constructivism, constructionism, technology and learning and how young people learn. These ideas challenged and in some ways affirmed what I believed through my work and experience in non-formal learning. My research in this thesis confirmed for me the power of collaborative working, constructionism and particularly teamwork in new learning contexts. It is also apparent to me from the research that the integration of technology in learning requires an alignment with the underlying pedagogy as has been suggested by Conole et al. and Fullan and Langworthy (Conole et al, 2004; Fullan & Langworthy, 2013).

Learning space

My approach was guided by a personal belief in the power of teamwork. A key element for this was a conviction that learning space was important to effective teamwork. I first saw this as a young Scout sitting in what was called a 'patrol corner' with a group of my peers. The corner was modest and formed with two benches, a small table and a pegboard for charts and notices. We were given to understand that this was our space and that the team/patrol had a measure of privacy to conduct its business. This work gave me the opportunity to research my belief in the importance of team learning space in a broader learning context. The process of the research deepened my understanding of importance of facilitating the team with dedicated, customised, learning space. It is an area of study that I would wish to explore further.

The approach to mentoring employed

In shaping the original pilot programme for Bridge2College later to become Bridge21, I proposed an approach to mentoring that sought to empower rather than direct the learner. Common approaches to mentoring with young involve one-to-one coaching where the mentor guides the learner with a close 'hands on' interaction. My belief and instinct was that a 'stand off' guide to the team would be more effective for the Bridge21 team-based model. This belief was affirmed in practice and follows the theory posited by Mitra for Schools in the Cloud and the use of encouraging Grannies in Self Organised Learning Environments (SOLEs) (Mitra, 2015). This for me was an example of moving from the intuitive to the informed by confirming my belief with literature and research in practice.

Interaction with colleagues

My learning journey in this work was travelled with generous and knowledgeable colleagues who contributed to, and where it was needed challenged my thinking. I drew confidence and support from these interactions and listening to those with greater expertise helped guide my research and will inform my future approach to academic work. I know from this work that I am comfortable working collaboratively in an academic context and draw energy and inspiration from these interactions.

Research Method

Much of my career and undergraduate education has been in the positivist disciplines of telecommunications engineering, computer science and mathematics. However, my personality is opposite to this training and is inclined to seek meaning and to accommodate the intuitive and to seek to describe a phenomenon as a picture or story rather than rely on stark evidential or quantitative data. This inclined me to apply a qualitative lead in the mixed methods research with the quantative data supporting in a very simple way. This qualitative inclination or bias was also encouraged in my Masters course. It is apparent to me that a greater rigor in the preparation of data instruments and more depth in the quantitative study could have shed further light on the experience of the participant and I will take that learning forward to any future research in which I'm engaged.

Imposing structure in retrospect on the research method employed was a major challenge in this work and locating the research in a method that best described it post-event was not the optimal approach. It is evident that I was dealing with a case study with clear boundaries and context and should have defined it as such earlier in the research. Additionally, the Design Based Research approach is well suited to the development of a learning model and I could have usefully structured the research to this approach had I come across it earlier in my work. In summary, I would invest careful prior consideration of research method in future work.

Learning Objectivity – 'the results were too good'

It became apparent from the early stages of the implementation and research that the response from the participants was particularly positive. This was of course encouraging but raised an understandable level of skepticism, suggesting that perhaps the results were too good and that factors other than the efficacy of the learning model might be at play. Given my role in designing and promoting the model, my natural response was to be defensive and insist on the veracity of the emerging results. This is not the ideal stance of the objective researcher and I struggled to maintain neutrality in consideration of the data. I do, of course, believe in the Bridge21 model and its efficacy and robustness has been shown in different learning contexts and by other researchers with greater skill in analysis than me. The involvement of other researchers and colleagues helped maintain balance in consideration of results and I take personal learning from the discipline of objective investigation of phenomena and emerging data.

Learning from Young People

I believe that at the heart of effective learning is a respect for the learner. This personal belief was reinforced and affirmed by my study and consideration of the ideas of great educational reformers such as Dewey, Montessori, Vygotsky, Piaget and Freire. I formed a view that there were two polar opposite approaches to teaching and learning with young people. One is based on policing and control and the other is founded on building trust and responsibility. Setting aside the justice and humane arguments, I believe that a system that seeks to build personal responsibility for learning and in the process grow the learner is fated to be more effective. In truth, I learned much from the young people engaged in this project and treating young people with respect as co-learners has long been a cornerstone of my personal values. I will take this belief and value with me in all future work in this field.

Summary Reflection

This work is in some sense the culmination of a 30-year learning journey for me that commenced as a 31year old undergraduate student in Computer Science. When I first engaged with third level study I was concerned that I would find myself out of my depth academically and without doubt, in my undergraduate study, I was personally stretched to comprehend the technical and mathematical concepts involved in a science degree but I got through. The successive academic challenges that I've undertaken since and including this work carried the same challenge and concern that I would push beyond my personal ability. I've learned that commitment and effort and an openness to listen and to seek help from colleagues works for me and has helped surmount significant academic hurdles in this work.

In undertaking postgraduate study, I wanted to integrate my personal interest and ideas for working with young people with the information technology background from my career and undergraduate study. I believe that this was a significant and positive decision for me and played to my personal strengths. During my business career I worked for a time as IT manager in a large company and I believe that I was most effective when seeking to interpret the requirements of business to the technical people and also in explaining the possibilities of technical solutions to those in the business areas. I believe that this personal experience in interpreting the use of technology in a human context helped shape my thinking about technology and provided a valuable background for my work in the Centre for Research in IT in Education at TCD and a marker for the work that followed with Bridge21.

The work for this thesis affirmed my belief in the power of technology in learning when implemented in an effective pedagogical context that empowers the learner. I believe that I can be most effective when working in such contexts.

7.8 As a Platform for Other Research and Educational Development

The Bridge21 model has featured centrally in a wide range of post-graduate research work at Masters, Doctoral and Post-Doctoral levels and contributes to post-graduate studies. The model is also being deployed in the professional development of teachers. This work includes:

(1) M.Sc. (Technology & Learning), Centre for Research in IT in Education, Trinity College Dublin

(2) Postgraduate certificate in 21st century STEM education for practising teachers, School of Education, Trinity College Dublin

(3) Bridge21 in Schools, C. Conneely - Ph.D. Candidate

(4) Bridge21 and Mathematics Education, A. Bray - Ph.D. Candidate

(5) Bridge21 and English, S. Kearney - Ph.D. Candidate

(6) Bridge21 for use in Computer Science CPD for teachers, L. Fisher - Ph.D. Candidate

(7) Bridge21 and History Education, Dr D. O'Donovan – Post.Doc.

(8) [Computer Science and STEM CPD for teachers (Bridge 21 Project), Dr J.R. Byrne

The research in this thesis and the other research cited here related to and referencing Bridge21 has contributed to academic discourse in the field of learning and in technology in learning and has provided a large and growing canon of published literature by this author and others:

(Bauer, Devitt & Tangney, 2015; Bray & O'Donovan, 2015; Bray, Oldham & Tangney, 2015; Bray & Tangney, 2014; Bray & Tangney, 2015; Byrne, Fisher & Tangney, 2015a; Byrne, Fisher & Tangney, 2015b; Conneely, Girvan, Lawlor & Tangney, 2015; Conneely, Girvan & Tangney, 2012; Conneely et al., 2013; Girvan, 2015; Lawlor et al., 2010; Lawlor et al., 2015a; Lawlor et al., 2015b; Tangney & Bray, 2013; Tangney et al., 2010). Abstracts from a selection of these papers may be seen in Appendix 5.

Additionally, the work at Bridge to College and the development of the Bridge21 model has attracted research interest from a number of academic partners including:

- National Council for Curriculum & Assessment
- School of Education, Trinity College Dublin
- Task Furniture in Education (TFE) Research at the National College of Art & Design
- Centre for Research in IT in Education, Trinity College Dublin

7.9 The Potential for Further Development and Implementation

This work presents and seeks to validate the Bridge21 learning model as implemented over a specific period covering three academic years: 2007-2008, 2008-2009, 2009-2010. Clear opportunities for further research arise and indeed further research beyond this work is currently in progress.

7.9.1 Potential for Longitudinal Study

A further longitudinal study that would look at the residual impact on students of engagement with the Bridge21 model would provide additional insight into the effectiveness of the learning method. Such a study could look at the individual learning journey of selected students. This could consider how students take forward the learning from Bridge21 to their lives after school and in particular in relation to any Third level experience and employment experience.

