Using Personalisation to Support Independent Learning

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A dissertation submitted to the University of Dublin, in partial fulfillment of the requirements for the degree of Master of Science in Technology & Learning

2012

Declaration

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

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Acknowledgements

I first of all want to thank my first year mathematics students who participated in this study, along with the members of staff in Donabate Community College tht helped with the rearranging of classes, release of students and provided assistance in various ways. In particular I would like to thank my Principal Ms. Olive Laffoy who was most accommodating throughout the study.

Secondly, a big thanks to Neil Peirce from the PERCOLATE Project for his invaluable advice at different stages throughout the project.

My sincere gratitude to both my supervisor Professor Vincent Wade and course director Dr. Inmaculada Arnedillo-Sanchez for their excellent guidance and advice throughout the past two years and duration of this project.

Finally, without the assistance of both my girlfriend Anne and parents Ann & TJ none of this would have been possible. Thank you all for your patience, reassurance and encouragement throughout the duration of the past two years.

Abstract

This study seeks to determine if a web based personalised learning system can support independent learning skills amongst new entrants to second level education. A case study approach is undertaken using mixed methods to analyse the collected data. In total twenty seven first year students, male and female, participated in the evaluation.

The web based personalised learning system used in the research, named 'MyPace' was developed as part of the PERCOLATE Project in Trinity College Dublin. The objective of the PERCOLATE project is to investigate innovative social and informal learning methods and applications by researching and evaluating techniques using state of the art social discovery, collaboration and personalisation technologies. For the purpose of this study the author was granted full permission to use the MyPace system by Trinity College Dublin.

This paper demonstrates how a personalised learning system can provide learners the opportunity to learn at their own pace while practising the skills required to succeed as future learners. Opposed to the traditional teaching and learning methods, the participants are presented with the option to use MyPace to independently learn introductory algebra. The implementation spans over a three week period while the teacher takes the role of a facilitator within the classroom. The aim is not to evaluate the MyPace personalised learning system but to investigate '*How could personalisation support the practice of independent learning in first year mathematics?*', while at the same time enabling the students to acquire the knowledge to complete the end of topic algebra examination.

The fundamental skill an independent learner should attain is to be responsible for his/her own learning needs. Personalisation helps with this by placing the learner in control, hence shifting the main responsibility from the teacher to the student.

Findings indicated there is a justified case to implement personalised learning within the Irish education system. This implementation does not only enhance learner effectiveness, make learning more fun and increase self-motivation but also supports independent learning skills required for lifelong learning.

The findings from the study also demonstrated: 1) there is a requirement to encourage and support independent learning skills amongst our young learners, 2) there is a justified proposal to integrate personalised learning within the first year mathematics syllabus, 3) this method of learning does not suit every learner.

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1. Introduction

1.1 Background

It is not a new notion that academics, employers and Irish Government members have voiced their concerns over the traditional teaching system failing to produce self-directed and independent learners. This failure to support and encourage independent learning has had the knock-on effect of students struggling to succeed at third level and thus not producing lifelong learners for the future:

> *There have been ongoing changes in the Leaving Cert curriculum in recent decades, and according to the Department of Education and Skills' website, the Leaving Cert programmes today "emphasise the importance of self-directed learning and independent thought; a spirit of inquiry, critical thinking, problem-solving, self-reliance, initiative and enterprise; preparation for further education, for adult and working life and lifelong learning". However, criticism by employers, the higher education sector, the media and the public suggests that Leaving Cert students do not focus adequately on these goals and that they do not achieve the skills required for higher education and for employment during senior cycle. Whether this arises from inertia within the second-level system or downward pressure from the points system is a matter for debate.* (Hyland, 2011)

The Hyland report explicitly points out the failings of the current educational system in Ireland where it continues to promote a familiar rote learning style which is ultimately aimed at passing the Leaving Certificate Examination. In a closed curricula there does not seem to be any near future sign of drastic change to amend either the Leaving Certificate points system which encourages this rote learning nor promote independent learning skills amongst our second level school goers in order to prepare them adequately for third level higher education.

The most recent report on Irish students' third level progression rates by the Higher Education Authority shows a strong correlation between student performance at post primary level and their successive ability to complete third level education, with mathematics being the most clearly reflective (Mooney, Patterson, et al., 2010). However the report also highlights the non-presence rates during the time of research as being high, especially in the computer science area in which mathematics is a fundamental and necessary requirement.

