Learning Circles: A technology enhanced peer-teaching workshop

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Declaration

I declare that the work described in this document is, except where otherwise stated, entirely my own work and has not been submitted as an exercise for a degree at this or any other university.

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"Individual commitment to a group effort - that is what makes a team work, a company work, a society work, a civilization work." – Vince Lombardi.

"I get by with a little help from my friends." – The Beatles.

Contents

Abstract

The concept of 21C learning is well-documented but often absent from many modern classrooms. Despite the profound changes that ICT has brought about in other areas, the model of classroom education developed during the Industrial Age remains prevalent (McGarr, 2009; Papert, 1993).

There is a cohort of modern students that have technical skills and access to a volume of information that previous generations did not. Prensky (2001) argues that these "Digital Natives" should have some input into how they learn and suggests that they are capable of producing, as well as consuming, digital content. The concept of "Mindtools" argues that students should use technology as a tool to learn with rather than from. By using technology to create digital artefacts, students can be engaged in constructive, productive learning and hence develop critical and higher order thinking skills (Jonassen, Peck & Wilson, 1999).

Peer teaching involves students learning from each other, and learning by teaching, and can be, if properly structured, a very effective learning technique (Goodlad, 1990; Leung, Marsh and Craven, 2009). A powerful demonstration of what students can achieve without a specialist teacher has been given by Sugata Mitra (2010). He conducted studies into what children, working together, but with no expert help, can learn using the internet as their primary source of information and found unexpected and impressive results. It is an extreme approach but a reminder of what can be achieved by motivated learners.

In educational planning, the student voice is important but it is often over-looked (Prensky, 2001). By focusing on the students, how they would like to learn and how they would teach each other, we may gain some valuable insights into how peer teaching and student generated content could be utilised as part of a 21C learning model.

This research involved creating a student-led 21C learning experience. It explored how students, working in teams, want to be taught, whether they can learn without a teacher and how they would teach their peers if given the opportunity. The roles of peer teaching, team work, learning without a teacher and user generated content are explored

within the context of an activity where students are required to create a learning experience for their peers.

Working in Bridge21, a technology-mediated collaborative learning centre (Lawlor, Conneely & Tangney, 2010), teams of second level students were each given a topic from the senior cycle curriculum, asked to learn it, and then prepare a learning experience, on that topic, for their peers. There were adult mentors to support the teams but none of these were experts in the topics being taught.

This was an exploratory case study and data collection was carried out using student questionnaires, student focus groups, mentor interviews and analysis of the student presentations and learning experiences. Four workshops took place and each one was four days in duration. A total of 82 students participated in the study and they worked on seven different subjects.

The findings suggest that the potential for students to learn independently is under-exploited and that requiring them to teach their peers is a strong motivator for independent learning. Students want varied learning experiences that include many of the elements which would fall under the heading of a 21C learning model. Technology has a significant role to play in the process of independent learning and in enabling the students to teach each other in innovative ways. By creating new learning experiences and digital artefacts, the student can construct knowledge both for themselves and their classmates.

Chapter One. Introduction.

It has been claimed that many modern classrooms are home to individualised, teacher-centred learning and use a model of education developed to meet the needs of an Industrial Age (Papert, 1993). Despite the profound changes brought about by ICT in other spheres, education has seen relatively little change (McGarr, 2009). Many researchers and policy makers argue that an Information Age society requires an Information Age pedagogy which, according to Voogt and Pelgrum (2005) includes small groups of students working, in teams, on a variety of activities, at their own pace, creating new solutions to problems.

Many modern students have technical skills and access to a volume of information that previous generations did not. Prensky (2001) referred to students who have grown up with technology as "Digital Natives", as opposed to "Digital Immigrants" who adopted technology later in life. Prensky made many claims about these "Natives", several of which have been criticised, but his arguments that students should have some input into how they are taught and that they are capable of producing as well as consuming content are important and relevant to this study.

The students' ability to create content is often under-utilised in modern education. When technology is used, it is often to present information to the students, much as a traditional teacher might (McGarr, 2009). The concept of "Mindtools" argues that students should use technology as a tool to learn with rather than from. By using technology to create digital artefacts, students can be engaged in constructive, productive learning and hence develop critical and higher order thinking skills (Jonassen, Peck & Wilson, 1999).

Peer teaching is a model of learning where students learn from each other and learn by teaching (Goodlad, 1990). It relies upon and strengthens the relationships between learners and can be, if properly structured, a powerful learning technique. The benefits to students of this approach are academic, personal and social (Leung, Marsh and Craven, 2009).

A powerful demonstration of what students can achieve without a specialist teacher has been given by Sugata Mitra (2010). He conducted studies into what children, working together but with no expert help, can learn using the internet as their primary source of

information. He argues that children can learn what they want to learn, even without a specialist teacher, if given access to the information and encouraged to explore and work things out for themselves. It is an extreme approach but a reminder of what can be achieved by motivated learners.

If we accept the arguments made above, there is a case for examining alternative methods of curriculum delivery. In educational planning, the student voice is often over-looked but, as Prensky (2001) says, it is an important one. By focusing on the students, how they would like to be taught, how they use technology in day to day life, how they would learn without a teacher, how they would teach each other and what support they need to achieve this, we may gain some valuable insights into how peer teaching and student-generated content could be utilised as part of a 21C learning model.

This piece of research involves creating a pupil-led 21C learning experience. The roles of peer teaching, team work and user generated content are explored within the context of an activity where students are required to learn without a teacher and create a learning experience for their peers.

It examines how the students would like to learn, how they try to teach their peers, what support they require, what obstacles they encounter in completing their task, whether they were engaged and motivated by this method of learning and whether they were able to create effective and engaging learning experiences for their peers. Four workshops took place in Bridge21, a technology mediated, collaborative learning programme for second level students, based in Trinity College Dublin (Lawlor, Conneely & Tangney, 2010). Teams of five second level students were each given a topic from the senior cycle curriculum and asked to learn it for themselves and then prepare a learning experience on that topic for their peers. The students had little or no prior knowledge of the topics. Each team had 1.5 days to research and learn the topic and then prepare their 30 minute learning experience. There were a group of adult mentors to support the teams but none of these were experts in the topics being taught. 82 students participated in four, four-day workshops covering seven different topics.

The methodology chosen for this study was an exploratory case study. Data collection was carried out using student questionnaires, student focus groups, mentor interviews and analysis of the student presentations and learning experiences. This data was analysed to help answer the research question and sub-questions set out below.

1.1 Research Question

This study explores a potential 21C method of curriculum delivery which includes; learning without a domain expert teacher, team work, peer teaching, technology and user generated content, within the context of an activity where students are required to learn without a teacher and create a learning experience for their peers. The role of the Bridge21 learning model within this context is also explored.

1.1.1 Sub questions

1. How would the students like to learn?

2. How would they teach each other?

    2(a). What support did the students require in learning without a domain expert teacher and creating a learning experience?

3. Were the students engaged in the activity and motivated to learn?

4. Did the teams create innovative learning experiences?

    4(a). Did the students learn?

1.2 Dissertation Roadmap

The literature review begins by discussing the concept of 21C learning. The theory of "Digital Natives" and the reservations associated with it are examined and the idea of "Mindtools", i.e. pieces of technology to learn with rather than from, is discussed. Peer teaching methods and the associated benefits are examined along with an example of students learning without a domain expert to teach them. Finally, some examples are given of how these concepts have been implemented in various educational settings.

In the design chapter, the design considerations that emerged from the literature review are discussed and the details of the learning experience being studied are laid out.

The research methodology contains a description of an exploratory case study, the details of the research sub-questions and the data collection methods employed to help answer each one.

The data analysis chapter is in two sections. The first section shows the data that was collected, how it was analysed and what findings were made based on that analysis. The second section discusses these findings.

The conclusion seeks to answer the research questions mentioned and suggests that the potential for students to learn independently is under-exploited, that students want to learn in a 21C manner, that technology has an important role to play in how the students learn independently and in the creation of interesting and innovative learning experiences for their peers and finally, that they are engaged and motivated by learning this way.

Chapter Two. Literature Review.

This study explores a potential 21C learning method of curriculum delivery which includes; learning without a domain expert teacher, team work, peer teaching, technology and user generated content. It will examine how the students say they would like to learn, how they try to teach their peers, whether the students were engaged and motivated by this style of learning and whether or not it was an effective method of curriculum delivery. This will take place within the context of a student-led learning experience in which second level students are asked to prepare a learning experience for their peers. The role of the Bridge21 learning model within this context is also explored.

In this literature review, 21C learning models are compared with current classroom practice and constructivism is examined as a key element of a 21C learning strategy. It is claimed that many second level students are highly computer literate and the skills they have are often under-utilised in formal education. The concept of "Digital Natives" is discussed along with the reservations associated with it (Prensky, 2001; Shah, 2009; Selwyn, 2009). The idea of "Mindtools" is discussed, i.e. the use of technology to allow knowledge construction rather than simply as an instructional aide. Students learning with, and from, one another is a key component of this study so peer teaching methods and the benefits associated with them are examined. Finally, some examples of how these concepts have been implemented, in both formal and informal education, are given.

2.1 21C Learning

Many modern classrooms are home to individualised, teacher-centred learning (ESRI, 2010). This has been true for many years and the increasing availability of technology has made little impact on the models of learning employed (McGarr, 2009). Education is "received" in most schools and evaluated through examinations. Paulo Freire (1993) describes the role of the teacher in this model as "depositor, prescriber". This teacher-led model means students get to make very few decisions about what they learn or how they learn it. Pressure to cover the course with a focus on the final exam means that discussion, discovery, collaboration and creativity are often excluded from the classroom. This can cause students to become dependent on their teacher rather than develop a sense of ownership of their learning. The individual aptitudes and learning styles of the students are

rarely taken into consideration (Goldberg, 1997). Papert (1993) describes this teacher-led learning as an Industrial Age model where students are brought to a single physical location, grouped by date of birth and all taught at the same pace. A student-focussed model, which uses modern technology and aims to develop learners who are equipped to deal with the challenges of an Information society, may look quite different.

The phrase "21C learning" is frequently used in educational literature to refer to learning models which will equip students with the skills they need for 21C life. Voogt and Pelgrum (2005) have created a table of "educational elements" which succinctly captures the concept (Table 1). It contrasts an Information Age pedagogy with that of the Industrial Age.