7.9.2 Potential to Explore Effectiveness against Formal Curriculum and In-School

The effectiveness of the Bridge21 model in tackling learning material from the formal curriculum and in an in-school context would be particularly interesting as this could provide an insight in how formal practice in schools could be changed. Some valuable research has already been undertaken in this area and how this model could be applied against the formal curriculum and in an in-school context is the focus of current research as detailed in Section 7.8 above (Johnston, Conneely, Murchan, & Tangney, 2012). The issue of developing teachers to work with the model arises in this context and research on this change programme would be interesting and is also currently in progress.

7.9.3 Potential to Explore Effectiveness with Primary School Children

This work focussed exclusively on how second level students experienced learning with Bridge21. There is clear potential to implement and explore the effectiveness of the model with primary school children and some implementation with children in this age range has already taken place.

7.9.4 Potential to Explore the Potential of the Model Beyond an Irish Context

This work sought to validate the Bridge21 model working with Irish children who experience their learning in a cultural and systemic context particular to Ireland. It would be interesting to see how effective or implementable the model would be in other national or cultural contexts and perhaps particularly in the developing world where it could help address resource challenges.

7.10 Acknowledgement of Partner Agencies

Bridge21 is a product of an extensive programme that required the support and partnership of a number of agencies including the Centre for Research in IT in Education at Trinity College Dublin, The Trinity Access Programme and Suas Educational Development. The author is grateful to each of these agencies for the faith and trust that allowed the development to occur. Additionally, the commitment of the people who worked with the model was crucial to the success of the programme.

7.10.1 The People – Mentors and Teachers

The Bridge21 model requires that the adults who work with the students adopt a supportive and 'hands off' approach and respect the integrity of the team system. The unique relationship between the learners and the mentors is a definitive characteristic of the model. The Bridge to College programme is fortunate to attract an amazing cohort of dedicated and committed volunteer mentors. Many of these are undergraduate and post-graduate students from a wide variety of disciplines and they are mixed with volunteers who come from life outside the academic context. The common characteristics among these mentors include their remarkable commitment to working with young people and an understanding and belief in the Bridge21 model. It is particularly gratifying to find many of the young people who experienced the Bridge21 model as second level students returning as mentors when they reach college.

The schools participating in the programme have spirited and talented teachers and leaders who were prepared to set aside norms, systems and practice to facilitate giving their students the opportunity to experience Bridge21.

7.11 Conclusion

Bridge21 is a learning model that has been shown to be effective, flexible and robust in its implementation as a model for team-based technology mediated learning and to offer potential as a model for 21st Century Learning.

The Bridge21 model is built on a highly structured instantiation of team-based learning and the team experience has been shown to make a significant impact on the participants. For the majority of the participants, this level and intensity of team working, either in or out of school, was a new experience and it would be reasonable to conclude, from the findings, that the students generally saw the experience as energising, challenging and enjoyable.

The reaction to Bridge21 was generally very positive and while different for different students, many demonstrated creativity, initiative, collaborative working, peer learning, leadership, meta-cognitive reflection on learning and a general lift in educational horizons.

The use of technology in the learning with the Bridge21 model has been shown to be effective and attuned to how technology is used by young people in their social lives and outside formal learning and consistent with a constructionist approach in pedagogy. Its use in the Bridge21 model may be said to be integral to the model but not dominant.

There is significant evidence, through the young people's personal reflections, that they believe that they have assimilated new learning and confidence through their engagement with Bridge21, that they have developed personally through the experience and that they will carry the learning to future work.

The results show that the model is an effective vehicle for supporting the transference of ownership of learning to the learners and in promoting a sense of personal responsibility for learning. These results suggest that Bridge21 has the potential to be of significant value in influencing how formal learning will meet the challenge of promoting an environment conducive to engaged learning as envisaged in the generally understood requirements for 21st Century learning.

Bridge21 has excited and facilitated work by other researchers and in this, the model has provided a flexible and robust scaffold for investigation and development in learning. It is clear that there is much potential for further research and for learning with and through the Bridge21 model.

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APPENDICES

Appendix 1 Instruments

Pre-questionnaire

BRIDGE 21

Questionnaire 1

This questionnaire is intended to find out information about your background in computers and your plans for future study and work. The information will help us to plan appropriately during the course and also to improve the course in the future.

All information is confidential. The contact information is requested only to allow for follow-up later on.

Background Information

1. Name:
2. Email address:
3. Age:
4. Mobile Phone number:
5. Gender: Male Female (Please circle the correct answer.)
6. School:

For the following questions, please circle your chosen answers.

7. What result did you get in Junior Certificate Maths?
   a) Level: Higher Ordinary Foundation
   b) Grade: A B C D E F NG

8. What result do you expect to get in Leaving Certificate Maths?
   a) Level: Higher Ordinary Foundation
   b) Grade band: A B C D E F NG

9. Have you attended a workshop here in the Bridge 2 College before? Yes No

Computer Use and Skills

10. Do you have access to a computer at home? Please circle: Yes No

If yes, is it (please circle): For your own use only Shared

11. Which of the following types of software have you been taught how to use in school and which do you use at least once a month? (Please tick all that apply.)

Piece of software	Taught in school	Use at least once a month (in home or school)
a. Word processor, e.g. Word		
b. Email		
c. Presentation software, e.g. PowerPoint		
d. Spreadsheet, e.g. Excel		
e. Database, e.g. Access		
f. Web authoring, e.g. Dreamweaver		
g. Multimedia applications, e.g. Moviemaker, iPhoto, Photoshop, etc.		

12. When using a computer *during the past week*, how much time did you spend on the following activities? (Please tick one box in each line. If you did not use a computer last week, tick "None" in each case.)

	None	Less than 1 hour	Between 1 and 5 hours	More than 5 hours
a. Visiting social networking sites (Bebo etc.)				
b. Email/Instant messaging				
c. Playing computer games				
d. Downloading music or videos				
e. Doing homework				
f. Searching for information (not homework related)				
g. Developing websites				
h. Writing computer programs				

13. Respond to each of the following statements by choosing numbers on a scale from 1 to 5, where 1 means you *strongly disagree* with the statement and 5 means you *strongly agree*. (In each line, please circle the number that most closely matches your opinion.)

Statement	1	2	3	4	5
a. I enjoy working with computers	1	2	3	4	5
b. I often have difficulties when trying to learn how to use a new computer package	1	2	3	4	5
c. I am very confident in my ability to use computers	1	2	3	4	5
d. Computers are far too complicated for me	1	2	3	4	5
e. I find working with computers very easy	1	2	3	4	5
f. As far as computers go, I feel less competent than my classmates	1	2	3	4	5
g. I usually find it easy to learn how to use a new software package	1	2	3	4	5
h. Computers frighten me	1	2	3	4	5
i. I consider myself a more skilled computer user than most of my classmates	1	2	3	4	5
j. I am very unsure of my ability to use computers	1	2	3	4	5
k. I think I could be a good computer programmer	1	2	3	4	5
l. Computer programming is too difficult a topic for me	1	2	3	4	5

14. Do you have any knowledge as to how to program a computer?

Please circle: Yes No

15. If you have answered "yes" to question 14, then specify which computer languages you know, indicating your level of competence. (Please tick one response for each language listed.)

Language	No knowledge	Some knowledge	Good knowledge
Java			
C			
C++			
Scratch			
HTML			
Other (please specify)			

Plans for Study at Third Level (University or College)

16. Do you hope to study at Third level (university or college)? Please circle:

Definitely Considering it Definitely Not

17. Has anyone in your immediate family (parents, siblings {brothers or sisters}) attended, or is anyone currently attending, Third level? (Please tick where relevant in the table below.)

If so, what area did they study / are they studying? (Please state the area, if known.)

Family member	Attended/attending Third level	Area studied/studying
a. Mother		
b. Father		
c. Sibling 1		
d. Sibling 2		
e. Sibling 3		
f. Other		

If you definitely do not intend to study at Third level, please skip to question 23.

18. Are you considering doing a Computer Science related course at Third level? Please circle:

Yes No Undecided

19. If you have answered "yes" to question 18 then please give your reasons for intending to study Computer Science.

20. If you have answered "no" to question 18 then please give your reasons for not intending to study Computer Science.

21. List up to 5 subject areas (in order of preference) you are considering studying at Third level.
    a. ____
    b. ____
    c. ____
    d. ____
    e. ____

22. What are your main motivations in choosing a Third level course to study? 1 indicates not very important, 5 indicates very important. (Please circle one number in each line.)