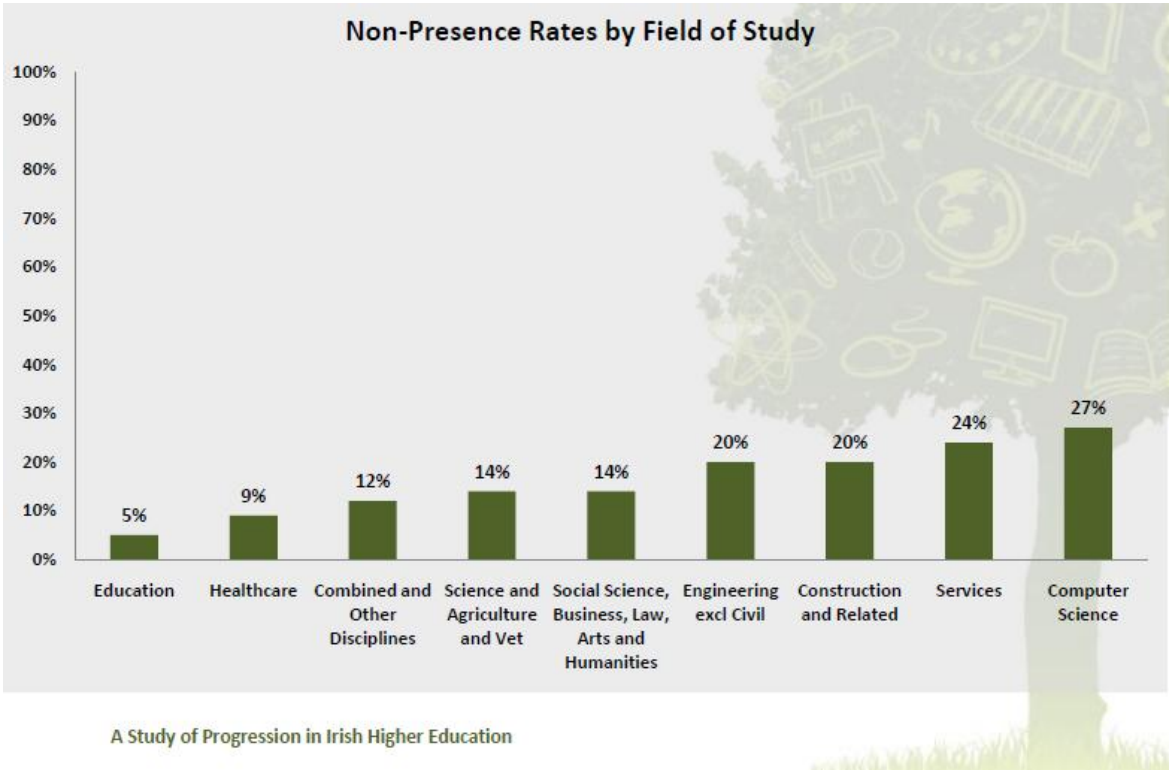


Figure 1: Non-presence rates after entrance year (March '08-'09)

The author proposes a solution to these high non-presence rates lies in the development of the lifelong learning skills identified in the Hyland report. Today it is largely agreed through educational improvements in various parts of the world that independent and self-directed learning skills are an essential requirement of today's learner. With this in mind "*the crucial question is how to engage and motivate the learner through providing personal choice and locally meaningful curricula and protect their entitlement to access those funds of knowledge and know-how and provide an academically rigorous induction into them*" (Crick, 2009).

In the context of this research the author believes that providing access to trusted web based personalised learning systems will not only transform the experience of the student, promote independent learning but also drastically change the classroom for the better. Although it does not apply to every young learner within Ireland, Robinson and Sebba (2010) indicate there has been a vast increase in the number of students that have frequent access to computers and the infinite range of online learning resources and institutions which are now available online to all internet users. Today's student can decide when and where they want to learn and bearing this in mind we should consider that now the impetus is to support the independent led learner through the use of digital technologies.

> *"Educational content is delivered via many electronic media including network-oriented (e.g. web), broadcast (e.g. digital and interactive TV), and package-based media (e.g. CDROM, DVD, etc.). However, the network-oriented approach—also known as web-based e-learning has attracted the most interest and lately has gone through a period of rapid growth. This exponential growth is due to the high demand for educational content mainly by academic and industrial users, but also by learners from other categories that span from rapid information seekers to life-long distance learners. Currently most interest in web-based e-learning is from university and corporate training users, but as the newest technology becomes more affordable and widespread, an increase in the percentage of the other types of users is expected"* (Muntean & Muntean, 2009).

The aim of this research project was to investigate how a personalised e-learning system could support independent learning skills while concurrently covering the curriculum efficiently. Aligned with supporting independent learning skills it is also hoped to encourage independent learning for the student's time within the secondary school system which will benefit the eventual transition to third level education.

1.2 Research Question

The question which framed the research project was:

How can personalisation support the practice of Independent Learning in 1st year Maths?

The following objective and sub questions derived from the research question and also contributed to the author's research:

Sub objective: The main goal is to use personalisation to provide learning opportunities for practising 'independent learning skills'. The intention of this study is not to produce independent learners but an appreciation of the associated skills is one of the goals.

Sub question 1: How does personalisation play a part within a curriculum that does not support self-directed learning?

Sub question 2: How can independent learning be supported when the students themselves are at entirely different levels of independence within one class?

1.3 Dissertation Roadmap

The paper begins with the literature review by investigating the motivation behind the research and discussing the second level system's current failure to develop learners with critical thinking skills. Leading on from this the areas of independent learning and personalised learning are discussed in depth. Chapter three outlines the design of the artefact, providing an insight into its architectural construction and its functionality. The following research methodology chapter presents the single case study approach undertaken and the mixture of quantitative and qualitative data analysis used to evaluate the findings. The collection tools used to gather the data and the implementation process involved to perform the trails concludes chapter four. A presentation of the case findings and an in-depth analysis aid the answering of the research question in the following chapter five which leads to the discussion before the final concluding chapter seven.

2. Literature Review

2.1 Introduction

Two factors that characterise our society today are: the abundance of information on the World Wide Web and the prevalence of information and communication technologies for easy retrieval of information and communication of ideas. Teaching students to capitalise on these factors and to be technologically literate to learn independently prepares them to be self-directed life-long learners (Wan, 2008).

In recent years the prospects and possibilities for education have been improved further by the development of internet and information technology which have essentially changed the approaches of teaching and learning. One such change which is a dominant recurring theme is discussed by Cheng (2001) where he states, "*there is an urgent need to develop a theory or model that can be used to deepen the understanding of the nature and process of self-learning and facilitate students becoming highly motivated and effective self-learners with the support of a networked human and IT environment*". The implications drawn from the theory can contribute to the paradigm shift of education in current worldwide education reforms. However, since 2001, and before, we are still talking about and discussing this shift of education to support the learning methods of self-direction and independence amongst our young learners.

When speaking recently to SiliconRepublic upon the receipt of US$5m from the O' Sullivan foundation to boost online education, Salman Khan, who is creator of the Khan Academy, said "*The school of the future will not resemble the school of today…In the past, the assembly-line, lecture-homework-exam model existed because that's what was possible in the no-tech and low-tech classrooms of their day."* Khan then proceeded to say "*one of the goals is to re-engage students, some with significant gaps in their knowledge, who have previously felt lost and disengaged. We can now build a new reality, using today's technologies, where learning is custom-tailored and collaborative, bite-sized and iterative,".* He concludes that this raises the opportunity for students to learn at a pace which is relevant to their needs resulting in a more self-directed learner that is focused. Additionally it can benefit the weaker student to improve to a level that is common to his/her peers.

When interviewed in relation to the donation founder, O'Sullivan himself showed his support for personalisation and online learning methods and systems stating, "*The facts on*

the ground show that engaged students can absorb and master material much more rapidly than we had previously thought possible. Below-average students become above average, and average students can become exceptional. We cannot delay in implementing these systems for our children, for our economy, and for our society." (Doyle, 2011)

2.1.1 The Motivation to Support Independent Learning

In recent years with the explosion of computer and internet access along with wireless technologies worldwide, both academics and government officials from around the world have keenly supported the encouragement of independent learning skills amongst young learners. Yet with this enthusiasm comes the reality of how to integrate these skills in a curriculum that does not lend itself easily to this genre of learning.