Aspect	**Less (industrial society pedagogy)**	**More (information society pedagogy)**
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

Table 1. Pedagogy in the industrial versus information society (Voogt and Pelgrum, 2005)

The Information Age model described above is active, collaborative and student focussed. Rather than learning known solutions to problems, the learners would work together to create their own solutions. This helps develop learners who are creative, self-directed, problem-solvers who can work with others and feel a sense of ownership of their learning.

A key element of most descriptions of 21C learning is the theory of constructivism. It is based on concepts proposed by Piaget, Montessori and Bruner, among others, and argues that learning is a process by which learners make meaning within themselves as opposed to receiving it from external source. It argues that children invent their own ideas rather than simply absorbing the ideas they hear from their teachers. They assimilate new information to their pre-existing ideas and adjust their understanding accordingly (Mitra, 2000). By this process, their ideas become increasingly complex and powerful.

In constructivism, the focus is on the learner and active learning. They learn by "doing" and discovering. Abbott and Ryan (2000) state that one of the core principles of constructivism is that "a person who is truly passive is incapable of learning". Constructivism borrows from research in child development, specifically in that play and experimentation are considered to be valuable forms of learning. Play involves considering new combinations of ideas. It is a self-structured and self-motivated process of learning which allows children to create, reflect on and work out their understanding (Mitra, 2000). In constructivism, students are encouraged to think for themselves and solve problems. The process that the learner goes through is more important than what they produce and authentic problems and scenarios are preferred to abstract, artificial ones. Collaborative, project-based activities where the group present their work, as opposed to individuals writing reports, are one way this can be implemented. This approach means that education becomes about the effort you put into learning as opposed to the effort that someone else puts into teaching. It is about "knowledge construction and not knowledge absorption" (Abbott & Ryan, 2000, p.74).

Social Constructivism is an extension of this concept which argues that learning is a social and collaborative process that should be facilitated as opposed to being taught directly by a teacher. It is influenced by Vygotsky (1978) who suggested that children

learned from within themselves and from the social or cultural influences around them. Vygotsky believed that a student could achieve more while working with a "more able other" than they could while working alone.

Sugata Mitra (2000) describes three learning models, one of which is where "the teacher or external resource determines the learning content and methodology", another is where "the teacher or external resource determines the learning, in consultation with the learners", and the third is where "the learners determine their own learning outcomes and how they will go about it ". This third model is both Piagetian and constructivist in nature in that it is student-centred and allows the students to have a say in what they will learn and how they will learn it.

A learning experience where students were able to influence how they learn while constructing knowledge for themselves and their peers would be radically different from most current classroom teaching and much closer to the Information Age pedagogy discussed above. It should help create active learners, improve communication skills and build confidence.

2.2 Digital Natives

The concept of "Digital Natives" was first proposed by Marc Prensky (2001). He was referring to people who have grown up with access to computers, video games, mobile phones, the internet, digital cameras and music players etc., as distinct from previous generations who did not have access to the same level of technology and information. Since 2001, things like the iPod, YouTube, Facebook, Twitter, Google, the iPhone and cloud computing have come along. "Google" and "Tweet" have become commonly used verbs and there are "apps" to help you engage in either. John Palfrey claims that we are living in the "most rapid period of technological transformation, ever" (Palfrey and Gasser, 2008).

Prensky believed that, as a result of growing up in an environment so rich in information and technology, the students of today "think and process information fundamentally differently from their predecessors" (Prensky, 2001, P.1). He claimed that "Digital Natives" expect to receive information quickly, that they prefer to skip around a document using hypertext rather than read it sequentially, that they prefer images, sound

and video to text, that they expect feedback instantly, that they prefer games to "serious" work and that they often multitask. He set these "Digital Natives" apart from "Digital Immigrants", i.e. those who adopted these technologies later in life either because they weren't on the cutting edge of modern technology or simply that these technologies didn't exist earlier in their lives. He mentions using reference books rather than searching online and printing documents rather than reading from the screen as examples of "Immigrant" behaviour.

There are many critics of the concept and it certainly has limitations. We cannot assume that all "Digital Natives" are more technically competent than their "Digital Immigrant" counterparts. It must be assumed that there is a wide range in the levels of technical ability among those considered to be "Natives", and indeed "Immigrants". As Nishant Shah (2009) says, "not all digital natives are equal". Many factors influence young people's access to technology. Golding (2000) mentions socio-economic status, gender and geography among others. Prensky's claim that "Digital Native" students "think and process information fundamentally differently" remains unproven. Selwyn (2009) argues that the whole concept is grounded in "common sense" as opposed to scientific analysis of empirical evidence. In addition to this, Livingstone (2009) argues that, even when young people do have access to technology, it is often used in an unproductive fashion. He claims that much of the computer use by young people is passive and solitary. Some "Digital Natives" could use technology as a way to cut themselves off from those around them and the many sources of information available may be distracting. Palfrey and Gasser (2008) also worry that the instant gratification from things like Google searches and instant messaging could lead to reduced attention spans among users.

Despite the reservations mentioned, it seems clear that current students are accustomed to processing a volume and variety of information that previous generations did not or could not access. Many of them are skilled at information gathering and processing and can create content and share information with their peers in ways that most "Digital Immigrants" could barely have imagined in their youth (Palfrey & Gasser, 2008).

Modern students may be less engaged by traditional learning methods than previous generations and better equipped, both in terms of skills and computing resources, to work

in different ways. Making the best use of these skills, and computing resources, is a challenge for educators. If they simply use technology to present information to passive students, they may not be taking full advantage of the power these technologies afford. Helping students to use technology to create artefacts of their own, and thus increasing their knowledge or understanding of a topic, may be a more productive use of the computer's power and the student's time. The concept of "Mindtools" expands further on this.

2.3 Mindtools

Papert (1980s) described three stages of learning, or of "the relationship between the individual and knowledge". The first, in early childhood, is self-directed, experiential learning. The second, in school, features "teaching" and "being told". The third, in creative adults, returns to experiential learning. Inamdar and Kulkarni (2007) argue that by providing opportunities for exploration, technology can bring self-directed, experiential learning into school. In practice, however, technology has mostly been used to provide new ways to present information to the students, perhaps making life easier for the teacher but the role of the student remains fundamentally unchanged (McGarr, 2009; Resnick, 1987). The learners are required to look or listen and remember what they have seen or heard. This leads to a situation where the students and the computer (or the programmer or designer) are each doing the job that the other is best suited to. Jonassen claims that no student can retain and retrieve the volume of information a computer can so they should focus on conceptualising, organising and problem solving and let the computer store the data (Jonassen, Peck & Wilson, 1999). The students should use technology creatively to complete meaningful tasks and construct knowledge for themselves. Jonassen uses the term "Mindtools" to describe pieces of technology that can be used as cognitive learning tools, i.e. computer applications that can be used to encourage critical thinking and higher-order learning (Jonassen et al, 1999). Windows Moviemaker, a basic film editing package, Audacity, a piece of sound editing software and Scratch, a visual programming package for novice programmers could all be examples of technologies that students can learn "with, rather than from" in that they allow the learner to express themselves in different ways and in using these technologies the learner is forced to structure or verbalise their ideas. Tools like Moviemaker and Scratch also allow the user to arrange and re-arrange their work using

a visual interface which may help the user to gain an understanding of the material they are working with.

It is argued that the people who learn most from instructional materials are the people who design and produce them (Jonassen, Wilson, Wang and Grabinger, 1993). On that basis, it makes sense that students should be engaged in the task of preparing instructional materials for each other. This forces the students to analyse and articulate the subject in order to teach it, which will increase their understanding of the subject (Jonassen et al, 1999).

By using technology to retrieve information, solve problems and develop learning materials for those around them, students could use technology in an effective manner to learn the topic in question and develop higher-order skills such as critical thinking, creativity and communication.

A technology-enhanced peer teaching strategy, where students develop and present learning materials for their peers, could leverage the strengths of the Mindtools concept in addition to the many claimed benefits of peer teaching, i.e. having the students teach and learn from their peers.

2.4 Peer Teaching

Peer teaching is an approach in which "learners help each other and learn by teaching" (Goodlad, 1990, P.1). Young students may naturally tend to help each other, whether asked to or not, but peer teaching is a step above this in that it is organised and involves a definite purpose (Topping, 1988). This approach can be applied in many ways, involving both one to one tutoring and group work.

It has been claimed anecdotally that people remember a high percentage of what they discuss with others, experience for themselves or teach to others but only remember a comparatively low percentage of what they read, see or hear. The role of the student in a traditional teacher-centred pedagogy is often based around passively reading, seeing or hearing. This largely excludes discussion, authentic personal experience and the power of learners as teachers from the classroom and, as a result, may not be the most effective way to learn.

In a peer teaching pedagogy, the role of the teacher is quite different from the more traditional “sage on the stage” model (King, 1993). The term “orchestration” is used by Dillenbourg and Fischer (2007) to describe the teacher or facilitator conducting collaborative learning activities.

There are many benefits claimed of peer teaching. Peer relationships don’t have the same authority balance as student-teacher relationship and so “the distance between the teacher and learner is reduced” (Goodlad, 1990, P.9). Students will often have similar language skills and styles to their peers. It is also probable that they will be at a similar academic level which may make the tutee(s) feel more comfortable in asking questions, admitting confusion or answering incorrectly. A study by Cohen, Kulik and Kulik (1982) found that students who used peer tutoring performed better in examinations than control groups who had not used peer tutoring. Beasley (1997) claimed that a collaborative, student-centred, peer tutoring programme helped students who were “passive, teacher dependent, uncritical recipients of information” become more “engaged, questioning and autonomous learners”. He also found that the benefits to the tutors included increased confidence and self worth and improved communication skills. Goldschmid and Goldschmid (1976) argue that peer tutoring can benefit both the student “teacher” and the student “learner” by encouraging participation, cooperation and social interaction. A more in-depth analysis of the extensive literature on this area is beyond the scope of this dissertation but Leung, Marsh and Craven (2009) carried out a meta-analysis of over sixty peer teaching studies and their findings endorse those mentioned here.

It should be pointed out that peer teaching is not a substitute for teaching and activities organised by teachers but it could be a useful part of their repertoire. Also, if the peer teaching work is not properly organised and structured it can lead to confusion among students as to their role and a failure to develop the skills intended. It could also lead to a disproportionate benefit to those students who are already learning well (Boud, Cohen and Sampson, 2001; Topping, 2005).