Reasons for choosing course	**1**	**2**	**3**	**4**	**5**
a. Ease of getting a job	1	2	3	4	5
b. Salary	1	2	3	4	5
c. Choosing a career which will allow me to help others	1	2	3	4	5
d. Would like to be self employed	1	2	3	4	5
e. Would like to run my own company	1	2	3	4	5
f. Interest in the area/topic	1	2	3	4	5
g. Opportunities for travel	1	2	3	4	5
h. Other (please specify)	1	2	3	4	5

23. Is there anyone who has inspired you with an interest in computing? Yes No
    If yes, please circle each that applies

Mother	Father	Sister	Brother
Friend	Relation	Famous person	Other

24. What do you think a university course in computer science involves? Please tick one response for each activity.

Activity	Not relevant	Somewhat relevant	Very relevant
a Doing a lot of mathematics			
b Spending a lot of time programming			
c Learning different programming languages			
d Working in groups			
e Being creative			
f Solving problems			
g Learning how to communicate			
h Designing computer games			
i Spending a year abroad			

And Finally…

25. What are your views on Computer Science (CS) as a profession? Rate each item on a 1-5 scale by circling the appropriate number, where 1 means not at all and 5 means to a very large degree.

Statement	1	2	3	4	5
a. CS is creative	1	2	3	4	5
b. CS is competitive	1	2	3	4	5
c. CS is interesting	1	2	3	4	5
d. CS is difficult	1	2	3	4	5
e. CS is well-paid	1	2	3	4	5
f. CS is prestigious	1	2	3	4	5
g. CS offers one the opportunity to engage in a variety of fields	1	2	3	4	5
h. CS demands that one engages in computer programming	1	2	3	4	5
i. CS involves working in a team	1	2	3	4	5
j. CS involves problem solving	1	2	3	4	5
k. CS involves doing a lot of mathematics	1	2	3	4	5
l. CS involves being useful to other people	1	2	3	4	5

Thank you for completing this questionnaire.

Post-questionnaire

Name

School

1. Overall, how would you rate your experience at the Bridge to College (B2C) programme?

Excellent	Good	Average	Fair	Poor
☐	☐	☐	☐	☐

Why do you feel this way?

2. **Three** things I learned about myself and how I learn during the B2C programme…

1.

2.

3.

3. **Three** things I learned about college during the B2C programme…

1.

2.

3.

4. Do you hope to go to Third level (university or college) after school?

Definitely not	Considering it	Definitely
☐	☐	☐

5. Has the B2C programme impacted on you in any of the following ways?

	Strongly disagree	**Disagree**	**Unsure**	**Agree**	**Strongly agree**
Taught me things about college that I didn't know					
Made me feel that going to college is achievable					
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 skills					
Increased my independence					

6. Any other comments?

__Thank you for taking the time to complete this questionnaire__

Focus Group Interview Structure – Students

Overall Research Questions:

1. Is teamwork a strong contributor to the learning experience?
2. Is there evidence of improved acceptance of personal responsibility for learning?
3. Is there a lasting impact to participation in the B2C model?
4. Is the model transferable to a formal learning context?

Research Questions to be addressed through student interviews:

1. What are the residual impacts of the B2C Programme on Participants?
   a. Did participation in the programme have a lasting effect on their attitude to learning?
   b. Did they learn skills that they still have?
      i. Technical Skills
      ii. Team Skills
   c. Did they use the skills learned anywhere else?
      i. In School
      ii. Out of school
2. Was the teamwork a significant factor for them?

Introduction & Explanation & Housekeeping

The B2C programme that you participated in during your Transition Year is a learning programme for young people, implemented in partnership between the Trinity Access Programmes and the Centre for Research in IT in Education at Trinity College, University of Dublin and Suas Educational Development. Research is currently being undertaken by the B2C programme staff, John Lawlor and Claire Conneely, to determine the effectiveness of the programme and the impact it has had on its participants.

The interview will be audio-recorded and later transcribed. All information collected will be anonymised (all names will be removed) and stored in Trinity College. Lectures, PhD theses, conference presentations or peer-reviewed journal articles may be written as a result of this research; however you will not be identified.

To take part in the research you must complete and return a **Student Consent Form** which we are giving you now and a **Parent Consent form** which we will give you to take home. Your participation is voluntary and you can change your mind about participating in the research at any time – in that case we will not use any information already collected about you.

If you have any questions, please do not hesitate to ask your teacher, John or Claire.

We need you to be absolutely honest and not to say what you think we might want to hear but to say what you really think.

Interview Questions

Introductory Questions

- When did you participate in the Bridge to College programme?
- What did you think was good about your experience at the Bridge to College?
- What did you think was bad?
- What can you remember as the best thing?
- What can you remember as the worst thing?

Main Questions

- Did participation in the programme have a lasting effect on your attitude to learning?
- What do you think about the experience of working in teams at the Bridge to College?
- What skills did you learn at the Bridge to College?
- What did you do with the skills you learned? - in school -out of school
- What is the difference between the Bridge to College and school?
    - How is the learning different?

Follow-up Questions

- What was your previous experience of working in teams? Can you give any examples
- Have you worked in any other teams since the Bridge to College?
    - If Yes– What was that?
    - How did that experience compare with the Bridge to College?
    - Do you think your experience at Bridge to College helped? How did it help?
- Did you work hard on the programme?

Probes

- How did it affect you? Can you give a real example?
- Tell me how you personally think about your learning? Did your thinking change because of the Bridge to College.
- When you went back to school what had changed for you? Can you give an example?
- If you were working hard – why was it fun?
    - Was it because of who you were with?
    - Was it what you were doing?
    - Was it because of where you were?
    - Were there other reasons?

Sample Focus Group Transcript Extract

(JL is the author and CC is assisting researcher)

JL: Intro

JL: Now. The first question is fairly easy. When did you participate in the B2C programme? K

Student K: I participated in the B2C programme before Christmas. With D (School).

JL: Ok so that was Christmas 2009.

Student K: Yes.

JL: Is that right?

CC: That's right.

JL: Christmas 2009. J you're the same? And A?

?: Yeah.

?: Yeah.

JL: All in the same group. Excellent.

CC: Were you all in the same week actually?

Student K: No. I was the second week.

CC: Ok, and you were the first.

Student A: J and I were in the first week.

CC: Ok.

JL: Ok. A maybe you'd kick me off. What did you think was good about your experience in the B2C?

Student A: I thought the fact that we work in teams was great because the formalised way of education was left at the door and we all just got into teams and settled down to work with every task that we were given. So I thought that was great.

JL: J, what did you think was good about your experience at B2C?

Student J: I thought the teams were great like cos whatever way we were given something to do, whether it was hard or easy, we'd all have to chip in and put it together which made it like much easier for us. But also like, we learned in different ways. Like we were dealing with computers, we learned how to make films by just using the camera and it was just, it was just really good.

JL: K, anything you thought was good?

Student K: Yeah. I thought working in groups and meeting new people. But the way I remember it more by interacting with people and doing it, like physically working instead of just reading books and trying to remember things. It was better, the way we learned.

CC: You liked that it was kind of hands on..

Student K: Yeah.

CC: and active. Yeah.

JL: So you were doing stuff.

Student K: I was.

JL: Ok. K, is there anything you thought was bad about the experience?

Student K: There was some days in the group where people would be just like zoned out and too tired.

JL: In your own group?

K: In my group.

JL: They were zoned out.

Student K: Yeah. Just didn't want to pay attention at all.

JL: Yeah.

Student K: But then you just had to figure a way around them and to try work with the other people who wanted to work.

JL: How did the team deal with that?

Student K: Well we'd try give them something that wasn't as hard, that they'd just enjoy doing and then they done it.

Appendix 2 Activities

Workshop Activity - GROUP PRESENTATION SCRATCH

<u>Time allowed:</u> 5 - 10 mins

<u>Content:</u>

Introduce yourselves!	Team name: Members:
Positives... • What did you like about scratch? • What did you like about the Wiimote Whiteboard?	
Negatives... • What did you not like about scratch? • What did you not like about the Wiimote Whiteboard?	
Teamwork • What were the key achievements for the team this week? • What problems/challenges did the team face this week?	

How have your perceptions changed this week (in relation to computers, programming, college, learning etc.)?	
Demo and talk through the details of your scratch project(s). *Invite members of the audience up to play your game* ☺	
Conclusion & Thank You Any last comments...!	

Workshop Activity Movie Making

Team Roles for Campaign

- Director: Has the artistic/ creative vision of how film should look.
- Producer: Delegates tasks to different members of team.
- Script writers: Write script-decide what happens in film etc.
- Researchers: Finds and pulls together interesting material and information
- Camera person: Follows directors instruction on camera shots and is responsible for handling camera altogether (don't break it!☺)
- Props: Finds & handles all props necessary for the shoot.
- Editor: Determines final look of film. Handle editing suite and work with the director and producer in deciding what shots stay in the film and what is cut.
- Actors: Act.
- Lighting: Makes sure lighting is good for shots (e.g. whether too dark/too bright etc.)
- Sound: Makes sure sound of actors is clear (e.g. that no trucks or buses are passing during dialogue!)
- Hair & Make-up: Works on actors to help them into their characters
- Wardrobe: Similar to props-finds and handles all costumes needed. Advises/provides actors with appropriate costumes.