A significant aspect of learning independently is to realise that making mistakes is a routine part of learning progression and not an indication of incompetence. It is up to us as educators of these young learners to frequently acknowledge that making and correcting mistakes are important aspects of becoming an independent lifelong learner. By learning this alone it inevitably becomes a crucial slice of knowledge for life. Smith (2001) agrees that students are more likely to be encouraged to learn when they have gained confidence in knowing that their learning is a result of methods that they control.

Although the motivation to support independent learning seems to be evident within our schools and current government, Crick (2009) justly points out that today we are still teaching our students as consumers within the education system, when in fact we should be building upon their confidence and developing their self-reliance and independence in order to become responsible for their own learning. Crick also states that it makes little sense to continue to direct our students and young learners to become collectors of information and facts, which encourages learning approaches that affront the most basic ideologies of pedagogy although this still tends to be the number one method of teaching and learning within schools today.

2.2 Independent Learning

In order for us to understand the definition and meaning of independent learning it is relevant for us to start at the beginning and first discuss self-directed learning (SDL). A definition of independent learning for the purpose of this study is then defined along with the main characteristics which are associated with this category of learner. The section concludes by acknowledging the smoother transition to third level when students have adapted to these learning skills.

2.2.1 The Beginning: Self-Directed Learning

The literature relating to SDL today is plentiful and ever increasing. However like many educational theories and learning styles there are a variety of meanings as to exactly what the definition of SDL is.

With regard to SDL in education, Malcolm S. Knowles, who was known as the father of andragogy (a term which became mainly popular as a way of describing adult learning through the work of Knowles), described SDL as "*a process in which individuals take the initiative, with or without the help of others.*" (Knowles, M. 1975). The processes in self-directed learning include diagnosing one's own learning needs, setting personal goals, making decisions on resources and learning strategies and assessing the value of the outcomes. These are all traits directly related to the independent learner which can be viewed in 2.2.3.

The argument and ideas to encourage and support self-directed learning amongst learners have not changed much in the past thirty five plus years. Knowles (1975) convincingly argues that there is considerable proof that people who grab the initiative in learning (proactive learners) ultimately gain more from their experience, and improve learning skills, than do learners that rely on the information being fed to them by their teachers (reactive learners). Consequently students have increased levels of motivation as they are entering a learning process in which they wish to take part and as a result they tend to retain what they learned for longer periods and put this information to use.

Hiemstra (1994) was another influential figure within this area of learning methodology and notes several things that are known about self-directed learning:

(a) Individual learners can become empowered to take increasingly more responsibility for various decisions associated with the learning endeavour;
(b) Self-direction is best viewed as a continuum or characteristic that exists to some degree in every person and learning situation;
(c) Self-direction does not necessarily mean all learning will take place in isolation from others;
(d) Self-directed learners appear able to transfer learning, in terms of both knowledge and study skill, from one situation to another;
(e) Self-directed study can involve various activities and resources, such as self-guided reading, participation in study groups, internships, electronic dialogues, and reflective writing activities;
(f) Effective roles for teachers in self-directed learning are possible, such as dialogue with learners, securing resources, evaluating outcomes, and promoting critical thinking;
(g) Some educational institutions are finding ways to support self-directed study through open-learning programs, individualised study options, non-traditional course offerings, and other innovative programs.

The following section compares the similarities between a self-directed and independent learner. However, it can be understood that the self-directed learner must be independent and therefore will possess many of the aforementioned skills which are required to achieve results. This relationship between the two is evident in the following section where the characteristics and definition of independent learning are presented.

2.2.2 Defining Independent Learning

Now that the characteristics are known, a definition of the term is required upon which to base later results and findings. However, similar to SDL as discussed in the previous section, there is no one general defined interpretation of the term independent learning.

One such definition by the Open University is, '*working with increasingly less structured teaching materials and with less reliance on traditional kinds of tutor support'*. (Moore, 1984). The meaning was also taken on by Kesten (1987) to more expansively review the terms which were frequently associated with the practice of independent learning; these results included those displayed in figure 2 on the following page:

Figure 2: Independent learning terms – derived from Kesten

Having inspected this diagram, it is evident that many of the above terms of Kesten resemble those of Knowles in his definition of the self-directed learner in the previous section.

From his analysis of the term, Kesten provides the following definition to describe independent learning:

"*That learning in which the learner, in conjunction with relevant others, can make the decisions necessary to meet the learner's own needs. These decisions ought to be made within the bounds of social acceptability and by self-directed, self-motivated, willing learners*." (Kesten, 1987)

A common theme thus far has highlighted that the learner must be much less reliant on the teacher, consequently shifting the responsibility of the learning path to the student.
Upon further examination of the related literature, Broad (2006) identifies and supports this finding by saying "*any definition of independent learning must make explicit or implicit reference to the responsibility of the student to allow any comparative measures to be made*". One cannot make a clearly defined judgment when asked to explain or measure ones responsibility "*it is enough to recognize the need to adopt some personal responsibility to be an independent learner*".

This requirement for an independent learner to be responsible is further supported by White (2008) maintaining the learner must be placed at the centre of the learning process and given the responsibility to apply the chosen steps to reach their learning goals.

Having evaluated the existing literature it has been decided for the purpose of the remainder of this paper that Kesten's definition amalgamated with Broad's reference to responsibility will be used by the author to define the term independent learning and on which to base results - "*That learning in which the learner, in conjunction with relevant others, can make the responsible decisions necessary to meet the learner's own needs*"

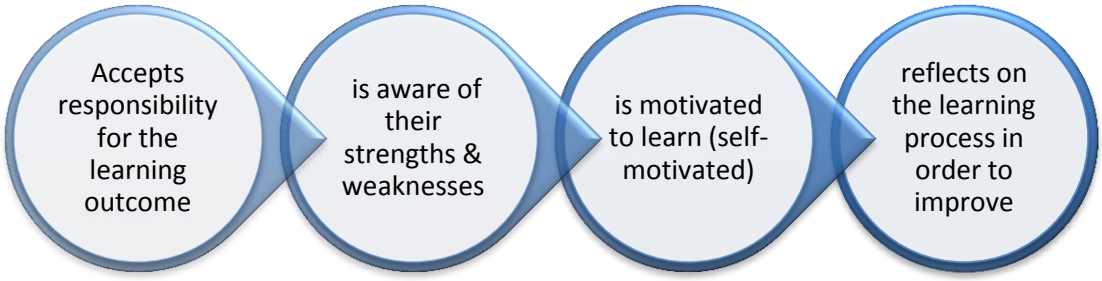


Figure 3: Characteristics of an Independent Learner

2.2.3 Successful Independent Learners: Development of Metacognitive Skills

In general metacognition is a term meaning one is aware of their learning process or simply the method of thinking about thinking.