2.4.1 Learning without a teacher

A series of studies which pushed the limits of peer education were carried out by Sugata Mitra (Mitra and Dangwal, 2010). He was exploring what and how children can learn

without an expert teacher to teach them directly. He asked a group of Tamil-speaking 10-14 year olds to learn molecular biology, in English, without any adult help, using only a computer with internet access. He then arranged for an older mentor, who had no knowledge of the subject, to support and encourage the students. He found that on their own, the children's test scores were similar those achieved by children in the local schools. With the help of the mentor, their scores increased to the levels of students in high-performing private schools. This is obviously not a complete educational solution but it does suggest there is great un-tapped potential for students to learn with and from each other using technology, and that support and encouragement increases this further.

2.5 Examples

This section contains some examples of how the concepts discussed in this literature review have been implemented. The examples given are High Tech High, a charter school movement in America whose aim is to develop students who are passionate about learning and can acquire skills through individual and collaborative project work, Bridge21, a technology-mediated collaborative learning programme based in Trinity College Dublin and the Computer Clubhouse Network, a programme which gives young people the opportunity to access technology and work in a collaborative community. This is obviously not an exhaustive list but by including examples from formal, semi-formal and informal settings, it represents a reasonable cross-section of implementations of the ideas discussed here.

2.5.1 High Tech High

High Tech High is a charter school movement, based in San Diego, where students are engaged in project based learning, solving real world problems and have more freedom than others students in equivalent schools (Hardy, 2001). The goal of the school is to create an environment where students are passionate about their work and develop the skills required for work and citizenship in the 21st century. The school operates on four key design principles; Personalisation, Adult World Connection, Common Intellectual Mission and Teacher as Designer (High Tech High, 2010). Personalisation means that each student has a staff advisor who monitors that students' development. The student can choose projects which interest them and their best work is compiled and presented in digital portfolios. Learning spaces and technical facilities are set up to facilitate both individual and small group work. The Adult World Connection is achieved through various shadowing days, lunch

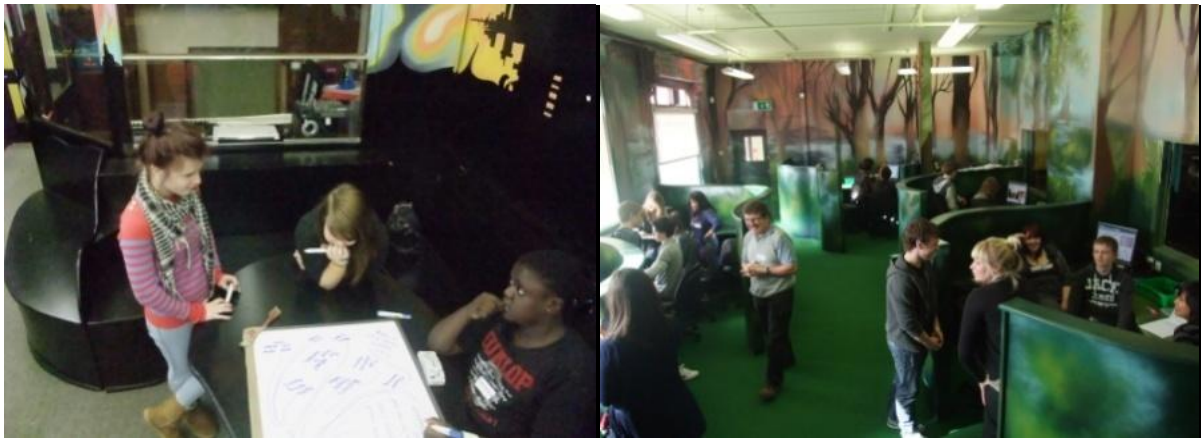
meetings and extended work experience programmes. Common Intellectual Mission means there is no distinction between developing technical skills and focussing specifically on college entry. The aim is to develop skills that will lead to success both academically and professionally. Assessment is based on project work, problem solving and presentations. The Teacher as Designer principle is applied through interdisciplinary teams of teachers developing programmes for 50-70 students. A flexible schedule allows for various styles of teaching, as is appropriate for the programme in question. High Tech High has proved very successful in the 11 years it has been running and is now an organisation of 8 schools (High Tech High, 2010). High Tech High includes many of the features of 21C learning as described by Voogt and Pelgrum (2005), it is set up so that students can use and develop their technical skills and allows students to use technology productively rather than simply as a new way to present information. It is an excellent example of how 21C learning principles can be applied in a formal education setting.

2.5.2 Bridge21

Bridge21 is a learning centre in Trinity College Dublin set up to facilitate technology-mediated collaborative learning (Lawlor, Conneely & Tangney, 2010). Second level students are released from school to take part in week-long workshops involving teamwork and technology. There is a heavy emphasis on collaborative, project based and constructivist learning. Twenty to twenty-five students participate each week and work in teams of four or five. The teams are fixed for the week and each team must elect a team leader. Much of the communication between the facilitator and the students is done through “team leader meetings” and the leader is responsible for passing information to and from the team. The learning space is designed to support collaborative work with moveable furniture in one room and “team pods” in the other. Each team has their own pod which contains two desktop PC’s for the team to share. This forces the team to share resources, encourages the sharing of ideas between peers and allows the students to work together and help each other. The students usually work on creative, technical projects such as movie making, animation or game design. A team of volunteer mentors support and encourage the students rather than teaching them directly. The teams are given deadlines to complete their work and must make presentations at regular intervals (Tangney, Oldham, Conneely, Barrett & Lawlor, 2009). Bridge21 allows students to use technology productively and the

team structure and resource sharing encourages collaboration and peer learning. Bridge21 is a semi-formal learning environment in that the students are working during school hours and the activities are led by a facilitator. It is a good example of the ideas discussed here as many of the features of 21C learning are implemented, any “Digital Nativeness” that the students possess is harnessed and built upon and several pieces of software are used as “Mindtools”.

Approximately 4,000 students have taken part in Bridge21 activities and their reaction has been overwhelmingly positive. They enjoy this style of learning and are often eager to take part in further activities. There is some evidence that working in this manner allows students to take ownership of their learning, improves motivation and helps develop higher order learning (Lawlor, Conneely & Tangney, 2010).



Pictures: Students working at Bridge21

2.5.3 Computer Clubhouse Network

The Computer Clubhouse Network allows young people to use technology to express themselves and explore ideas by working on projects in a supportive and collaborative manner. It aims to provide access to technology to disadvantaged young people and to encourage under-represented sectors to develop technical skills (CCT, 2002). The clubhouse model is that of an out-of-school project and operates as a drop-in centre. This means that those students who do take part are self-motivated to some degree and have some level of aptitude or interest in working with technology. It may appeal to their “Digital Native” side! Students work on continuous and short-term projects in areas such as web design, animation, computer programming and music production. The students are supported by a

team of volunteer mentors who offer technical assistance and encouragement. The clubhouse helps young people develop technically, creatively and personally and incorporates many of the elements of 21C learning described by Voogt and Pelgrum (2005).

There are over 100 computer clubhouses in countries around the world and more than 25,000 students take part in activities there each year. There is evidence that the students benefit both in terms of technical skills, confidence and raised educational aspirations (Computer Clubhouse, 2012).

Summary

In this literature review, the elements of an Information Age pedagogy have been discussed and it has been shown that many of these could be encompassed by a constructivist approach to learning that includes play, discovery and active learning. We have discussed the concept of "Digital Natives" and acknowledged its many limitations but accept that many learners are now accustomed to receiving and processing information in ways previous generations never did and that this is both an opportunity and a challenge for educators. Student involvement in the process of deciding how to meet that challenge is vital. We have seen that while technology has often been used as a tool to learn from, it can be used to facilitate knowledge construction among learners and become a tool they learn, and indeed teach, with. It has been shown that peer teaching is an under-utilised but, if properly structured, powerful learning technique. The benefits to students of this approach are academic, personal and social. We have seen that the teacher doesn't need to be the main source of information for students to learn and that the teacher can orchestrate groups of students and guide them through researching and producing information to share with each other. Finally, we have seen some examples of how these concepts can be applied in practice.

Chapter Three. Design.

This chapter contains a discussion of how the concepts mentioned in the literature review could be applied in a student-led technology enhanced peer learning experience and the details of how the learning experience being studied was implemented. This chapter is divided into two sections. The first section discusses the concepts covered in the literature review and how they could be combined and applied to a peer teaching workshop. The second section describes how this was actually implemented.

3.1 Design of the learning experience

The literature review has suggested that while the "digital native" concept has many limitations, there is a cohort of modern students that are computer literate, can access online resources and are accustomed to processing more information than any previous generation could have (Prensky, 2001). Many are also capable of creating digital artefacts of their own. These skills are often under-utilised in traditional classrooms. A constructivist learning model, where the students can engage in discovery and learn "by doing", could be implemented for these students using modern technologies and the skills many of the students possess or could develop. The design implications of this are that the students can be engaged in searching for information, preparing learning activities and creating digital artefacts as part of this learning experience.

There may be a tendency among students to teach as they have been taught, i.e. to present information to their students, so they should be encouraged to think about how they would like to learn and to create the kind of interesting and varied learning experiences they would enjoy themselves. While preparing a presentation may represent a certain level of engagement with a subject, it could also allow the students to simply copy and paste text from one place to another without really thinking about it. This would not represent "learning by doing" and may avoid the kind of active engagement with the topic that constructivist learning seeks to achieve. By creating artefacts and planning activities on the topic, it should lead to a more enjoyable and productive learning experience for both the "student" and "teaching" teams. The opportunity to discuss how they like to learn allows the students to influence how their peers will try to "teach" and is in keeping with Prensky's argument that the student voice is an important one in the planning of learning activities.

The concept of 21C learning was discussed and the elements of an ”information society pedagogy” were explained (Voogt & Pelgrum 2005). These included teams of students working together, at their own pace, on a variety of activities, creating new solutions to problems and presenting their work rather than taking individual written examinations. This suggests that students can work in teams, helping each other to learn and to create and present original learning experiences for their peers, and that by working this way, they will develop more of the skills required by an information society while also covering curriculum content.