Role	Name
Campaign Manager	
TV Ad Editor	
Radio Ad Editor	
Poster Ad Editor	
Creative Director	
Scriptwriters (x2)	
Researchers (x2)	
Radio presenter(s)	
Actor(s)	
Artist(s)	

Appendix 3 Ethics and Permissions

Title of Project:

Bridge2College

Purpose of project (including academic rationale):

The Bridge2College is a joint research initiative between Trinity College's Centre for Research in IT in Education and the Trinity Access Programmes and Suas Educational Development. The principal investigator is Brendan Tangney and the project leader is John Lawlor.

The project seeks to address the problem of the lack of a pragmatic model for classroom practice that leverages the learning advantages of teamwork and technology. The research tracks the iterative development and implementation of a model for team-based technology-mediated learning using a pragmatic methodology. In particular, the project aims to examine the efficacy of the model in a number of formal learning contexts. These include out-of-school outreach workshops – the **Bridge2College** programme – and in secondary school classrooms – the **Bridge21** programme.

Brief description of methods and measurements:

The participant set for this research project consists of students, teachers and school management teams. The data collection methods are as follows:

Students will take part in learning activities based on teamwork and multimedia technology (PC computers, laptops, digital cameras, music recording equipment)

Teachers will take part in training & subject-planning activities based on teamwork and multimedia technology (PC computers, laptops, digital cameras, music recording equipment)

All participants will be asked to complete pre and post-questionnaires which will inform semi-structured interviews.

A random sample of students & teachers will be observed during classroom activities using observation protocols, cameras and audiovisual equipment.
A random sample of participants will take part in semi-structured interviews which will need to be audio recorded for later qualitative analysis.
Data will be anonymised and treated using standard quantitative and qualitative techniques

Participants:

Participants will be recruited from schools who have given the research team permission to conduct the research project, obtained through the Board of Management and school principal.

For the **Bridge2College** (out-of-school outreach) programme students will be selected by their teachers and the research team. Both parental and student consent to take part in the research will be required to include each student in the data collection activities described above. The students will be drawn from primary school (ages 5-12) and secondary school (ages 12-18). To enable generalisations to be drawn the research will take place in at least 20 schools of varying demographics and gender mix.

For the **Bridge21** (classroom/in-school) programme, teachers will take part in the training activities on a voluntary basis and will give their consent to participate in the research. All students in participating teachers' classes will be involved in the learning activities as part of their normal school curriculum day. However, both parental and child consent to take part in the research will be required to include an individual student in the data collection activities. The students will be drawn from primary school (ages 5-12) and secondary school (ages 12-18). To enable generalisations to be drawn the research will take place in at least 20 schools of varying demographics and gender mix.

As part of this research involves the use of computers by participants, individuals with epilepsy cannot take part.

Debriefing Arrangements:

Debriefing will take place following the post-questionnaires at which stage the participants will be encouraged to ask any questions and raise concerns. Further debriefing will take place with the random sample of participants who participate in semi-structured interviews.

Following analysis of the data, students, parents, teachers, and members of the board of management of each school will be informed of the outcomes of the project.

Statement of ethical considerations

The research project will take place as part of the normal school day. The **Bridge2College programme** will take place in a specifically designed TCD premises and the **Bridge21 programme** will take place in participants' schools.

All **Bridge2College programme** activities have been planned and designed to be of educational benefit to students and teachers, particularly in relation to the acquisition of 21st century learning skills and technical skill development. Before commencement of the project, it will be necessary to obtain permission from students, teachers, school principal and board of management. As they are under the age of 18, students will also require parental consent in order to take part in the project. Parents will be contacted through the school with details of the project and its possible consequences.

The **Bridge21** in-school programme activities will be directly relevant to curriculum requirements. Teachers will participate in the programme on a voluntary basis and the research team will assist the teacher in designing learning activities relevant to their subject area. All students in a participating class will take part in the learning activities. However, permission to record data from individual students will be sought from both parent and student. Thus, allowing a student to take part in the learning activities without requiring them to take part in the research.

Consent forms will be accompanied by information sheets (please see attached documents). Additional information sessions will be held with the board of management, school principal, class teacher, parents and students as required by the board of management or school principal.

Relevant Legislation Relevant to the Project:

Data Protection Act

Parental Consent Form

Dear Parent/Guardian

As part of the Bridge to College Programme (run by Suas Educational Development in partnership with the Trinity Access Programme) with which the school is engaged, your child will be working with other students using modern technology. They will be under the supervision and guidance of adults and college student mentors. All activities will comply with best practice in Child Protection and the policies of the school, Suas and Trinity College in this area.

It is expected that the young people will be taking photographs and making movies and will be photographed at various times during the activities. This is a central aspect of this very innovative programme. Management of these images will be strictly in compliance with the above policies and guidelines.
We wish to seek your permission to take such photographs and where appropriate to publish them consistent with child protection policy. Please sign below to indicate your consent.

Child's name: ____

Parent's signature: ____

Yours sincerely,

________________________________ John Lawlor

John Lawlor

B2C Programme Manager

B2C Parent/Guardian Information Sheet

[Date]

Dear Parent/Guardian,

The school has arranged for some of the [TY/5th Year] class to participate in the **Bridge to College (B2C)** programme from [*Tuesday X – Friday X]*.

The **B2C** is a joint research initiative between Trinity College's Centre for Research in IT in Education and the Trinity Access Programmes and Suas Educational Development. The principal investigator is Brendan Tangney and the project leader is John Lawlor. 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.

The programme will take place in Oriel House, in Trinity College from *9.30am – 3pm* each day. A member of staff will meet the group at the front gates of Trinity College at *9.15am* on the first morning and show them to the workshop centre at Oriel House. After that, students are expected to make their own way to and from the programme each day. It is important that students make every effort to be on time on the first morning; however, in the event of unexpected lateness, please phone 01-8964099 to inform the programme staff. Attendance and lateness throughout the programme will be recorded and reported according to the usual school guidelines.

At the **B2C** 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 week, researchers from Trinity College will be present to collect information about the students' learning experiences. During the activities, interactions between the students working together will 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 the **B2C** programme. Use of video footage and images will be strictly in accordance with best practice in Child Protection policies and guidelines. Your son/daughter's name will not appear alongside any images/video footage. 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 [teacher's name] as soon as possible. If you have any questions in relation to this, please do not hesitate to contact us.

Kind regards,

Claire Conneely & John Lawlor

Bridge to College Programme Team

(01) 8964099 / conneecm@tcd.ie

Teacher Consent Form

I have been provided with an information sheet which outlines the activities teachers will take part in, how data will be collected and stored and how I can contact the research team.

I understand that I may withdraw from the project at any time should I wish to do so for any reason and without penalty.

I also know that images/video footage of me may be used for promotional material about the **Bridge21** programme and that I can withdraw from this at any time.

Data Protection: I agree to Trinity College, University of Dublin storing of any personal data relating to me 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 teacher: ____

Date: ____________________

Signature of Project Leader (TCD): ____________________________________

Date: ____________________

Teacher Information Sheet

You are invited to participate in the **Bridge21** pilot programme this year. The **Bridge21** programme is based on an alternative model for teaching and learning which is team-based, technology-mediated, project-based & cross-curricular. It has been developed over the past 3 years in an out-of-school context at the **Bridge2College** – a joint research initiative between Trinity College's Centre for Research in IT in Education, the Trinity Access Programmes and Suas Educational Development. The principal investigator is Brendan Tangney and the project leader is John Lawlor.

The overall aim of **Bridge21** is to leverage the success of the B2C model and pilot its implementation in the formal classroom. The adaption of the model to the formal classroom requires the development of a pedagogy that is based on collaboration, social learning and the creative use of technology.

The Bridge21 programme will take place throughout the academic year. During the programme, professional development workshops and seminars will be provided to participating staff, particularly in relation to teamwork skills, technology-mediated learning and developing the role of the teacher in the classroom. Training programmes will be also provided to students in relation to teamwork and technology skills. Members of the project team will spend significant portions of time in partner schools delivering workshops, engaging with students and supporting teachers and principals.

Throughout the programme, the project research team will collect information about students' and teachers' experiences. During class activity, interactions between students working together and between teachers and students will be recorded using observation tests. Students and teachers will complete pre- and post-questionnaires at various intervals during the programme. A random sample of students and teachers will also participate in interviews and focus groups.

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.