From reviewing both the definition and characteristics of an independent learner we can say that the learner must be associated with a certain level of metacognitive awareness and skill to take part in this learning process. In addition to this "*Psychological research has also indicated that it is important that children become independent as learners in certain significant ways, involving the development of reflective and metacognitive capabilities*" (Hendy & Whitebread, 2000)

It has been shown by Nisbet and Shucksmith (1986) that these metacognitive capabilities in young learners in their latter primary and introductory secondary education can be encouraged by teachers through discussion, modeling and strategy training. However, as stated earlier in the paper's introduction, sadly these skills are not being currently executed or supported within the existing second level system in Ireland.

A common method to engage the learner in the metacognitive process involves the learner partaking in reflection. This study will provide a new learning experience to this particular group of students and according to Nortcliffe (2005) students should be provided with the opportunity to reflect upon their learning when engaging in a new learning strategy. Although similar to other subjects within the curriculum, the mathematics syllabus in question does not provide much room for additional student tasks due to the existing workload to be covered and time constraints.

2.2.4 Supporting the Transition from Second Level to Third Level

As was briefly discussed in the introduction to this paper, a recognisable problem in our second level education system is that our students are still being predominantly taught using rote learning methods which constantly feeds information to learners. Ultimately it is the learner's aim to retain and memorise vast amounts of facts and figures in order to achieve a certain number of points in their leaving certificate examination. However once students achieve this and begin their chosen third level course they are presented with a major transition where they will experience a whole new process of learning information and must become much more independent and self-directed in their learning methods. Unlike secondary school teachers, lecturers will certainly not regularly pursue students for homework nor will they perform tasks such as checking that notes have been written and taken down correctly. This transition is one which can cause great difficulty and stress to many students yet it can be eased through the early support and encouragement of independent learning skills within our second level schools.

Recently, Murtagh (2010) supports this point when she acknowledged that "*the diverse prior experiences of our students, and a desire to ensure that they develop as lifelong learners, led us to consider the notion of 'preparedness'. Furthermore, there is evidently a need for students to have a clear notion of what independent learning is and how they can manage this themselves prior to entry to programmes."*

In light of this, the diagram below shows how the often difficult and stressful transition for students can be eased with the early introduction of independent learning skills (responsibility, reflection, learner awareness of strengths and weaknesses, self-motivation) when compared to the existing route most of our students face.

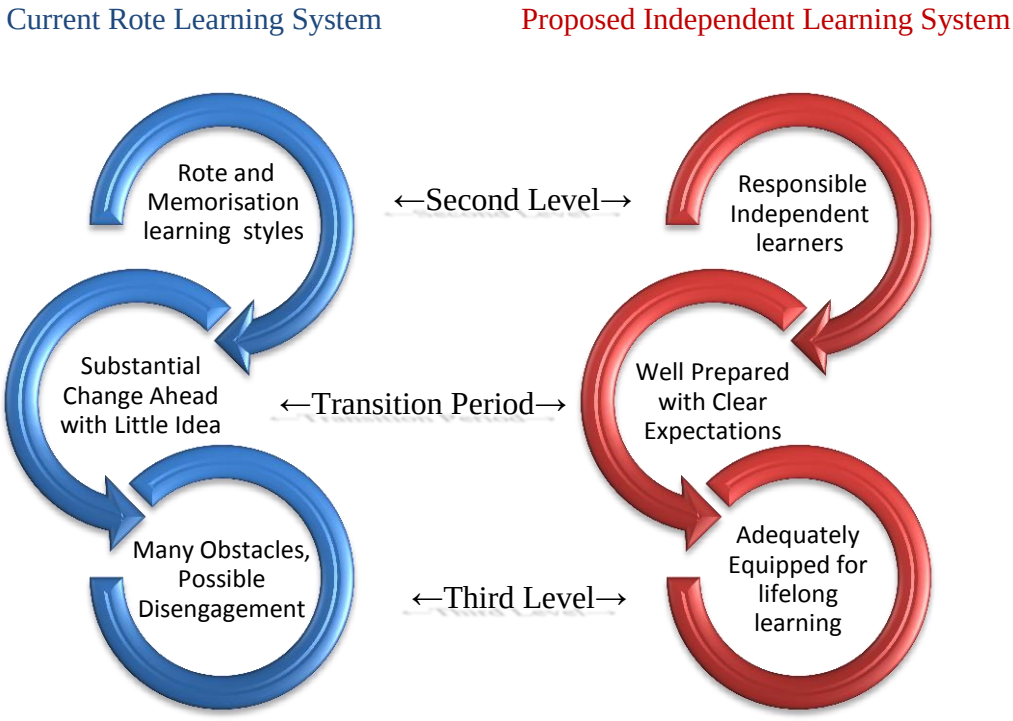


Figure 4: Comparing the transition from second to third level

At the time of writing this paper (November 2011 – April 2012) this radical need for change has become a possibility, with the current Irish Minister for Education, Ruairi Quinn, announcing he wishes to eliminate teaching methods that promote rote learning and teaching to test. Although this is only a proposal right now, this overhaul of teaching and learning methods would also involve major changes in the way the current outdated Leaving Certificate points system is designed and have an enormous knock on effect within third level institutes and the way their courses are structured.

2.3 Personalised Learning

The term personalised learning has been about for many years and it is suggested to have come from Howard Garder's theory of multiple intelligences (Johnson, 2004). It not only focuses on the development of the student's lifelong learning skills but also places the student at the centre of the learning. Increased levels of choice, responsibility, and learner satisfaction are all facets of personalised learning which ultimately contribute in a positive way to the student's development and intrinsic motivation.