The concept of “Mindtools”, i.e. pieces of technology that students can use to learn with, rather than from, was also discussed. By allowing computers to do the storing and retrieving of facts, the learner can be freed to develop skills such as critical thinking and higher order learning. The learner can use technology to work and engage with the content they are studying and may, in the process, develop a deeper knowledge and understanding of the topic than if the content was simply presented to them. If students could create digital artefacts on the topics they are studying in a way that causes them to engage with and understand the topic and allowed them to express their knowledge and understanding of it, this would be an excellent method of covering curriculum content and also developing higher order skills. Taking this idea one step further, it has been suggested that the people who design and produce instructional materials learn more than the audience who view/use them (Jonassen, Wilson, Wang & Grabinger, 1993). On that basis, it makes sense that students should prepare learning materials, or experiences, for each other. This would be a powerful learning technique for the students creating the learning experiences and, if done well, for their peers too.

It has been claimed that a peer teaching model can help develop learners that are engaged and autonomous, can discuss topics using their own level of language, can work together to achieve learning objectives and can question their peers and their peer’s work. Benware and Deci (1984) claim that learning for teaching creates high levels of motivation and that learning by teaching leads to excellent levels of retention, if perhaps not the fabled “90% of what we teach to others”! This suggests that students given the task of learning something so that they can teach it to others will be motivated to learn it well and the

process of preparing a learning experience for their peers will re-enforce this learning further and will also help the students develop communication and critical thinking skills.

In the work of Sugata Mitra, we have seen an example of what engaged students can learn, without direct instruction from an expert teacher, if they have access to the internet. Students can learn to a certain level on their own and their performance improves if they are encouraged by a friendly mentor, whether the mentor has any subject knowledge or not (Mitra & Dangwal, 2010). This may mean that students do not need a subject -expert teacher at all times. If suitably motivated and encouraged, by working on their own or with their peers, they can gain an understanding of many of the topics they are traditionally "taught" directly by a teacher. It suggests that the traditional role of the teacher as the primary source of information for learners is changing and that how teachers work with their students may have to change too.

Traditionally, classroom teaching has relied on reading, seeing and hearing as learning methods. This study intends to use discussion, personal experience and above all, learning for and by teaching.

Finally, some examples of how the concepts mentioned have been implemented were discussed. The design of this learning experience was based on the Bridge21 model. Bridge21 workshops involve teams of students, working on creative technical projects and presenting their work to their peers. There is a highly structured team-based model in place with the teams staying fixed for the duration of the workshops and with each team electing a team leader. The learning space is also configured to support collaborative learning with flexible planning and presentation areas and fixed "team pods". The students are supported through their work by a team of mentors who offer advice and encouragement without teaching the group directly. All of these elements are included in the design of this learning experience. All of the students had been involved in activities in Bridge21 prior to taking part in this workshop.

3.1.1 Design Summary

Students, working in teams, were given the task of learning an element of the senior cycle curriculum without an expert teacher to help them and then creating a learning

experience on the same topic for their peers. Initially, each team was asked to make a presentation on how they like to learn, thereby influencing how they would be "taught". Each team was then assigned a topic from their school curriculum, asked to research the topic on the internet and learn it for themselves and then prepare lessons, artefacts and activities on the subject. The students were constructing knowledge for themselves and their peers and as such, this was a collaborative and constructivist learning experience (Abbott & Ryan, 2000; Holmes et al, 2002). The teams were working on a variety of subjects and there were no subject expert teachers to help so they had to try and learn with or from their peers or work things out for themselves (Mitra & Dangwal, 2010; Leung, Marsh & Craven, 2009). The topics covered were mostly suggested by current second level teachers.

3.2 Implementation

Four workshops were run. Each one was four days in duration and there were twenty to twenty-five students, working in four or five teams, taking part in each workshop. In total, 82 students participated in the activities, which took place in Bridge21. All of the participants had taken part in previous activities at Bridge21 so they were familiar with working in teams and with the Bridge21 model in particular.

The students taking part in each workshop came from six different schools so many of them did not know each other prior to taking part. For this reason the workshop began with ice-breakers and team-building activities.

3.2.1 Ice-breaking and forming teams

The ice-breakers included an activity where pairs of students had to design name-tags for each other, introduce each other to the rest of the group and speak about the work they had done during previous Bridge21 workshops. The students were then arranged into teams and took part in some team-building activities involving problem solving and agreeing a plan, as a team, for extreme survival scenarios such as being lost in the desert or at sea. Each team also had to think of a team name and elect a team leader. In any Bridge21 workshop, if possible, students from the same school are put into different teams. This means that each team starts the workshop as strangers so getting to know each other and successfully completing some small tasks together can provide an important foundation for several days of close collaboration.

3.2.2 How do you want to learn?

The students took part in a series of brainstorming activities and discussions on topics such as “your favourite websites”, “your favourite websites for learning” and “a time I learned something well”. The intention here was to highlight that many of their most memorable learning experiences were real-life, practical experiences where they wanted to learn and to remind them that learning isn’t restricted to school work (Jonassen, 1994).

Each team was then asked to prepare a presentation about how they, or their peers, like to learn. They had the option to simply express their own opinions, to carry out research online or to question or survey their peers. They were reminded to think about the learning experiences that had been discussed. This activity was in keeping with Prensky’s (2001) assertion that students should have a say in how they learn. It allowed them to discuss learning in a wide context but also to influence the type of the learning experiences that the teams would create for each other later in the workshop. The teams had approximately two hours to prepare their presentations before presenting to the whole group at the end of the day.

This task was an opportunity for the students to express and explore what they considered to be important in a learning experience and was leading to the primary activity of the week, learning a new topic without a teacher and creating a learning experience for their peers.

3.2.3 Learning to teach and teaching to learn

Each team was assigned a topic from the Senior Cycle curriculum. The subjects were suggested by current second level teachers and were new to the majority of the students. The Chinese language topic was an exception, in that it is not on the Senior Cycle curriculum but it was deemed suitably complex and relevant to be included as a topic in this study.

The seven topics were:

1. Maths – Probability
2. History – The Space Race and the 1969 Moon Landing
3. History – Nazi Propaganda
4. Biology – The Digestive System
5. Physics – Light: Reflection and Refraction
6. Geography – Brazil
7. Languages – Chinese

The students were asked to design the kind of learning experience that they would like to take part in themselves and were reminded about the various "How we like to learn" presentations, which were available to all of the teams.

The majority of the students had never worked with these topics before so the first challenge was to do some initial fact-finding and learn the topics for themselves. Each team had the use of two computers with internet access to achieve this. By using online resources and tutorials, and working together, the students first familiarised themselves with their topics and then decided which elements of the topic they would focus for their learning experiences.

The next stage was to generate ideas as to how they might create their learning experience. Each team chose some specific elements of the topic they wanted to cover and prepared a list of ideas for what they thought their learners should experience. These ideas formed the basis of a discussion with the facilitator regarding what was practical and achievable within the time and resource constraints of the workshop. The students were encouraged to, where appropriate, create their own activities or artefacts in addition to what they found online but the use of technology was not compulsory.

To run their learning experience, each team had the use of two rooms; one with a PC connected to a big screen and projector and the other with 10 desktop PC's, all with internet access. All of the resources within the Bridge21 learning space were available to the students e.g. whiteboards, markers, paper, post-it notes and pens, along with the learning space itself. During the workshop, the students had approximately one working day, about 6

hours, to research and learn their topic and prepare their learning experience. There were team meetings with the facilitator at various stages through the day to demonstrate the progress they were making and to help them make decisions about exactly what they should cover and how they should cover it. The hope was that their ideas for how to teach would lead to the use of technology rather than specifically trying to include technology for its own sake. It was suggested to them that a thirty minute learning experience was a good time to aim for.

A small change was made for the final two workshops in that the use of Microsoft PowerPoint was strongly discouraged. It was widely used during the first two weeks but both the facilitator and the students involved felt that it was being used as an "easy way out" for the "teaching" team and that it did not encourage the development of interesting learning experiences for the "student" teams.

Summary

This activity allows second level students to think about how they currently learn, how they would like to learn and to have a go at learning a curriculum topic without a teacher and creating an enjoyable learning experience for their peers. The students worked in a collaborative, constructivist manner, in keeping with Voogt and Pelgrum's (2005) description of 21C learning, they developed new technical skills and used many they already possessed, to both access and create digital content and artefacts, and they did all this within the framework of a peer teaching exercise. An examination of this workshop should be helpful in exploring the stated areas of interest of this study.

Chapter Four. Research Methodology.

This project examines a method of learning where students were asked to learn curriculum material without a teacher and then teach it to their peers. It explores areas including; learning without a domain expert teacher, team work, peer teaching, technology and user generated content. This chapter contains details of the research strategy being employed, some information about the participants and an explanation of what data was collected, and how it was collected.

4.1 Research Strategy

An exploratory case study approach was followed. Case studies are a way of observing what happens, collecting data, and making a report based on analysis of that data. They involve a deep examination of a single event (Davey, 1991) and allow for both quantitative and qualitative data collection (Kitchin & Tate, 1999). Qualitative data can be collected from many sources; observation, interview data, open questions on questionnaires and data taken from artefacts, documents and presentations made by participants (Cresswell, 2008). Case studies can involve single or multiple cases (Yin, 2003). Multiple cases can enhance the results of a study, providing increased confidence in the findings.

The exploratory case study is a method that allows the researcher to generate insights regarding the phenomenon of interest rather than confirming expected outcomes (Mayer & Greenwood, 1980). If extensive empirical research has not taken place around the topic of interest, an exploratory case study is a logical first step and it allows for activities to take place before research questions have been fully formed (Yin, 1994). The issues being explored can be examined in this context and conclusions reached which may be relevant in a wider setting. An embedded multiple-case design was considered for this study but given the timescale available, detailed analysis of individual teams was not deemed practical so a single case design was chosen. The overall cohort of 82 students was the unit of analysis in this case.

An exploration of this topic, and the various sub-questions associated with it, meant that various sources of data, both quantitative and qualitative, were required. This study is not an attempt to prove anything conclusively, merely to examine certain issues within a

specific context, and it is an area in which extensive empirical research has not taken place. Case studies can be useful in answering both "How" and "Why" questions, i.e. capturing outcomes but also gaining an understanding of the factors that led to those outcomes (Cohen, Manion & Morrison, 2011). In this study, how students say they would like to be taught and how they teach each other are important outcomes but the reasons behind them are also of interest.

4.2 Ethics

The School of Computer Science and Statistics has granted ethics approval for the Bridge to College programme which covers this piece of research. The students are under eighteen years of age so both parental and participant consent is required.