From time to time, we may also record video footage and images of you and students at work to use in communications and promotional/marketing material about the programme. Use of video footage and images will be strictly in accordance with best practice in Child Protection policies and guidelines. You have the right to remain anonymous and to choose where your information may be used. Should you wish to be omitted from any promotional materials, you can still participate in the programme, but no images/video footage of you will be used.

Participation in this programme is voluntary. Teachers may withdraw 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 to be omitted from the research part, you can still participate in the programme, but none of your information will be used in the research. Please sign below to indicate your consent. If you have any questions please do not hesitate to contact us.

Kind regards,
Claire Conneely & John Lawlor
Bridge to College Programme Team
(01) 8964099 / conneecm@tcd.ie

B2C Principal/Board of Management Consent Form

The board has been provided with an information sheet which outlines the activities students and teachers will take part in, how data will be collected, stored and used and how it can contact the research team.

The board understands that it may withdraw the school from the project at any time should it wish to do so for any reason and without penalty.

Signature of Chair of Board of Management: ______________________________________

Date: ______________________

Signature of Principal: ____

Date: ______________________

Name of school: ____

Signature of Project Leader (TCD): ____

Date: ______________________

B2C Participant Consent Form

I, ____(your name) agree to take part in the research part of the **Bridge2College** 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 **Bridge2College** 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: ______________________

Participant Information Sheet

The **Bridge2College** is a joint research initiative between Trinity College's Centre for Research in IT in Education and the Trinity Access Programmes and Suas Educational Development. The principal investigator is Brendan Tangney and the project leader is John Lawlor.

During the programme, researchers from Trinity College will collect information about your learning experience. Interactions between you and your classmates working together will be observed. Interactions between you and your teacher may also be recorded. You will also be asked to complete a questionnaire 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 **B2C** 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 your teacher, John or Claire.

Kind regards,

Claire Conneely & John Lawlor
Bridge to College Programme Team
(01) 8964099 / conneecm@tcd.ie

Appendix 4 Foundation Documents
Proposal for a CRITE 'Computer Clubhouse' Scheme

Proposal

The Centre for Research in IT in Education (CRITE) and Suas Educational Development, in conjunction with the Trinity Access Programme (TAP), hope to establish a 'Computer Clubhouse' Secondary Schools initiative with 15 TAP-affiliated, disadvantaged schools. The Clubhouse scheme will be based on a model which is in operation in 86 locations in 18 countries worldwide, and seeks to harness the creative abilities of disadvantaged students through exposure and access to I.T.

Logistics

The success of this project will be dependent upon approval by Trinity College, and the gaining of access to college computers. A small amount of funding would be desirable - to provide for the training and reimbursement of mentors (through book tokens, etc.) and to provide for prizes and a 'graduation' ceremony for the pupils. Trinity Access Programme will meet these funding needs.

Project Outline

Our aim is to work with the 15 schools currently involved in the TAP programme, and to offer two places on the scheme to each school. The students would be involved for a 3 hour period, (10:30am-1:30pm) on Saturdays, for one full cycle of the project, which will run concurrently with each of Trinity's three terms. Therefore, three cycles will operate in any given academic year, each with a class of 30 students.

4/5 co-ordinators will supervise the projects' four distinct programmes, and will be assisted by volunteers. These programmes will include film making, Lego/robotics, music and web design. These co-ordinators will be taken from the MSc (IT in Education). Suas will provide 15 extra mentors, who will be undergraduate students in Trinity, to support the work of the co-ordinators.

The pilot of this project will start on Saturday October 30th and finish 7 weeks later, on the Saturday December 11th. Each student will have a brief general introduction to all of the programmes, and will then be asked to commit to one of them. On completion of the project, each pupil will give a public presentation of their work.

The Computer Clubhouse Concept

The Computer Clubhouse model, already in action in Dublin is a learning environment where young people can explore their own interests, and become confident learners and creators through the use of technology. It gives participants the opportunity to become designers and creators - not just passive consumers of Technology. Through the Clubhouse, pupils will have access to computers and software to help them create projects according to their interests, while at the same time sharing a sense of community with each other. For example, it is envisaged that those students who choose the web design and film-making programmes will use their skills to report on the projects of their fellow pupils, thus bringing an interpersonal dynamic to the learning process.

The Clubhouse concept revolves around four main aims:

- A focus on "constructionist" activities, encouraging young people to work as designers, inventors, and creators.
- Encouraging young people to work on projects related to their own interests.
- The importance of maintaining a sense of community, where young people work together with one another, and are supported and inspired by adult mentors.
- Offering resources and opportunities to those who would not otherwise have access to them.

Rather than playing games with computers, young people will learn how to use professional software for design, exploration, and experimentation. They can try for themselves what it is like to be an architect, engineer, composer, artist, journalist, or computer programmer.

The project is planned in light of the current educational research which shows that adolescents learn most effectively when they are engaged in designing and creating projects, rather than memorizing facts or learning isolated skills out of context.

Increased Awareness within Trinity

The project will not only benefit the students involved but will also serve the purpose of exposing volunteers and indeed the wider college community, to the realities of educational disadvantage which are on their doorstep.

Increased Prospect of University

Trinity wishes to make a concrete and visible contribution to Dublin City, and has already shown its commitment through the Trinity Access Programme, and numerous voluntary tuition programmes. The recent commitment by the government to reserve 15% of Trinity places for students of alternative background highlights the need to have a more diverse body of students at Trinity. It is envisaged that by getting alongside 92 inner-city pupils each year, Trinity will be able to empower young minds, and plant the possibility of proceeding to third level education, where previously the interest would not have existed.

An Active & Broad Education

As stated, current research is having an impact on the standard approach to education. Trinity have recently established the Broad Curriculum model, which widens the scope of the undergraduate degree, by offering greater choice to students, beyond the confines of their particular faculty. This project has similar goals – with the co-ordinators and mentors all being engaged in a challenging new learning environment that no faculty could replicate. Likewise, the TAP students would have an educational opportunity to go beyond the Secondary school curriculum and take part in an interesting, hi-tech programme, for which there would be neither time nor resources in the classroom.

Based on the success and growth of the clubhouse model to date, we feel that a tangible impact could be made to the lives of many young Dublin pupils, as they enjoy a refreshing opportunity to direct their own learning, outside the confines of the classroom, and without the looming threat of examinations.

Bridge2College Foundation Document (2007)

1.1 Context and societal need

Growing up in poverty can affect people's future: children who grow up in poor families are more likely to leave school early and without qualifications, and to end up unemployed or in low-paid jobs which means that they are more likely to be poor as adults (*EU Survey on Income and Living Conditions: intergenerational transmission of poverty 2005*; Central Statistics Office, August 2007). Education has enormous potential to address inequality and disadvantage. However, this potential is not being maximised. The evidence is clear: 97% of young people from the highest income group enter higher education; 21% of those from the lowest income group do so (*Combat Poverty submission to OECD Review of Higher Education*, 2004). Research indicates that children from disadvantaged communities constitute the majority of those who fail to benefit from the education system and that under-achievement in school can have inter-generational effects on families and their communities (*DEIS Action Plan,* 2005).

Specifically in relation to third level education, lower socio-economic groups remain disproportionately underrepresented. The trend in recent years is not towards significant improvement - within the university sector, the lower socio-economic groups represented an even smaller proportion of entrants in 2001 than they did in 1995. Lower socio-economic groups' persistent under-representation in higher education is, in many ways, a product of the high levels of attrition and under-performance among these groups through second-level education. Each year over 4,000 11-15 year–olds drop out of school before reaching the Junior Certificate (*HEA 2005-2007 Action Plan for achieving equity of access to Higher Education*, 2008). However, even those who achieve a minimum threshold in the Leaving Certificate examination remain substantially less likely to transfer to higher education than their peers from higher socio-economic groups.

The gap between professional and working classes of those who complete the Leaving Certificate has not been significantly reduced in recent years (*Smyth & Hannon,* 2000). Admission rates to 3rd level of students from lower socio-economic communities have shown minor increases, but they remain disproportionately represented (*O'Connell, Clancy & McCoy,* 2006). Students in our higher education institutions continue to be predominantly from the middle and higher income groups (*HEA 2005-2007 Action Plan for achieving equity of access to Higher Education*, 2008).

Research indicates that lower socio-economic groups greatly value education – however a lack of knowledge and experience of higher education institutions within the community and the family may act as a barrier to entry to third level (*O'Reilly,* 2008). Other socio-economic reasons relevant to poor progression rates to third level include:

- Long-term unemployment
- Low family income
- Little or no family tradition of progressing to higher education
- Under-represented socio-economic groups in higher education

Data from the CAO, State Examinations Commission and the HEA indicate that where a young person is brought up can have a direct impact on the type of education they receive. In some urban areas, fewer than 2% of eligible young people and adults progress to higher education. There are still large disparities in access between different postal districts of Dublin. Areas with a high concentration of lower socio-economic groups have low admission rates to higher education (*Clancy*, 2001). In 2004, five postal districts in Dublin (D20, 22, 1, 17 & 10) had third level admission rates of less than half of the county average of 50.8% (*O'Connell, Clancy & McCoy,* 2006).