In this section the author begins by further investigating the term 'personalised learning' and proceeds to comprehend its main objectives. E-learning technologies which are used to support personalisation is a topical conversation between academics which is discussed at length half way through this section in 2.3.5. Before concluding this section the author discusses some of the important factors involved in implementing personalised learning within a school setting as well as highlighting the current technical state of the art features of personalised learning.

2.3.1 What is Personalised Learning?

Personalised learning within the educational context is also referred to as 'Personalisation' and it is important to note that it is a widely disputed and controversial phrase among past and present academics and throughout education circles. Personalisation, although today closely linked with ever changing and improving learning technologies, is not a new or recent phenomenon.

By adapting the education system to learners' needs rather than the opposite way round and by giving the learners the opportunity to fulfill their potential the concept of personalised learning is facilitated.

Hartley (2007) shares a common understanding of the term personalisation saying it is closely related with the notion of 'choice'. Together with this freedom of choice the learner must also maintain one of the fundamental traits of an independent learner which is becoming 'responsible' for their selected choices. In addition to the learner taking responsibility for choice, personalisation is regularly conveyed as taking account of the specific requirements of each learner, and planning a specific curriculum to meet those needs (Hartnell-Young & Vetere, 2008). This involves adapting the education system to meet the individual needs of the learner rather than the opposite way round. With independent learning there is often a misconception that it can translate into 'learning on

your own/in isolation'. The same is often associated with personalised learning where it is deemed to just focus on activities inside the classroom, however in reality it "*also takes into consideration those outside a classroom*" (Courcier, 2007)

As mentioned in the conclusion to the independent learning section (2.2.4), the Irish government, namely Ruairi Quinn, wish to revamp the teaching and learning methods associated with the second level system. Even though this recommendation has been voiced by educators and academia for many years, it usually involves the acceptance of political power before any change can be envisaged. Similarly, while working within the Department for Education and Skills in England, the then British Labour party politician David Miliband was and still is regarded as a sincere supporter of personalised learning and publicly spoke about the topic at length. During his tenure he described personalised learning as the following:

> *"High expectations of every child, given practical form by high quality teaching based on a sound knowledge and understanding of each child's needs. It is not individualised learning where pupils sit alone. Nor is it pupils left to their own devices – which too often reinforces low aspirations. It means shaping teaching around the way different youngsters learn; it means taking the care to nurture the unique talents of every pupil."* (Miliband, 2004, p. 3)

Finally, in today's educational community, technology plays a key role in the concept of personalisation, predominantly in the form of e-learning. Within this context it is the responsibility of the user to choose the most relevant and appropriate information based on their judgment in order to construct knowledge. Sun and Ousmanou (2006) identify that this form of personalisation "*requires adapting and optimising information selection and delivery to meet a user's needs*". This relationship between technology, personalisation and e-learning provides students with the opportunity to choose what they learn, when they want to learn and where they wish to learn, which is discussed in more detail further into this chapter.

From viewing the literature based on this section alone the author has decided to highlight the concepts associated with personalisation under the following headings in the diagram which follows:

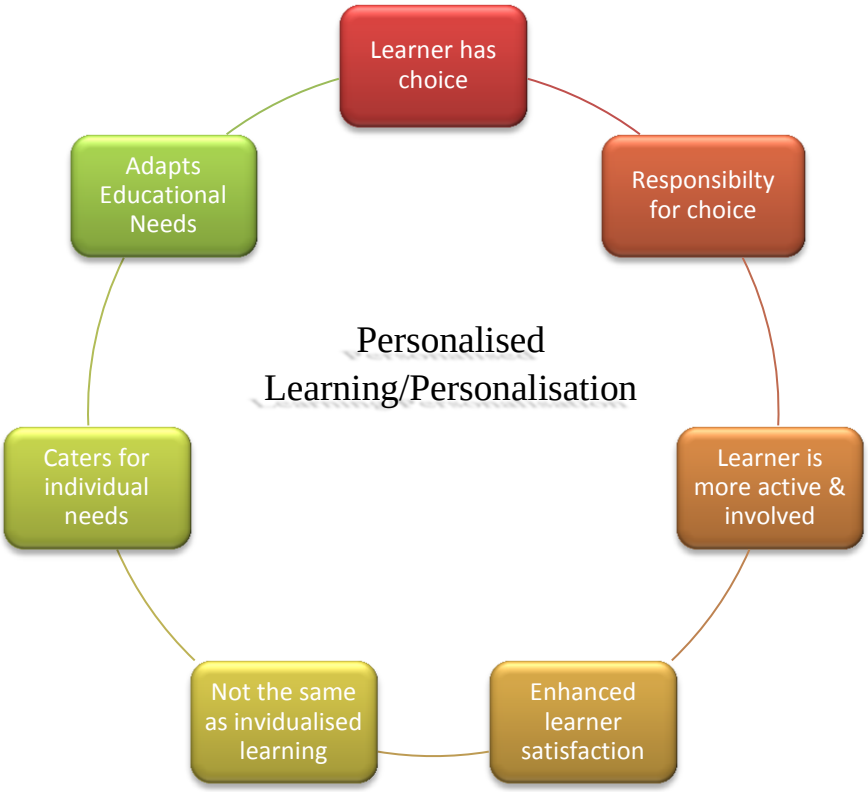


Figure 5: Concepts of Personalisation

2.3.2 What is the Objective of Personalisation?

Personalisation can have many different objectives, the most common of which include:

- Motivating learners
- Enhancing learner effectiveness
- Improving efficiency
- Increasing learner satisfaction
- Developing the learners critical thinking skills
- Support for the needs and interest of the individual learner

Subsequently, these underlying objectives enable one to examine the concepts of personalisation which is more concerned with how the individual student learns as opposed to what they learn.

The first underlying objective mentioned above, motivating learners, is a central aspect of most teaching styles within the classroom and according to Burton (2007) '*is a key precept as is the expectation that all learners can achieve at a level normally considered beyond them'*. Inside the normal everyday classroom the student motivation is predominantly external orientated which sees students being rewarded, encouraged and punished as opposed to being intrinsically motivated which allows the student to set his/her own goals and tasks, take control of their learning and reflect on how they learned based on the learners own preferences and interests. Personalised learning supports this form of intrinsic motivation.