4.3 Profile of participants

82 students participated and were selected randomly from seven of the schools involved with the Bridge to College programme. The students were all in Transition Year and there was a wide range of academic ability within the group. The participants had all completed an initial four day technology-mediated collaborative learning workshop as part of the Bridge to College programme and 26 students had also completed a week of Bridge21 computer programming workshops prior to taking part in this study.

4.4 Researcher Bias

While case studies have many advantages, there are some weaknesses which must be addressed. Nisbett and Watt (1984) mention that case results may not be generalisable, that they are not easily cross-checked and therefore may be biased or subjective and that they are prone to issues of observer bias. As Programme Coordinator at Bridge21, the researcher was leading the activities being examined and had worked with all of the participants during the preceding workshops.

4.5 Data Collection

The methods of data collection used in this study included pre and post questionnaires, semi-structured student focus groups, mentor interviews, observation and analysis of the student presentations and project work. Both qualitative and quantitative data was generated by the questionnaires through discussion questions, and "Yes or No"

and Likert scale questions, respectively. The focus groups, mentor interviews, the researcher observations and the student presentation and project work are all qualitative data sources.

There were several sub-questions that this study set out to answer and thus to explore the areas mentioned above. The relevant data collection methods for each sub-question are discussed here.

1. How would the students like to learn?

The students' projects about "How we like to learn" were analysed to help answer this question.

2. How would they teach each other?

The learning experiences that the students created were observed and video recorded to help answer this question.

2(a). What support did the students require?

The researcher was leading the workshop and observation notes were taken. Audio recordings were made of some of meetings between the teams and the researcher as they planned and developed their learning experiences. The post questionnaire contained questions about how difficult they found the task of preparing a learning experience and which parts of the process were the most challenging and the mentor interviews included discussion about what type of help the students required and what types of interventions the mentors made during the workshops.

3. Were the students engaged in the activity and motivated to learn?

The post questionnaire contained questions which sought to measure the motivation level of the students with regard to this style of learning. This area was also covered during the student focus groups and the mentor interviews. The answers given by the students here may refer as much to the Bridge21 model in general, as they do to the specifics of the peer teaching workshop being studied here.

4. Did the teams create innovative learning experiences?

Each "student" team rated the quality of the learning experience created for them during the student interview, both in terms of innovation and effectiveness. The quality of the learning experiences was also assessed by the researcher and the mentors.

4(a). Did the students learn?

Various strategies were considered for this question. The first issue considered was that of short-term versus long-term retention. Given the time scale of the study, any measurement of long-term retention was deemed impossible. Pre and post tests were also considered but, given the limited time available, it was decided that this would mean being very specific about which content the students would cover or a high likelihood of the assessments being meaningless. The students' opinions on whether this method of learning was effective were considered important so they were questioned about how much they felt they learned about the topic they "taught" to others and the topic which was "taught" to them. This may not have been acceptable as part of a more quantitatively rigorous methodology, such as an experiment, but was sufficient to give an indication of the general effectiveness of the method of peer teaching employed in this case.

By answering these questions we should be able to discuss the effectiveness of students learning in this way, whether or not they would like to, and what support they need to work in this manner. This is all relevant to whether or not this style of teaching could play a role in formal education.

Summary

This chapter has explained that an exploratory case study approach was taken during this study and given some information about the participants. It also contained a breakdown of the sub-questions being explored in this study and which data collection methods are being used for each one. The next chapter contains analysis and discussion of the data collected.

Chapter Five. Data Analysis.

The first section of this chapter briefly mentions the data sources that were employed and then sets out the data that was collected, how that data was analysed and describes the findings based on that analysis. The second section involves a discussion of these findings and how they relate to the ideas mentioned in the literature review.

5.1 Data Sources

There were several sources used to gather data for the purpose of analysis.

1. Student questionnaires - (pre and post).
2. Student work, presentations and artefacts.
3. Observation - (direct and video).
4. Student interviews.
5. Mentor interviews.

All student presentations were video-recorded and any digital content the students created was collected for analysis. As the researcher was leading the activities, he was present throughout the process and took some observation notes. Finally, interviews with the students and mentors were recorded using a smart phone.

5.2 Data Analysis and Findings

Data analysis is a continuous process that begins with the researchers' first impressions and runs through until the final results or conclusions are reached (Stake, 1995). The first step is to explore all of the available information and for the researcher to get a general sense of the data. An initial exploratory analysis of qualitative data involves immersing oneself in the data, making notes, forming impressions and thinking about how the data should be organised (Cresswell, 2008). A first pass through the audio and video recordings and the student questionnaires, along with the brief notes which were taken during the workshops allowed the researcher to form some initial opinions and develop a sense of any patterns or points of interest emerging from the data.

5.2.1 Questionnaires

The questionnaires sought to explore the students' attitudes towards teaching and learning, their experience of learning without a teacher, the challenges they faced in

creating a learning experience for their peers and their overall feelings of engagement and motivation during these workshops. The questionnaires were hand-written by the students and then entered into Excel spreadsheets by the researcher. This allowed for quick sorting, grouping, re-arranging and easy calculation of any of the quantitative questions included in the questionnaire. The students' answers to the open questions on the questionnaires were analysed and codes and themes were extracted.

Overall Experience

On the post questionnaire, the students were asked to rate their overall experience during the Learning Circles workshop. They were given a five point scale with 1 representing "Excellent", up to 5 representing "Poor". The students were very positive about the experience, with an average rating of 1.25 over the four weeks from the 80 students who completed the questionnaire. There was a small variation from week to week, with week two giving the lowest rating at an average of 1.67. When asked to explain their rating, 178 answers, covering 12 different reasons were given. 40 students said that it was fun, 36 said that "It worked" or that they learned something, 25 said it was new or different, 24 mentioned meeting new people and 13 said that everyone got along well. Being part of a team, increased confidence, the facilitator and mentors and the fact that it was interesting were also mentioned although 5 students did mention that it was less fun than the first workshop they took part in at Bridge21.

> *"Because I love the way things are done around here, laid back, hardworking and not stressful at all."*
>
> *"It was incredibly fun, it was easy to get along with everybody. The week was also very productive, I learned so many things (Like Chinese And Samba!) I also improved my communications skills."*
>
> *"I loved it this week because all of us really clicked as a whole group and we got great work done as well as having fun."*
>
> *"It was much better than school, we got the opportunity to learn and teach a leaving cert subject to the other groups."*

The vast majority of the comments were very positive but one student did say that *"I think I am used to school and didn't like the sudden learning change".*

How do you work?

A Likert scale was included on both the pre and post questionnaires to measure, among other things, how often students work alone or in groups and how often they find learning interesting or boring. On the pre questionnaire, these questions referred specifically to school. On the post questionnaire, they referred to the work the students did during the Learning Circles workshop. It was a five point scale with 1 representing "Never" and 5 representing "Always".

	In School....	**During this workshop...**
I work on my own	3.35	1.86
I work in groups	2.89	4.30
It was interesting	3.01	4.40
I was bored	3.20	1.20

Table 2. "How you work" Likert scale.

The ratings of 2.89 and 3.35 for group-work and solo work in school do not suggest a completely individualised environment but these workshops clearly involved significantly increased time working in a team for these students. There is also a clear rise in how often students felt interested in their work compared to school and most students said they were never bored during the four day workshop.

How did you learn?

The next question covered how the students learned their topic without an expert teacher to teach them. 7 out of 80 said they knew the material already and from the remaining 73 students' answers, 94 data points were identified, with some students giving more than one answer. 71 students referred to learning from the internet, with 14 of those mentioning YouTube or other online video sites while 4 others played online games related to their topic. After this, discussing the topic with their team-mates, trying to simplify it for their peers and studying notes in preparation for their learning experiences were also mentioned. Only 2 students mentioned asking for help from a mentor.

This suggests that the students are capable of finding the necessary information online and understanding it, possibly with the help of their peers, and also points to the potential motivational power of learning to teach.

Is teaching your peers a good way to learn?

The participants were very positive about the experience of learning for, and by, teaching with 73 out of 79 answering "Yes" to the question "Do you think teaching your peers is a good way to learn?". The reasons they gave for their choice were analysed, and codes and themes were extracted. There were 101 data points collected and these were grouped into 16 codes.

Learn by teaching – 13	No judgement - 2	More respect – 2	We both learn – 2
Learn by research – 6	Can make it fun – 6	Talk our own way – 15	Can relate better – 18
They concentrate more – 6	Same level – 6	Less pressure – 3	Comfortable – 3
Have to plan/think – 2	Discover new ways to learn – 1	Pressure to know it first – 14	Know what is interesting – 2

Table 3. "Why Peer Teaching?" codes.

These codes were arranged into three main themes.

Theme	**Codes**
Motivation	Learn by teaching, Have to plan/think, both learn, research, pressure to know it first, discover new ways to learn
Relationship/Understanding	Concentrate more, Can relate better, Talk our own way, Same level, More respect, Know what is interesting
Atmosphere	Less pressure, Comfortable, No judgement, Can make it fun

Table 4. "Why Peer Teaching?" themes.

The pressure to learn the material to teach and working through the process of creating and delivering a learning experience were seen as big motivating factors in learning the topic. The students felt that their peer relationships and a shared level of language were advantageous in teaching each other and that the atmosphere created by peer teachers was comfortable, fun and allowed them to ask questions with less fear of judgement than in a normal classroom setting.

There were 6 students who answered "No" to this question. 5 of these mentioned a lack of discipline without a teacher to maintain order as the reason for this. One student

pointed out that not all students are at the same level and that it is difficult for a "weaker" student to try and teach a "smarter" student.

Learning from your peers

The students were positive about the experience of being taught by their peers, but not as strongly as for learning by teaching. 65 out of 80 answered "Yes" to the question, "Do you think being taught by your peers is a good way for you to learn?", with 13 answering "No".

The students who answered "Yes" to this question gave similar reasons to those given for the previous questions, without the motivating factor of learning to teach.

Theme	Codes
Understanding/Respect	Easy to take in, Talk like friends, Relate better, Understanding, Respect, Same level, Variety of opinions
Fun/Interesting	Make it interactive, more enjoyable, more fun, interesting

Table 5. "Learning from peers" themes and codes.

Some of the students who answered "Yes" also mentioned that the teaching students would "need to prep well" and that they could explain well "If they know" the material. This concern was also mentioned by some of the students who answered "No", with "lack of experience", "wouldn't teach properly" and "adults know more" among the phrases used. The students who answered "No" also mentioned a lack of discipline and the fact that they could easily get distracted without a teacher.