The broad aim of education should be to activate human creativity and responsible citizenship, so that our education system will promote the necessary skills and competencies to sustain a productive economy (*Zappone,* 2007). However, the source of educational disadvantage is not limited to the education system –

parents, peer groups and communities all have an important role to play in the formation of the expectations and aspirations of young people (*O'Reilly,* 2008).

There already exist a number of access initiatives and policies which focus on tackling a range of social, educational and financial barriers to access of education. In addition to these constraints, the culture of third level institutions is recognized as an obstacle to the integration of students from lower socio-economic groups who may not have the cultural capital needed to adjust quickly to the university environment (*O'Reilly,* 2008). Access initiatives must seek to identify and involve not only the bright and determined students, but also those who are sometimes marginalised, those who may have learning or behavioural difficulties, and those who are constantly excluded from programmes (*Fleming & Gallagher,* 2003).

It is not enough to focus on higher education institutions but also on the cultural values and norms of students from lower socio-economic groups and how these are often undervalued in the educational system (*O'Reilly,* 2008). Programmes designed to promote social inclusion in education should also include an emphasis on instrumental areas of knowledge, such as ICT (*EU Includ-ED Report,* 2007). The failure to encourage and accommodate students from all socio-economic classes in our education system is a strategic loss to the ICT industry in Ireland and to the economy generally.

Rationale

Young people readily adopt new technology and online capability at a pace that far exceeds society and formal education's capacity to adapt. Young people have no inhibition in building their social networks, deriving their views and establishing their principles through whatever media they identify with. The B2C model builds on the international experience of Computer Clubhouses (*Resnick, 2002*), designed to exploit the potential of technology to engage young people positively and to facilitate a new model of learning. The Computer Clubhouse model seeks to strike a balance between structure and freedom in the learning process, facilitating young people to express themselves and gain confidence as active, independent learners (*Resnick, 2002*). This difference in approach compared to formal schools could leave the Clubhouse programme on the margins of education. Thus, a programme to merge the two approaches is an important and worthwhile initiative.

The B2C programme uniquely engages directly with formal educational structures, by linking with the already existing curriculum and programme of the partner schools. Research from the B2C first year of operation has shown that there is a tendency among the young people from the participant schools towards low self esteem and poor perceptions of education and their learning ability. There is a need to link the technical skills and creative talent of young people with their personal understanding of how they can learn. The B2C programme currently targets 14 designated disadvantaged schools in Dublin, from the D2, 4, 5, 8, 12, 20, 22 & 24 postal districts. Current rates (based on the 2007 cohort) in relation to these schools highlight that there is a need to challenge perceived barriers towards 3rd level opportunities and poor perception of talents and capacity to learn:

Postcode	**School**	**Progression Rate**	
		2007	**2008**
Dublin 2	Westland Row	35%(n=6)	38% (n=8)
Dublin 4	Marian College	52% (n=44)	57% (n=48)
Dublin 5	Ard Scoil La Salle	32% (n=18)	44% (n=28)
Dublin 8	Mercy, Goldenbridge	57% (n=8)	47% (n=8)

	CBS, James St	3% (n=1)	33% (n=14)
Dublin 12	Ard Scoil Eanna	36% (n=4)	57% (n=8)
	Assumption	33% (n=26)	51% (n=25)
	Mercy, Drimnagh	24% (n=14)	42% (n=15)
	Drimnagh Castle	N/A	N/A
	Loreto, Crumlin	23% (n=18)	56% (n=32)
Dublin 20	Pobalscoil Isolde	42% (n=20)	42% (n=18)
Dublin 22	Colaiste Brid	51% (n=65)	44% (n=45)
	Moyle Park	50% (n=55)	63% (n=64)
Dublin 24	Old Bawn Community School	52% (n=57)	55% (n=56)

Programme Structure and Design

The programme is structured so that it:

- Positively engages the young people and encourages them to improve their attitudes towards personal learning and education
- Builds an enthused, able and committed team of volunteer mentors that are inspired and developed by their experience
- Complements and enhances the work of the participant schools
- Empowers children as creators and in control of their own learning
- Emphasises teamwork, problem solving and constructivist learning approaches
- Supports the young people to recognise and develop their talents
- Presents college as a real, attractive and viable opportunity after school

The programme is specifically designed in this way so that:

- The young people realise their potential and engage with educational opportunities available to them after school
- The volunteer mentors realise their leadership capability and develop a sense of social commitment
- The young people develop teamwork and interpersonal skills and become confident learners and creators
- The partners develop a platform for the further development, expansion and replication of this programme nationwide, in partnership with schools, 3rd level institutions and community groups

The B2C Model

The computer clubhouse genre, devised at Massachusetts Institute of Technology (MIT) in the mid-90's, is guided by four core principles: support learning through design experiences, help youth build on their own interests, cultivate an "emergent community" and create an environment of respect and trust (Resnick & Rusk, 1996). The B2C model builds on the clubhouse principles yet employs its own distinctive elements, namely the learning space, team-based approach, the exploration of challenging themes and the encouragement of access to third level education. These distinctive elements, together with mentoring, social interaction and personal reflection comprise the inter-working components of the learning model.

The B2C operates in uniquely decorated learning space, specifically designed to promote and assist technology-mediated collaborative learning. The team spaces, known as pods, are intended to encourage team-work. Computer sharing, as opposed to individualising machines, is a key feature of the team-based approach. The space is also designed and constructed so as to encourage individual learners to a new frame of reference in learning that is self-directed and peer assisted.

The B2C's concepts of team-based learning are borrowed from the learning methods of the international Scout Movement. Participants are encouraged to play a constructive role and to take responsibility within their team. Team Leaders are selected and team meetings are part of the design and planning process for the work undertaken. Design is a critical element of the learning model. The participants engage with their peers in designing projects that explore challenging themes, infused with concepts of values-based learning. Participants present their work in a plenary session as members of their team.

The participants are released to the programme during school hours for a block of 3.5days (22 hours). This represents a significant commitment of school time – the equivalent of an entire Computers module or 17% of a year's class time for a Higher-Level Maths student.

Programme Impact

Since its commencement of operations in November 2007, Bridge to College has provided a learning experience to 600 young people from over 20 primary and secondary schools in areas designated as socially disadvantaged. The findings from the first year of operation point to a significant impact in changing the perceptions of the participant young people in attitude towards their personal learning and in particular their attitude to accessing third level education. The likely longer term impact requires further investigation and research. Consistent with the research from the first year of operation, it is likely that further engagement with the model and programme will deepen impact with the participant students.

Programme Development

The next stage of the programme will aim to build upon the research-based evidence of the success of the first year of operation, which has yielded encouraging results against the original aims and objectives. The various options and issues in relation to broadening and extending the B2C learning model and experience require consideration.

The first question to be addressed is how to extend the B2C experience for the primary beneficiaries? The primary beneficiaries are the young people who participate on a 3.5 day (22 hour) block-release from school. Research evidence from the first year's implementation points to a high impact on the personal development of the participants. It suggests that further contact with the young people, both direct and indirect, could not only serve to cement their initial experience, but would also provide opportunity to further assess the impact of the programme.

The second question to be considered is how can the B2C learning model be leveraged to influence thinking and practice in the use of technology in learning within formal education structures? Results from the first year of operation highlight the significant impact and efficacy of the B2C learning model. The target audience for future influence includes teachers, trainee teachers and those involved in curriculum development and policy in this area.

Extending the impact for the primary beneficiaries

A number of options are under consideration for extending the impact for the primary beneficiaries – the student participants.

a) Dedicated computer science workshops

b) Mentoring opportunities with younger (Primary school) children

c) Using the model to support Leaving Certificate project work (LCA)

Extending the programme to effect systemic change in education

A number of opportunities arise to leverage the Bridge to College programme to influence teaching and educational policy.

a) In-service training for teachers from the participant schools.

b) Trainee Teacher (B.Ed.) sessions on the model and method.

c) Supporting M.Sc. Technology & Learning programme.

d) Presentations of key influencers in education policy.

Benefits, Outputs, Outcomes

Benefits:

The B2C programme aims to:

- Improve the perspective on personal learning, education and 3rd level access of the participant students
- Improve the ICT skills of the participant students and their confidence in the application of their skills
- Develop the teamwork and creative skills of the participant students
- Develop and encourage volunteer mentoring and social awareness among 3rd level students

Outputs:

- 45 1-week (22 hour) workshops over a 2 year period, with a maximum of 25 students each week (550 students per year)
- Service learning volunteer mentoring programme for 60 young adults over a 2 year period (30 mentors per year)
- 20 partner-designated disadvantaged schools in the Dublin area

Outcomes:

- Improved perspectives on personal learning of the participants.
- Improved positive propensity towards 3rd level.