One of the main objectives and outcomes of personalisation is its ability to increase the learner's satisfaction and engage them in the learning process. Anything that breaks the mode of rote learning and memorisation is generally welcomed by the learner and considering that nowadays our students are growing up in the most advanced technological era it is no surprise they become excited and willing to engage with personalised learning systems. Steichen, O'Connor, and Wade (2011) confirm this objective of personalisation where part of their results in a recent study confirms student interaction within a personalised system to be more motivating, engaging and fun.

Learners are often criticised for not thinking about their learning but in a traditional educational system that mainly encourages the learner to recall and repeat on paper what has been taught, who is at fault: the educational system, the educator or the learner?
Engaging the learner in personalisation encourages metacognitive skills and supports the development of critical thinking skills and deeper learning. Similar to the skills associated with independent learning, the skills acquired through personalisation enables the learner to be responsible for his/her learning path, and reflecting on decisions and deciphering whether they be right or wrong in order to improve their own learning.

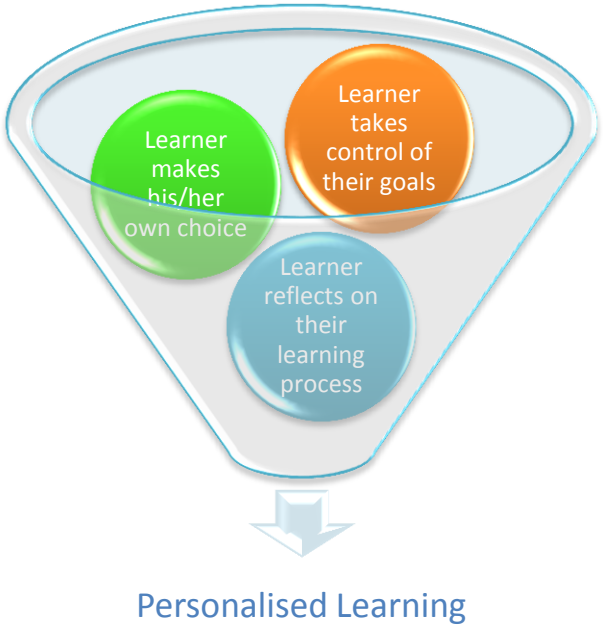


Figure 6: Learners Role in Personalised Learning

Finally, a key element of personalisation is the ability to provide each individual with a different learning experience while catering for their interests. Each learner learns differently to the next, accounting for the provision of individual needs, formerly known as differentiation by task (Johnson, 2004). Personalisation allows for each learner to move at his/her own pace and not at the defined pace set by the teacher. This allows for the learner to work to his/her level of ability. Whereas, in the traditional educational system, teaching and learning may move too fast and leave the learner behind, or in the other case, it may move too slowly prohibiting the gifted and talented students from excelling and moving forward with their learning.

2.3.3 E-Learning Technologies to Support Personalised Learning

Learning technologies are continuously being developed and are rapidly emerging within the education sector, the latest high profiled release (at the time of this study) being the launch of iBooks2 by Apple. Schools and colleges of this generation are now embracing these learning technologies more than ever and using them to enhance and in some cases introduce personalised learning into the classroom. The global spotlight now seeks to shine on which are the most sophisticated, adaptable, effective and satisfying learning technologies that can support personalised learning resulting in a market contested by some of the largest tech companies in the world.

Originally e-learning consisted of information being provided in the shape of a learning content management system (LCMS) which typically consisted of well-structured educational content displayed in various formats based on the course or curriculum being studied. The user's selection process was based on a number of factors, namely: cost, delivery, content quality and achieving his/her learning goal. The aim of e-learning has now moved on further from this with its intention being firmly placed on the personalised delivery of the content based on the user's learner requirements.

Subsequently, e-learning suppliers are motivated by the delivery of sophisticated and visually appealing content and now that an ever increasing and high proportion of people have regular access to internet (see figure 7 below) and internet enabled devices, these suppliers are looking to output their applications and content via various devices at a small charge to the consumer. It has been shown that where learners are exposed to these e-learning devices and technologies, the probability of personalisation is more likely to take place (Robinson & Sebba, 2010). However, many schools still do not have the optimal internet speeds available as every school is unable to budget for the luxury of affording such devices or technologies for individual students.