How hard is it to be a teacher?

The questions "How hard is it to be a teacher?" and "Why?" were included in both the pre and post questionnaires. On a scale of 1 to 5 (Very Easy up to Very Hard), the students rated teaching at 3.69 on the pre-questionnaire and 3.78 on the post-questionnaire; a slight increase. When asked why they felt this way, discipline was the most common answer on both questionnaires but was given less often on the post questionnaire; 25 students mentioned it, down from 39. Several other ideas were mentioned more often on the post questionnaire. These are shown in Table 6.

Theme	Pre-Questionnaire	Post-Questionnaire
Discipline	39	25
Preparation	11	15
Make it interesting/fun	13	25
Subject knowledge	7	13
Communication	0	16
Patience	5	5
Lack of technology in class	0	1

Table 6. Why is it hard to be a teacher?

This wider spread of opinions suggests the experience gave the students a better understanding of what is required to teach a class, particularly in the areas of having to present information to a room full of students and having to try and do so in a clear, interesting way.

Motivation

Two short questions on the questionnaire specifically sought to examine the level of student motivation during the workshop. The first asked "Did you feel more motivated to learn the topic knowing that you would teach it to others rather than just learning it to pass a test yourself?". 79 out of 80 students answered "Yes" to this question.

Another asked "Would you be willing to take part in further workshops like this one?". Again, 79 out of 80 answered "Yes" to this. While neither of these questions was particularly deep, a 99% response such as this is a strong endorsement of this style of learning.

What were the hardest things to do?

In response to the question, "What were the hardest things for you and your team to do?", 87 data points were collected and sorted into 15 codes. These are shown in Table 7.

Get them interested – 6	Remember/Understand – 5	Planning/Preparation – 14
Public Speaking – 2	Decision-making as a team – 7	Work together – 2
Make it fun – 4	Meet deadline – 4	No teacher – 1
Research – 2	Finish the task – 1	Explain clearly – 3
Teach – 6	Choose a Team Name – 4	Think of a way to teach – 25

Table 7. "Hardest thing to do" codes.

These codes were arranged into 5 themes.

Theme	Codes
Learning/Research	Remember/Understand content, No teacher, Research
Planning/Decisions	Planning, Decision making as a team, Work together
Preparation/Finish	Complete the task, Meet the deadline, Preparation
How to teach	Think of a way to teach, Make it fun, Get them interested
Teach/Explain	Teach, Explain clearly, Public Speaking

Table 8. "Hardest things to do" themes.

By far the biggest challenge the teams faced was finding ways to make the material interesting or fun for their peers. 35 of the 87 data points fed into this theme with close to half of the students referring to it in some way. Completing the task and time-keeping were mentioned by a few students and general team issues such as working together and making decisions were also mentioned. Remembering or understanding the material was mentioned by only 5 students. In general, it seems that the students felt that learning the material without a teacher was quite achievable but having to teach it in a fun, interesting way was much harder.

The questionnaires suggest that the students enjoyed this learning experience and found it engaging and challenging. It seems that the majority of students were comfortable researching and learning without a teacher but they found it difficult to come up with interesting ways to teach the material. They were very positive about the idea of learning by teaching and positive, albeit less so, about the idea of learning from their peers. The student presentation work and the learning experiences they created are discussed next.

5.2.2 Student work

"How we like to learn" presentations

The students' "How we like to learn" projects followed one of two patterns. A short spoken introduction followed by a short video demonstrating the idea or ideas the team wished to discuss or a straight-forward PowerPoint presentation where several ideas were presented. Codes and themes were extracted from these projects based on the students' various ideas about learning. From the 17 projects analysed, 60 data points were extracted and these made up 16 separate codes, listed in Table 9.

Active – 5	Video – 2	Internet – 2	Technology V Books -8
Teamwork -8	Practical – 3	Learning Space - 3	Continuous Assessment – 1
Games – 5	Class size – 1	Relaxed Atmosphere – 2	Clear Instruction/Explanation – 2
Song – 5	Research/Discovery – 4	Presentations -2	Friendly V Strict teacher - 8

Table 9. "How we like to learn" codes.

These codes were arranged into 5 main themes.

Theme	**Codes**
Technology	Technology, Internet, Video, No more books.
Teamwork	Teamwork
Active	Active, Interactive, Practical, Games, Song
Atmosphere	Relaxed atmosphere, Friendly teacher, Learning space, Class size
Project-based	Research, Discovery, Presentation, Continuous assessment

Table 10. "How we like to learn" themes.

Some students presented a negative view of school situations involving strict teachers and boring books in a Victorian-style classroom and then contrasted this with a more relaxed atmosphere in a modern, technology-rich learning space with a friendly teacher or facilitator leading the class. Teamwork, technology and the relationship between student and teacher were the most common issues mentioned, along with a desire for learning to be active with problems to solve, information to find and tasks to complete. Learning through song and continuous assessment, as opposed to one final exam, were also mentioned as ideas the students were in favour of.

Learning experiences

Video footage and artefacts from student-led learning experiences were collected for analysis. The researcher was not present during many of the learning experiences so an initial viewing of each video allowed for some brief note-taking and to get a sense of how the students tried to teach. Each video was then viewed for a second time with the researcher taking more detailed notes.

During the first two workshops, most of the teams (8 out of 9) based their learning experiences around Microsoft PowerPoint presentations. In most cases, they prepared slides and something else to go with it, mostly videos or games. Three teams used YouTube videos, three teams made videos of their own, seven teams used games they found to play online or at least learned about online and one other team invented a new type of quiz

game for their learning experience. One team used light experiments as part of a physics lesson, one wrote a poem and another wrote a play for their students to perform. All of the teams engaged with the process and attempted to develop interesting learning experiences. In most cases, they needed to be encouraged to look further than preparing slides as many of them saw this as a new and interesting way to teach. When encouraged though, every team came up with at least one learning activity or experience to accompany their presentation and most came up with two or more. One team got their students to complete a word-search, which was little more than a time-filler, but most teams got their students engaged in some kind of productive work or at least a fun quiz-style activity to check for understanding/learning.

Due to the fact that so many teams created PowerPoint presentations during the first two workshops, it was decided that PowerPoint should be banned from use in the learning experiences during weeks three and four. Some of the students from the earlier workshops had commented that:

"PowerPoint gets really boring sometimes."

And that:

"PowerPoint is the easiest way for the teacher, not the best way." [for the students to learn]

The reason for this change was explained to the students and, with this new rule in place, there was a definite increase in the variety of the learning activities that the teams produced. Over the two weeks, three teams still made presentations but they were a minor part of the learning experiences, three teams showed videos they had found on YouTube, four teams showed videos they had made themselves, two teams used online games and one team used experiments to teach physics. One team wrote a short scene in Chinese to help their students learn some key phrases. As part of a history lesson, one team created Facebook pages for John F. Kennedy and Neil Armstrong and included key facts about the moon landings using status updates. A team teaching about Nazi propaganda got their students to make a propaganda poster showing their team leader in a positive light, and another got their students to do the same about Adolf Hitler. To help their students

understand the digestive system, one team asked their students to lie on the ground, one at a time, with each one performing the role of a different section of the digestive system. First, someone lay down straight, as the oesophagus. Next, someone curled in a ball at his feet, as the stomach, and so on. A “cheese-burger” made of Play-Doh was then passed through the system, from the oesophagus into the stomach etc. with each stage performing a task e.g. churn up the burger or extract the nutrients (green Play-Doh) from the burger. The final lesson was about Brazil and included Samba lessons for all of the students, and the facilitator!

Pictures: Neil Armstrong’s Facebook page and a digestive system lesson.

There were a number of factors which may have reduced the effectiveness of some of the learning experiences. A lack of presentation skills among many of the students was noted. Those who had prepared slides often turned their backs on their students to read from the slides or just read aloud from their notes. Some were obviously nervous about speaking in public, even to a small audience of their peers. Some of the students were obviously at the limit of their knowledge of the subject they were teaching and there were a few factual errors in their work, e.g. one group had John F. Kennedy congratulating Neil Armstrong on reaching the moon. Some of the teams had excellent ideas for how their students could learn but didn’t properly explain the context of a particular item or activity or the reasoning behind it and as a result, the students did not fully understand what was happening. One example of this was when a team teaching about Nazi propaganda wanted their students to create a piece of propaganda of their own. The students were just asked to make a poster about anything they wanted without any direction about a subject for their poster or an explanation that the idea was to help them understand what propaganda is in

general, rather than specifically focussing on how the Nazis used it. The students completed the task but did not really understand why they were doing it.

There are areas where the teaching teams could improve and areas where they may need more help in planning and preparing their work but all of the teams engaged with the process of creating an interesting learning experience and, to varying degrees, they achieved this goal. Their lack of experience as teachers may have reduced the effectiveness of some of the learning experiences but overall, particularly when the option to use PowerPoint was taken away, the students' learning experiences were interesting and effective.

5.2.3 Student interviews

Students were interviewed in their teams while preparing their learning experiences and after they had run them. The first interviews involved the entire team, and were effectively team meetings with the facilitator to plan how their learning experience would run. The teams' initial ideas of how they might teach were discussed, they had an opportunity to seek advice on any problems they were having with the project and they were offered some advice or guidance on completing their task.

The interviews after the learning experiences mostly involved two members of each team at a time. The two to be interviewed were chosen randomly and the interviews took place while their team-mates were working on another project. The questions asked in these interviews were not directly influenced by the students' questionnaire answers but they did cover many of the same areas. They included questions about how the team chose to teach and why they chose to work that way. Any challenges or problems the team faced were discussed and whether or not the students felt that they had been successful in teaching their peers. The students also gave some feedback on the learning experience that had been created for them.

Learning without a teacher

The students were first asked about their experience of learning without a teacher. In general, they were very positive about this experience. Most teams were able to find and understand the information they needed. Two teams (both teaching physics) mentioned

reaching a limit of what they could understand without any adult help. Many of the teams divided their topic into sections and covered a piece each but some of them worked together and helped each other learn.

"It was easy enough to find info"

"There were bits we didn't understand. Most of it was okay though."

"It was easy enough to find information on the internet. You have to cut out a lot of stuff and skim through different websites."

"We kind of explained it to each other as well, as we understood it."