- Teamwork is a positive contributor to the learning experience.
- Technology has a high impact on the learning experience.
- Development of a personal responsibility and confidence in learning amongst participants
- Positive feedback from teachers on all aspects of the programme & use of newly learned skills within other school work.

Partners

TAP: The Trinity Access Programme is a formal component of Trinity College and receives strong support from the HEA, the Department of Education and Science and the EU Student Assistance Fund. Its goal is to make Trinity's student body more inclusive and diverse. To achieve this it runs a number of programmes aimed at a broad spectrum of individuals, from primary school children to mature students. These programmes aim to support Trinity in achieving its goal of having 15% of its CAO annual intake from students from non-traditional backgrounds, which includes socio-economically disadvantaged students, mature students and students with a disability. The TAP primary and secondary school programmes focus on working in partnership with 20 primary and 20 secondary schools with disadvantaged status. These programmes are aimed at sparking an interest in further education and providing appropriate supports for students who wish to attend 3rd level.

CRITE: The Centre for Research in IT in Education is a multi-disciplinary research centre whose focus is upon creating, and evaluating, innovative learning experiences, inspired by educational principles and technical progress. They use technology to help mediate a constructivist dialogue between the learner, instructor and subject matter.

Suas Educational Development is a professional, dynamic and vibrant movement, active in ten colleges throughout Ireland, with over 3000 volunteers. Its mission is to support quality education in under-resourced communities. Suas currently supports schools and education organisations in Ireland, India and Kenya that collectively educate over 13,000 children. Suas's core strategies are to educate, to engage and to inspire.

Theory of Change for Bridge2College

B2C: Vision, Mission and Underlying Beliefs

VISION

- *All* young people are given the opportunity to raise their educational aspirations and fully realise their educational potential

MISSION

- Create a quality, values-based & innovative learning model which can effect systemic change in the Irish education system

UNDERLYING BELIEFS

- All young people have the ability to raise their educational aspirations and fully reach their potential
- Young people are highly moral and want to belong to a values-based society
- The Irish education system must change it's educational policies & practices to meet the needs of *all* young people and to address social/environmental/economic challenges
- Technology is a powerful asset to teaching & learning & it's potential is largely untapped in the Irish education system
- An innovative learning model can help young people to develop vital skills of teamwork, creativity & problem-solving

B2C: Theory of the Problem

Problem

- The Irish education system is not meeting the needs of all young people
- There is a huge untapped pool of talented young people and society is missing out on the opportunity to reap the benefits

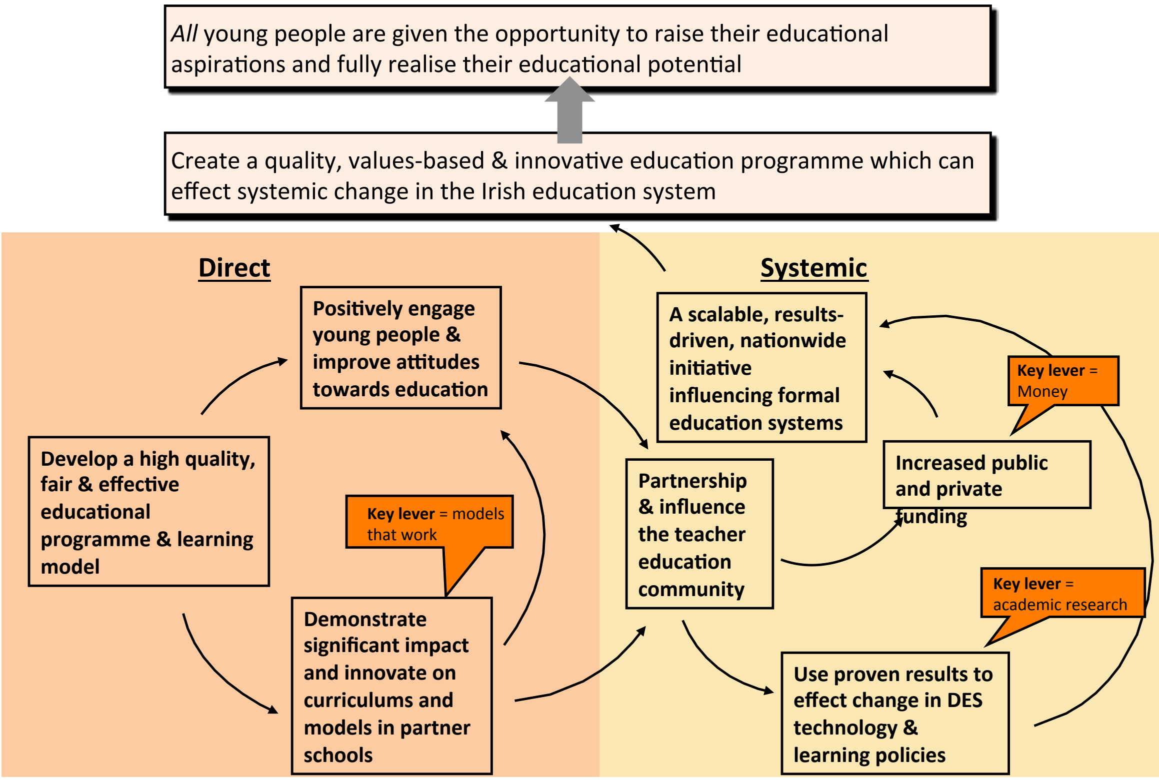
Symptoms:

- Every year , one in six Irish young people leave school without reaching Leaving Certificate level & their likelihood of doing so is strongly influenced by their social background.
- Over 750,000 adults in Ireland between 25–64 years of age have little or no formal educational qualifications.

Underlying Causes/Barriers to Change

- Young people from disadvantaged communities constitute the majority of those who fail to benefit from the education system & under-achievement in school has inter-generational effects on families and their communities (*DEIS Action Plan, 2005*).
- The cultural values & norms of students from lower socio-economic groups are undervalued in the educational system (*The evolution of University Access Programme in Ireland, 2008*)
- Educational equity is a moral imperative for a society in which education is a crucial determinant of life chances. (*Levin, 2009, p. 5)*

B2C: Theory of Change



Appendix 5 Relevant Publications

Papers with this Author Leading

[1] *Lawlor J., Conneely C., Tangney B., Towards a pragmatic model for group-based, technology-mediated, project-oriented learning – an overview of the B2C model, Proceedings of the 2010 TechEduca Conference.*
http://www.scss.tcd.ie/tangney/B21/B21-Model.pdf

Abstract:

The poor assimilation of ICT in formal education is firmly rooted in models of learning prevalent in the classroom which are largely teacher-led, individualistic and reproductive, with little connection between theory and practice and poor linkages across the curriculum. A new model of classroom practice is required to allow for creativity, peer-learning, thematic learning, collaboration and problem solving, i.e. the skills commonly deemed necessary for the knowledge-based society of the 21st century. This paper describes the B2C (Bridge21) model for group-based, technology-mediated, project-oriented learning which, while being developed as part of an out of school programme, offers a pragmatic alternative to traditional classroom pedagogy.

[2] *Lawlor, J., Marshall, K., & Tangney, B. (2015). Bridge21–exploring the potential to foster intrinsic student motivation through a team-based, technology-mediated learning model. Technology, Pedagogy and Education, 1-20.*

Abstract:

It is generally accepted that intrinsic student motivation is a critical requirement for effective learning but formal learning in school places a huge reliance on extrinsic motivation to focus the learner. This reliance on extrinsic motivation is driven by the pressure on formal schooling to 'deliver to the test'. The experience of the use of ICT in formal learning is marked with a naive and largely unfulfilled assumption that it would of itself promote a 'game-changing' shift in student motivation. This study investigates the effectiveness of a team-based, technology-mediated model called

Bridge21 to encourage intrinsic student motivation. The data for the study come from 425 secondary school students, average age 16 years, who participated in workshops of 3.5 days in duration. The workshops took place in an out-of-school learning environment in one academic year. Bridge21 seeks to provide a vehicle to allow the transfer of control of learning from the teacher to the team and in this way to encourage and promote student autonomy. The principal findings reported in this paper are that participation in the workshops had a direct positive impact on the students' perceptions around their learning and on their intrinsic motivation to learn.