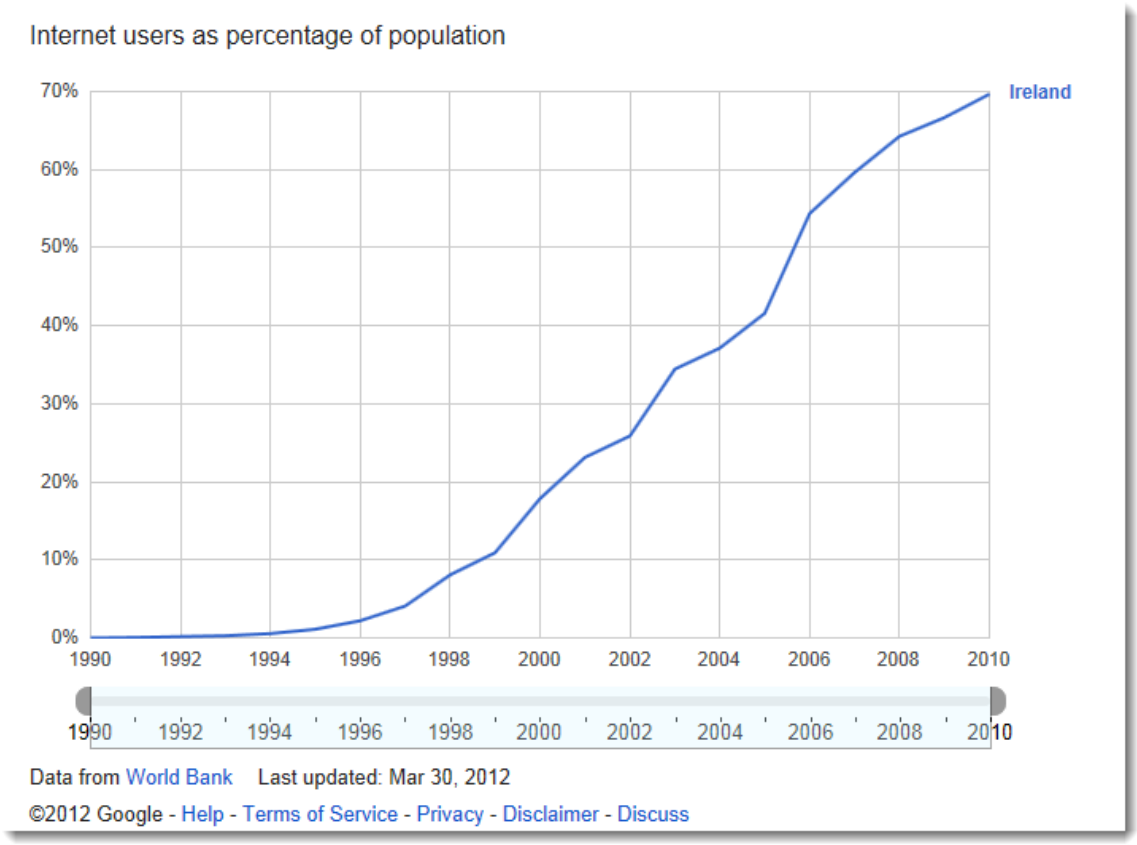


Figure 7: Irish Internet Users as a Percentage of Population

Presently, personalised e-learning does not have to take the form of the user having a personal device (although in the future it most likely will), yet more often involves a personalised web based experience. This development of personalised web based learning is a topical issue within e-learning circles, where attempts are strongly focused on the most appropriate way to create individualised learning paths while simultaneously maintaining the learners' requirements. However with the "*advancement of artificial intelligence technologies, ontology technologies enable a linguistic infrastructure to represent conceptual relationships between course materials*" (Chen, 2009). These state of the art advancements help overcome certain previous underlying difficulties which affects young learners, Paolucci (1998) indicates that a common problem when learning with personalised and hypermedia learning systems is the issue of cognitive overload. The student who has been in a controlled and monitored learning environment for most of their education is now presented with this whole new learning experience can often be overwhelmed. The difficulty most often lies in the sudden "freedom of navigation" and vast amount of information which is available to choose from. Other difficulties highlighted by the literature can include: 1) Adjusting to correct user difficulty level 2) Creating individualised learning paths, and 3) Price of access to the system (Muntean & Muntean, 2009).

The current state of the art personalisation concepts which help in overcoming these problems are now discussed in the following section 2.3.4

2.3.4 Current State of the Art Personalisation

The problems with customary web based and e-learning systems have been discussed in the previous section, and the conclusions were drawn that the one size fits all approach, the inability to create individualised learning paths and cognitive overload are the stand out failures. In agreement with this, Sun and Ousmanou (2006) proposed that in order to satisfy the needs of the learner "*some characteristics of users' preferences which influence them in constructing knowledge should be incorporated into the information systems to support personalised information provision*". Thus since the problem with e-learning systems has been identified, the question is how can personalisation provide the learner with these tailored learning experiences while at the same time reaching their educational requirements? (Tan, Luo, Tong, Chen, & Shen, 2008)

The solution to this problem has begun as far back as the earliest hypertext and hypermedia work by Vannevar Bush in 1945 (De Bra & Brusilovsky, 2009). However, since the early 1990's, with the development of Adaptive Hypermedia Systems (AHS), we have witnessed rapid developments over the past twenty two years and now the area draws large volumes of research - Moscow born Peter Brusilovsky from University of Pittsburgh and Paul De Bra from Eindhoven University of Technology being two of the most recognised researchers and contributors in the field of Educational Adaptation.

AHS have the capabilities do what traditional systems failed to do: create a personalised learning path by adapting to the individual user's needs (Brusilovsky & Maybury, 2002). These systems, referred to in the context of educational hypermedia, can personalise the information based on the user's interests and needs. The diagram below shows the early architecture of the adaptive system:

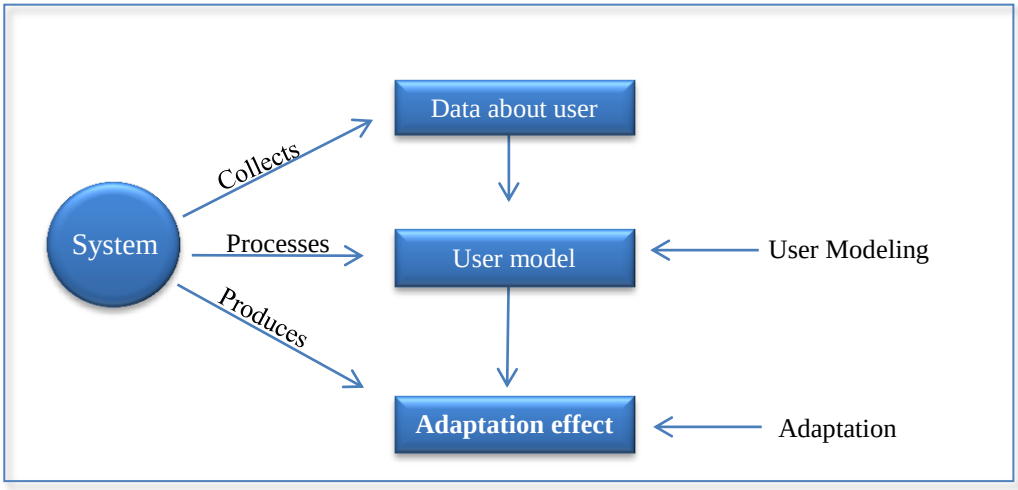


Figure 8: Structure of an adaptive software system (Brusilovsky & Maybury, 2002)

Over time the use of adaptive methods have changed particularly within the area of education hypermedia. The AHS has primarily been associated with providing e-learning solutions but although "*research has delivered a variety of systems for the same application areas, there is still no consensus as to what is the ''ideal'' architecture of such adaptive systems.*"(Knutov, De Bra, & Pechenizkiy, 2009)

However, ambitions to improve on current adaptive systems continue with O'Keeffe and Wade (2009) recently presenting a system that supports the adaptive selection and sequencing of content and services together in an integrated method:

> "*We define the notion of a personalised web experience (PWE) as an experience that involves the integration of the personalised selection and presentation of content, personalised service adaptation and personalised service composition. Such next generation AEs effectively generate adaptive service workflows and adaptively compose content, seamlessly integrating the adaptive selection, composition and presentation of content and services. This work builds upon existing AE technology and integrates portal and semantic web business process and planning techniques to support the unified AE*."