Learning by teaching

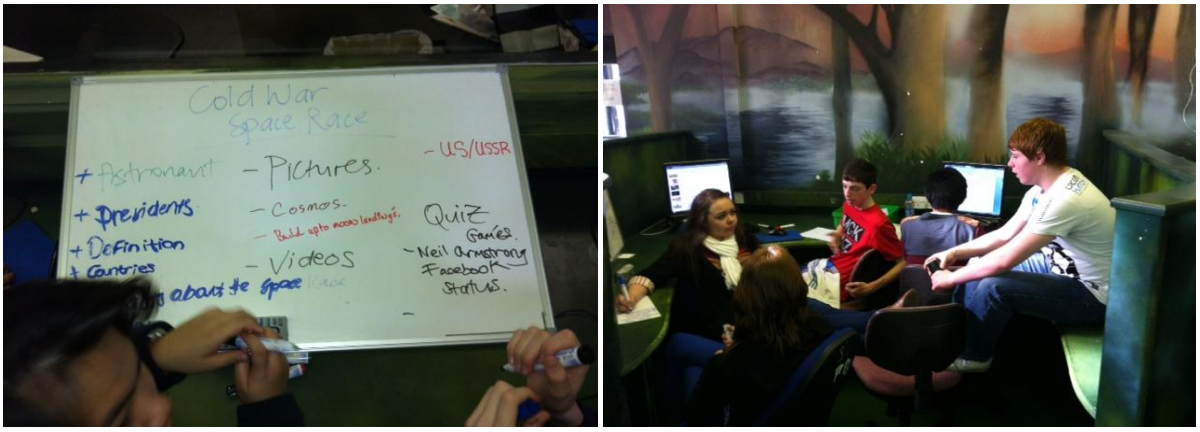
The teams were very positive about the idea of learning by teaching. They felt that they had learned their topics very well by going through the process of learning and then teaching and they felt that what they had learned would stick with them. Due to time constraints and the fact it that it would have restricted what the students would teach and possibly influence how they would teach, it was decided that pre and post tests were not a practical option to measure learning for these workshops. The students' opinions on whether, or how well, they learned were deemed by the researcher to be a sufficient indicator of the effectiveness of this method of learning. Of the 17 teams, 15 felt they learned about the topic they were teaching. The other two had some prior knowledge of the topic and just tried to teach based on that.

"I could write a page about the digestive system whereas before I could write a paragraph."

"I didn't understand it before but I know all about it now"

"I'll remember it, I really will."

"It went well. We learned a lot by doing it."



Pictures: Ideas for teaching about the Space Race and a team planning session

Did you learn from your peers?

Of the 16 teams that were asked this question in the interviews, two main ideas emerged. Eight teams answered with a straightforward, "Yes", and eight more gave a more reserved, "Yeah, a bit", or a very close variation of same. Nobody said they had learned nothing from the learning experience created for them. The teams who said "Yes" felt that they learned what the other team tried to teach them. The "partial learning" answers were from teams who felt they only understood some of what was presented to them. Some students were very positive about peer learning in general while others felt the lack of presentation skills and clear explanations of why certain activities were happening undermined the experience somewhat.

> *"You can enjoy yourself. You understand more, from each other. You speak the same way as each other. You respect each other."*

> *"The explaining was good though. They went through steps. It was very good actually."*

> *"I didn't think worked, I didn't learn much. There was a lot of information to take in."*

> *"They did okay. Didn't see the point of the last bit."*

What is good about peer learning?

When asked what was good about learning from their peers the main points that emerged were that the relationships they had could be used as an advantage, that it would

mean a level of respect which may not exist towards a teacher, that learners might be more comfortable asking questions and that the level of language used by both peers might make it easier to understand each other.

"I like the way it was kids teaching kids, it puts us on the same level..."

"In English, if she's translating Shakespeare, she's not basically translating Shakespeare" ..... "Translating Shakespearean words, they say it in teacher language instead of student language."

"You don't have to use 'big language'!"

What was the hardest part of the whole experience?

When asked what the most challenging part of the whole process was, one overwhelming theme emerged. The hardest part was trying to think up interesting ways to teach the material or find ways to make the material interesting. Only one team mentioned learning the material themselves as a problem, two teams mentioned issues with managing the project within their own team and one team mentioned public speaking or presenting but almost every team said they struggled to make learning fun or interesting for their students. "Learning by doing" was a big theme from the "How we like to learn" presentations and implementing this, and the other ideas that emerged, was a real challenge for the students.

"Finding a way to make it fun"

"We were thinking hard about how to make it interesting for other people."

"Coming up with different ideas to make it interesting"

"Trying to get it entertaining at the same time as educational" [is hard]

This explains the teams' tendency to make presentations even though they had proposed a different style of learning as best for themselves. Under pressure, they went with what they knew and taught as they had been taught. However, when this option was removed, with some difficulty, and with plenty of encouragement from the facilitator and

the mentors, the teams were able to produce interesting learning experiences that were, in some cases, very effective.

One team had major problems working together. There were personal issues between some of the team members from before the workshop began and they struggled to agree on how to complete the project. This led so a situation where it was not possible for one student to continue to work with the team. She joined another team for the remainder of the workshop. The remaining three team members did manage to complete the project to some degree but it was a rushed job and they only covered material they had previously learned in school.

Could it work in school?

A final round of student interviews also included questions about learning without a teacher and peer learning within the context of formal education, specifically, the possibility of employing a method like this to prepare students for the Leaving Certificate exams.

Many of the students said that learning without a teacher and peer learning could be usefully employed for parts of the formal curriculum. There were varying opinions about which subjects would be best suited to this style of learning with most of the core subjects proposed as both good and bad by different students. They felt that a level of supervision and structure would definitely be required and that the students would need some experience of working together before taking on a project such as this. In general though, the students felt that there is potential for this method to work in a more formal setting.

"Definitely." Definitely? "Definitely!"

"Yeah. Especially if you knew it was for your Leaving that you'd pay more attention. Like, this is good but it's not really important but if like... we're not aiming towards something, we're just having a laugh and experiencing it like but if you actually were aiming towards something you'd get really like, into it."

"First years couldn't"

"You'd have to have teams who knew how to work together."

“Authority, probably, if you were messing or something.”

5.2.4 Mentor Interviews

Brief interviews were carried out with two of the volunteer mentors who had helped at different times over the four workshops. They were asked if the experience of mentoring was any different for these workshops compared with any of the previous activities they had helped out with, they were asked what kind of help the students needed during the project and whether they felt the students were engaged and interested in working this way.

The mentors said that the students were very comfortable with the technical skills they had learned on previous visits to Bridge21 and that the students had very few problems learning their topics without a teacher. The biggest area where the students needed help was in planning how they would teach. They said that in some cases they needed to pitch in an idea or two to gets things moving but once they did, most of the teams were able to come up with several options. Overall the mentors thought that these students engaged with the task and, in many cases, completed it very well.

"Very high retention of previously learned skills"

"Interesting ways to cover it was the hard bit."

"How to do it beyond just presentation."

"They were certainly able to learn it on their own."

"They seemed confident in their knowledge"

This section described the data that was collected, how it was analysed and presented the findings made based on that analysis. The next section contains a discussion of those findings and how they relate to the ideas mentioned in the literature review.

5.3 Discussion

5.3.1 How do they like to learn?

The students described a variety of elements that they believe would make learning more enjoyable and more effective for them. Many of the ideas they had are constructivist and constructionist in nature and typical of most descriptions of 21C learning. They included teams of students, solving problems, learning through research and discovery and presenting their work to their peers. These are all elements of an Information Age pedagogy as described by Voogt and Pelgrum (2005). Most of the teams mentioned using modern technology for learning. A comfortable, modern learning space designed for team-based project work and a friendly and encouraging facilitator and mentors were also proposed by several teams. The most notable thing about the analysis of how the students like to learn is that almost every theme that emerged was an element of the Bridge21 learning model (Lawlor, Conneely & Tangney, 2010). The students were obviously influenced by the environment in which they were working but nonetheless, it represents a strong endorsement of this style of learning.

5.3.2 Learning without a teacher

The students seemed capable of learning most of the required material without an expert teacher to help them. Very few teams mentioned any problems either finding the necessary information or understanding it. Some mentioned having to “skim” lots of websites to find the necessary information, some teams divided their topic into sections and each member took a section each while others discussed the topic amongst themselves and gained an understanding by explaining it to each other. The students’ ability to filter through large amounts of online information is in keeping with Prensky’s (2001) ideas about “Digital Natives”. The mentors were rarely asked for help with this part of the project and there were only two teams who encountered topics that they just couldn’t understand.

These findings provide some support for the claims made by Sugata Mitra (2010) that there is potential for students to learn curriculum content without a teacher if they are motivated to do so. It should be pointed out that the teams had some flexibility with which parts of their topic they wanted to cover and that some of the students had a level of prior knowledge of the topics they were working with and may have tended to “play it safe” in

terms of what they would teach. That said, the teams seemed very engaged with this part of the project and almost every student said they had learned about the subject their team was teaching.

Learning by teaching

The students felt that peer teaching was an effective way to learn. There were some concerns about discipline but a large majority felt that there were many benefits to learning with and from their peers.

All of the teams who tried to learn new material said they did so successfully. They mentioned the motivating factor of having to teach what they've learned to others, having to think about the material so they could simplify it and put into their own words and that they learned "by teaching".

Learning from your peers

The students were less positive about learning from their peers. Over 80% said it was a good way to learn but when asked in interviews how well they had learned the topic only about 50% felt they learned what they were supposed to. They still spoke of the benefits of peer teaching and included many that were mentioned in the literature review, such as a similar level of language, feeling comfortable asking questions or making mistakes and the fact that peers would have a good sense of what would be fun or interesting for each other. They also mentioned potential discipline problems and their peers lack of experience as teachers as possible drawbacks to learning from them.

It seems that learning for teaching and learning by teaching are effective ways to learn but learning from their peers was less successful. It plays an important role in this context in that it motivates the peer teachers to learn their subject and this learning is reinforced by preparing and delivering their learning experience.

5.3.3 How would they teach each other?

The students proved capable of creating interesting and effective learning experiences for each other. There was an initial tendency to lean on familiar technology and a familiar style of teaching. When allowed to do so, the teams mostly started with a decision to put together PowerPoint slides on the topic they were learning and teaching and then try

to come up with something fun or interesting to go with it. As one mentor commented, "they were still thinking inside the box".