[3] *Lawlor, J., Conneely, C., Oldham, E., Marshall, K., & Tangney, B. (2015). Bridge21: Teamwork, Technology and Learning - A pragmatic model for effective 21C Team-based Learning. Technology, Pedagogy and Education (Accepted for publication subject to revision)*

Abstract:

There have been calls for decades by many educational writers and commentators for a new model of learning to facilitate what is generally described as 21st Century Learning. Central to this challenge is the required shift in responsibility for who leads and owns the learning - from teacher to student. Such a shift requires a pragmatic pedagogical model to facilitate the transfer of control and ownership of learning. Vygotsky's 'more able other' identified the peer as a key figure in learning. Teamwork facilitates project-based learning and when mediated with technology proves an effective partner in creating an engaging and autonomous learning experience. This paper describes the rationale for the design of a team-based model of 21st Century Learning, particularly drawing upon the team-based learning model of the World Scout Movement. Results from a year-long study of the implementation of the model in an out of school context with 288 second level students are presented. We argue that Bridge21 is a candidate learning model for effective, implementable, 21st Century, Team-based Learning.

Papers with Contributions from this Author

***[1]** Tangney, B., Oldham, E., Conneely, C., Barrett, E., Lawlor, J., (2010), Pedagogy and processes for a computer engineering outreach workshop – the B2C model, IEEE Transactions in Education, vol 53 no 1, pp53-60.*
http://www.scss.tcd.ie/tangney/B21/B21-IEEE.pdf

Abstract:

This paper describes a model for computer programming outreach workshops aimed at second-level students (ages15–16). Participants engage in a series of programming activities based on the Scratch visual programming language, and a very strong group-based pedagogy (Bridge21) is followed. Participants are not required to have any prior programming experience. An empirical evaluation was undertaken to evaluate to what extent the model was successful in: 1) giving the participants a deeper understanding of what studying a computing degree and working in the computing profession entails; and 2) increasing their interest in pursuing a third-level qualification in a computer-related area.

[2] Conneely, C., Girvan, C., Lawlor, J., Tangney, B., An *Exploratory Case Study into the Adaption of the Bridge21 Model for 21st Century Learning in Irish Classrooms,* in editor(s) Butler, D., Marshall, K., Leahy, M., *Shaping our Future: How the lessons of the past can shape educational transformation*, Dublin, Liffey Press. 2015, pp 348-381.

Abstract from book chapter:

Over the past four years the authors have run an initiative, known as Bridge21, in which more than 3,000 students have participated in out-of-school, team-based, technology-mediated workshops. These workshops typically ran for 3.5 consecutive days and took place during the school day in a purpose-designed learning place on the university campus. In the course of that time, a very particular model for ICT-enabled group learning has emerged (Lawlor, Conneely & Tangney, 2010), which has the potential to engender the development of the 21st century skills listed above. This chapter gives an overview of the (Bridge21) model and reports upon the main themes

which have emerged from an analysis of data gathered over the four-year period. The chapter then goes on to describe an on-going action research project, involving a number of second level schools, to explore how the model can be adopted in classrooms to deliver the mainstream curriculum. We argue that the model provides a pragmatic and concrete methodology which can be used in Irish second level classrooms to deliver the curriculum, through embracing collaborative, ICT-mediated, project-based learning.

Papers Involving the Work of Other Researchers Related to Bridge21 Without this Author

[1] *Conneely, Claire, Carina Girvan, and Brendan Tangney. "An exploration into the adaption of the Bridge21 model for 21st century learning in Irish classrooms: Case Study Report for the NCCA." (2012).*

Abstract:

This report describes the experiences of teachers and pupils in 8 schools as they engaged with the research team, and authors of this report, in attempting to adapt the Bridge21 model of 21st century (21C) learning for use in the mainstream classroom to deliver core curriculum content. The work, and the report, is firmly situated within the context of the Junior Cycle reform process and the participating schools can be viewed as innovators in the emerging change process. The schools come from a diverse geographical and socioeconomic background and thus are a representative sample of the wider cohort of secondary schools in the country. A characteristic they share is strong school leadership, which is supportive of the process, and groups of teachers who are open to exploring changes in classroom practice.

[2] *Conneely, Claire, Damian Murchan, Brendan Tangney, and Keith Johnston. "21 Century Learning–Teachers' and Students' Experiences and Views of the Bridge21 Approach within Mainstream Education." In Society for Information Technology & Teacher Education International Conference, vol. 2013, no. 1, pp. 5125-5132. 2013.*

Abstract:

Bridge21 is an innovative approach to learning for secondary education that is team and project based and that takes place in a technology mediated environment. This paper reports on the current expansion of the Bridge21 project to mainstream schools at a time of proposed Government led reforms for lower secondary education in Ireland. Data were drawn from case studies with two participant schools over the course of academic year 11/12. Student experiences and views were captured by means of questionnaires which amongst other items asked students to create a visual depiction of their Bridge 21 experiences. Teacher experiences and views were gleaned by means of focus group interviews. Overall students reported positive experiences of the programme. Teachers were also positive but reflected the challenges of implementing a new approach to learning in the context of existing norms with respect to pedagogy and assessment. The application of visual research methodologies provided an innovative and useful complementary insight into students' experiences of the intervention.

[3] *Storm, A. P. (2015). Realistic Mathematics Education, Mobile Learning And The Bridge21 Model For 21st-Century Learning. Mobile Learning and Mathematics, 96.*

Abstract from book chapter:

The use of the phrase "perfect storm" in the title of the chapter reflects our aim: to show how the co-incidence of the three factors (mobile learning, Realistic Mathematics Education (RME) and the Bridge21 model of 21C Learning) gives rise to learning opportunities that optimise the potential of each component. In this chapter, we describe the key features and the Bridge21 model of 21C teaching and learning. We then illustrate how these can be brought together by outlining a learning activity designed to be delivered using the Bridge21 model and showing (a) how mobile technology can be used to facilitate a realistic, contextualised social constructivist mathematical learning activity; and (b) how that learning activity can be orchestrated and scaffolded in a pragmatic classroom setting.

***[4]** 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.*

Abstract:

This research study explores peer teaching and learning without a domain expert teacher, within the context of an activity where teams of second level students (~16 years old) are required to create a learning experience for their peers (with Bridge21). The study looks at how participants would like to be taught and how they would teach their peers if given the opportunity and examines the support they require, their motivation levels, and if they actually learn curriculum content using this approach. An exploratory case study methodology was used, and the findings suggest that students want varied learning experiences that include many of the elements which would fall under the heading of 21st century learning, that with some support and encouragement they can create innovative learning experiences for their peers, and that they can learn curriculum content from the process.

[5] Byrne, J.R., Fisher L., & Tangney, B., Computer science teacher reactions towards raspberry Pi Continuing Professional Development (CPD) workshops using the Bridge21 model. Computer Science Education (ICCSE), 2015 10th International Conference on 267-272

Abstract:

This paper describes in-service post-primary school teacher reactions towards the provision of a Raspberry Pi Continuing Professional Development (CPD) Programme designed to build capacity in python programming, circuitry and hardware configuration. The Bridge21 social constructivist model of teaching and learning was used for workshop delivery, and teachers were encouraged to use the same model to enhance Raspberry Pi delivery on return to the classroom. This paper presents results from the analysis of four (N = 4) one day Bridge21 Raspberry Pi CPD workshops delivered in the authors' home institution over the 2013/2014 academic year. This paper examines teacher reactions towards the use of the Bridge21 model for learning

about using the Raspberry Pi. The authors administered a mixed methods evaluation instrument to a self-selecting sample of N = 61 teachers to capture reactions towards use of the Bridge21 model for Raspberry Pi CPD delivery. Qualitative coding of text responses combined with statistical analysis of Likert scales gathered from the evaluation instrument indicate that (a) teacher reactions towards the use of the Bridge21 model for learning Raspberry Pi technologies was positive and (b) teachers intended to use the same model to enhance their own Raspberry Pi delivery in the school classroom.

[6] Bray, A., & Tangney, B. Barbie Bungee Jumping, Technology and Contextualised Learning of Mathematics.

Abstract:

There is ongoing debate about the quality of mathematics education at post-primary level. Research suggests that, while the capacity to use mathematics constructively is fundamental to the economies of the future, many graduates of the secondary-school system have a fragmented and de-contextualised view of the subject, leading to issues with engagement and motivation. In an attempt to address some of the difficulties associated with mathematics teaching and learning, the authors have developed a set of design principles for the creation of contextualised, collaborative and technology-mediated mathematics learning activities. This paper describes the implementation of two such activities (Using the Bridge21model). The study involved 24 students aged between 15 and 16 who engaged in the activities for 2.5 hours each day over a week-long period. Initial results indicate that the interventions were pragmatic to implement in a classroom setting and were successful in addressing some of the issues in mathematics education evident from the literature.