To get them thinking "outside the box", the teams in weeks three and four were banned from using PowerPoint in their learning experiences. Some of the earlier students had commented that PowerPoint presentations were not really in keeping with the style of learning they had described as best for themselves and the researcher was also concerned that the "learning by doing" aspect of creating a learning experience could be avoided by simply copying and pasting text from Wikipedia into PowerPoint without really engaging with the material. This change led to an increase in the variety of the learning experiences created.

Most teams, despite finding it a challenge, were able to come up with interesting ways to cover the material. It might have required some encouragement and sometimes a second or third attempt at a plan but, in general, they stuck with it and got there in the end. There was some variation in how well their various ideas were implemented but they engaged with the project and tried to teach as they said they'd like to be taught.

What challenges did they face in creating their learning experiences?

The teams felt that coming up with interesting ways to cover the material was the hardest part of the whole project. Whether trying to take a subject that they didn't find interesting and make it interesting for their peers or just trying to avoid giving one long presentation, this was the area where the teams felt the most thought and effort was required. The mentors also commented that it was at this stage that they felt the team required the most help, whether that involved encouragement or offering an idea or two to get the teams started. It was a challenge for the teams but it was one they engaged with and were mostly able to overcome.

Another area where some of the teams struggled was in actually running their learning experiences. Some seemed more focussed on getting their bit finished rather than thinking about whether their students learned or understood what they were supposed to. Some of the activities were not as well thought through or presented as you would expect from a trained teacher and as a result some of the students were confused at times as to

what they were supposed to do or why they were supposed to do it. This was not the case for all teams but among the teams whose students said they learned “a bit”, a lack of confidence and communication skills among the “teachers” was often cited as a problem. This lack of confidence and communication skills is quite common among students at this level and while this made it harder for their students to learn the content they were covering, this style of learning may help to develop those very skills more so than time spent in a traditional classroom. Regular presentations are a part of any Bridge21 activity and this is an area where Bridge21 students often felt that they improved during their time there.

One other area where problems arose was in general team management. This was not a problem for most teams but two teams mentioned that they struggled to divide the workload evenly, with some members taking on, or having to take on, the majority of the work to be done. All of the students had experienced working in teams in Bridge21 prior to this workshop but this project was bigger in terms of the amount of work to be done and the time they had to complete it. Managing this time and workload was mentioned a problem by some students.

5.3.4 Motivation

The students were, in general, very engaged in the project and motivated to do well. Their responses on the questionnaire and in the interviews suggested that they enjoy the technology-mediated team-based project work they have done in Bridge21 in general, and the challenge of the Learning Circles workshop in particular. They rated the work they were doing as “Interesting” most of the time and most students said they were never bored during the workshops. Overwhelmingly, they said they would like to take part in further workshops like this one if the opportunity arose and that knowing they would have to teach their peers was a big factor in motivating them to learn their topic for themselves. This is in keeping with the findings of Benware and Deci (1984) who claimed that student motivation while learning for teaching was higher than when learning for an examination.

5.3.5 Could this work in school?

Of those students asked in interviews, most felt that this method of learning could be used to learn curriculum content in school. Some felt that the fact that it would be in preparation for an examination would add another level of motivation for the students and

others felt it would be important that the teacher set clear goals for everyone involved and was on hand to maintain discipline. It would also require a level of trust and responsibility in that students would be relying on their peers to teach them and would in turn have to work hard to ensure they were able to teach their classmates. The students may also need some training in working together on projects such as this. While it may not be straightforward to implement at the moment, there is potential for this type of learning to become part of how 21C students learn in school.

5.3.6 Limits of this study and further work

The evidence of learning in this study was based on the students' perceptions of how well they learned. There was no formal measurement of prior knowledge so for a more rigorous study, pre and post tests would have to be administered. The topics assigned to some of the teams in this case were quite broad. This allowed students some freedom to choose which areas they would teach but may have allowed the students to avoid the more difficult areas. A more detailed brief would challenge the students to learn all aspects of the subject and allow for more meaningful measurement of their learning. This study has focussed on the overall cohort as a single case but there may be value in focussing on the experience of a single team or teams taking part in future workshops. We have reached the conclusion that the students are capable of learning without a teacher but not really investigated how they did this. How they learn could be a very interesting area of study. Teacher interviews would also be worthwhile, both on the quality of the teaching and learning being done by the students and on the viability of this style of learning for use in the classroom.

Summary

This study has found that students want to learn in a constructivist, 21C manner. It suggests that they are capable of learning curriculum content without a teacher if they have access to the internet and work together. They can find and create resources for teaching and learning, create innovative and effective learning experiences for their peers and learn by teaching each other. They found this style of learning very engaging and enjoyable. These findings suggest that this style of learning could be an effective part of a 21C learning solution.

Chapter Six. Conclusion.

This project set out to explore a potential 21C method of curriculum delivery that combined ideas such as Digital Natives, Mindtools, peer teaching, learning without a teacher and the Bridge21 model. By examining how modern students would like to learn, whether they can learn without a teacher, how they would teach each other and whether they are engaged by this style of learning, we hoped to find out if there is potential for this type of learning to be used in more formal educational settings.

The findings suggest that students would like to learn in a collaborative and constructivist manner. The students described teamwork, technology, project work and many other elements mentioned in the literature as part of a 21C pedagogy.

The students in this study were mostly able to learn without an expert teacher to teach them. They were able to find information online and learn it whether working alone or with their team-mates. Sugata Mitra (2010) has claimed that motivated students can learn without a teacher. The structured team-based approach used in Bridge21, in combination with learning for and by teaching, may allow students to take ownership of their own learning and help develop the motivation required to learn in this way.

The study suggests that, despite an initial tendency to "teach as they have been taught", students are capable of creating innovative learning experiences for their peers using online resources they have found, artefacts, both digital and physical, they have created and activities they have developed themselves.

The findings support the idea that students can learn by teaching their peers. The students found that both the preparation and delivery of lessons was an effective way to learn both in terms of motivation and engagement with the material. There were some problems with how effective peer teaching was for the students being taught. They were still positive about the experience but the main benefits in this model of peer teaching seem to be for the "teachers".

This study took place in Bridge21. The facilities available and the style of learning employed there were key factors in being able to run this activity. Physical resources such as whiteboards and markers for planning and computers with internet access for research and

creating artefacts and the space allowed for the teams to work as they saw fit were all necessary elements of this workshop. The students had all previously experienced working in this environment and some referred to “knowing how to work in a team” as an important prerequisite to this activity.

The students found this workshop to be an effective and enjoyable way to learn. They were highly motivated, felt they had learned well and were keen to take part in further workshops if they could.

Finally, this study suggests there is potential for learning without a teacher, peer teaching, technology and teamwork to play a role as part of a 21C learning solution. As the students said...

“....before you teach you have to double make sure you know what you're talking about....”

“....when you’re teaching someone something, you tend to learn yourself.”

“I think we could do it!”

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Appendices

Appendix A: Participant Consent Forms

Participant Information Sheet

Bridge21 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,
Kevin Sullivan & Claire Conneely
Bridge to College Programme Team
8964099 / ksulliva@tcd.ie

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: _____

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]*.

Bridge21 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,
Kevin Sullivan & Claire Conneely
Bridge to College Programme Team
(01) 8964099 / ksulliva@tcd.ie

B2C Parent/Guardian Consent Form

I _____ (name of parent/guardian) consent to _____ (name of child) taking part in the **Bridge2College** programme from [*Tuesday X – Friday X]*.

I have been provided with an information letter which outlines the activities my child will take part in, how research data will be collected and stored and how I can contact the research team. I understand that I may withdraw my child from the research project at any time should I wish to do so for any reason and without penalty.

I also know that images/video footage of my child may be used for promotional material about the **Bridge2College** programme but their name will not be identified.

Data Protection: I agree to Trinity College, University of Dublin storing of any personal data relating to my child which results from this project. I agree to the processing of such data for any purposes connected with the research project as outlined to me.

Signature of parent/ guardian: _____

Date: _____

Signature of Project Leader (TCD): _____

Date: _____

Please note: As this research involves the use of computers, children with epilepsy cannot take part in either the learning activity or research study, please inform the school if this is the case. If there is a family history of epilepsy the child may take part, but does so at your risk.

Appendix B: Pre Questionnaire

1. What is your favourite class (or classes) in school?

_____

Please give a reason! (Choose as many as you like)

It's fun ☐ I like the teacher ☐ I'm good at it ☐ Other ☐

If "Other", please explain.

_____

_____

_____

_____

2. Which group at your school has the best IT skills?

Students ☐ Teachers ☐

3. How hard do you think it is to be a teacher?

Very Easy ☐ Easy ☐ Okay ☐ Hard ☐ Very Hard ☐

Why?

_____

_____

_____

4. Would you consider teaching as a possible career for the future?

Yes ☐ No ☐

Thanks ☺

Appendix C: Post Questionnaire

Name

School

Team Name

1. Overall, how would you rate your experience at the Bridge21 Learning Circles workshop?

Excellent	Good	Average	Fair	Poor
☐	☐	☐	☐	☐

Why do you feel this way?

_____

_____

_____

_____

2. During this workshop……

	Never	Only now & again	Sometimes	Nearly always	Always
I worked on my own					
We worked in pairs					
We worked in groups					
The work was interesting					
I worked things out for myself					
I learned things from my peers					
I was bored					

3. What topic did your team teach? _____

4. Did you have to learn about the topic before you taught it?

   Yes ☐ No ☐

   If Yes, please explain how you learned about it? If No, please explain why not.

_____

_____

_____

5. How hard was it to create a learning experience for another team?

Very Easy	Easy	Okay	Hard	Very Hard
☐	☐	☐	☐	☐

6. Do you think teaching your peers is a good way for you to learn?

   Yes ☐ No ☐

   Why?

_____

_____

_____

7. Do you think being taught by your peers is a good way for you to learn?

   Yes ☐ No ☐

   Why?

_____

_____

_____

8. Did you feel more motivated to learn the topic knowing that you would teach it to others rather than just learning it to pass a test yourself?

   Yes ☐ No ☐

9. How hard do you think it is to be a teacher?

Very Easy	Easy	Okay	Hard	Very Hard
☐	☐	☐	☐	☐

   Why?

_____

_____

_____

10. What were the hardest things for you and your team to do?

_____

_____

11. Would you be willing to take part in further workshops like this one?

Thanks ☺