2.3.7 Implementing Personalised Learning Within Our Schools

"*Whilst no education professional can seriously question the personalised learning agenda – in fact most of us merely wonder why it has taken so long to arrive – the major unresolved problems surround implementation*." **(**McFadden**,** 2008**)**

Throughout this chapter 'responsibility' has been identified as a key concept of both independent and personalised learning. This responsibility is more often referred to as an attribute the learner must possess but at the same time it is also a quality which the teacher must hold. According to research by Professor Geoff Whitty of London University's Institute of Education, "*only seven per cent of pupils are ever asked to comment on teaching and learning*" (Garnett, 2008). With regard to effective implementation of personalised learning within our schools and inside our classrooms, this is a significant point; hence, the teacher must take control of the teaching and ensure to question the learners on the quality of the learning experience that is taking place.

Five important areas have been highlighted by Diack (2004) which are suggested to aid personalised learning within schools. These five areas which are outlined on the next page also coincide with the 'key components of personalised learning' introduced in the UK by the Department for Education and Skills (DfES) in 2004

Figure 9: Implementing Personalised Learning in Schools – Diack, A. 2004

These highlighted areas provide a firm basis for the application of personalised learning in our schools and with the education minister's recent announcement of reform of the second level curriculum in Ireland there will perhaps be some of these recommendations put into practice in our schools of the future.

2.4 Conclusion

After reviewing all the relevant literature the most apparent difference shows that independent learning has a main focus on 'learning' while personalised learning takes into consideration both the aspects of 'teaching' and 'learning' (Courcier, 2007).
Arising from this the author has taken into consideration the following key concepts for the remainder of the research.

Independent Learning:
There is an obvious requirement for our students to become more self-directed and independent in their learning. The lack of these traits along with developing critical thinking skills is causing our students to struggle to make the transition from second to third level. A solution to this is to highlight, encourage and support student:

- **Responsibility** – the learner to take responsibility for their learning
- **Motivation** – the learner must be self-motivated
- **Strengths and weaknesses** – the learner must be aware of these
- **Reflection** – the learner must reflect on their learning to improve

Personalisation:
As we have learned from the first section within this chapter, personalised learning is neither based upon individuals learning on their own nor will it mean teachers having to create personalised lesson plans tailored to individual students. Predictions show the school of the future will be influenced by the personalised systems that are available in the form of educational hypermedia, thus providing the opportunity for a more personalised learning experience which can take place almost anywhere or anytime. The stages involved in introducing such personalisation are ones that have to be taken carefully and must have partnerships both within and beyond the school walls.

Together, both personalisation and independent learning will be incorporated and evaluated in the research to answer the question '*How can personalisation support independent learning in 1st year maths?*'

3. Design of the Learning Experience

3.1 Introduction

Selecting the most appropriate personalised learning system was a crucial factor in the design and implementation of the research. Initially the author contemplated the idea of developing a system to suit the research but ultimately decided against for reasons which are identified within the next section. The remainder of this chapter discusses the functioning and architectural overview of the selected personalised learning system before concluding with the acquisition of the content and closing summary

3.2 Selecting the Appropriate Learning System

An important aspect of the study, in order for the personalisation to support independent learning, was to keep the participants engaged and create a fun experience. For this, a personalised e-learning system was required which had to contain some of the following requirements:

- Ease of navigation
- A proven success rate or something new which has potential
- Visually appealing and tailored to secondary school students
- Mathematics content available or allow the adding of content with ease
- The system must ideally be web based or have the ability to be hosted locally
- Preferably the selected system would be free/open source

Once these above-mentioned points had been confirmed the author researched the many available e-learning and adaptive learning systems which were currently available. The following is a list of the three systems which the author narrowed down, researched and surveyed for potential use:

1. **Cognitive Tutor**: is adaptive software developed by Carnegie Learning which is a US based company and publisher of mathematics programs.

   Although this solution may be popular in the US the curriculum and lessons on offer do not apply to the Irish curriculum which could cause lots of difficulty.

Also, the interface is deemed by the author not to be appealing to the twelve and thirteen year old participants of this research

2. **Knewton**: caters for personalising the learning experience and allows the tailoring of content for each student. This system encourages the parent to become involved in their child's learning and identifies concepts and ways the student learns best. The interface views well and allows the teacher to develop and use his/her own content along with that of others while taking advantage of the many analytical tools to track student progress. It is math orientated and web based which accommodates this research although it does have a fee.

3. **ActiveMath**: was developed in Germany by the German Research Center for Artificial Intelligence in Kaiserslauten, Bremen. It is not one of the more popular systems within education circles but it has a similar web based adaptive environment for learning mathematics as the aforementioned two. This system has a very basic layout and is user friendly but does lack that fun aspect along with it being visually outdated.

During these early stages of research the author was given the opportunity to examine and possibly use for this research a new PLS part developed by the KDEG (Knowledge, Data and Engineering Group) of Trinity College Dublin. On introduction it became apparent this system had numerous advantages over all the others which had been investigated previously. The system known as MyPace had just been jointly developed by the KDEG section of Trinity College Dublin, NUI Galway, University College Dublin and Waterford Institute of Technology, all of who developed different sections/portals of the system. Ultimately MyPace met all the criteria set out at the start of this section and it was immediately decided upon by the author to use this system and a full separate installation was arranged for this research.

3.3 Functioning of the Personalised e-Learning System: MyPace

As can been seen from the main image below, the interface of MyPace is strikingly colourful, which appeals to the participants' age group, user friendly, as the participants

are not advanced technically and most of it looks like fun. The six main areas of MyPace are highlighted in the image below and followed by a detailed explanation of each.

Figure 10: Screenshot of the MyPace Interface

Search bar and results

Area 1 is the main section of the interface which contains the search bar along with the displayed results. The search uses a web search engine and sources its results from content uploaded by the author. In total there are over 102 single pieces of content in the search database with each piece of content having numerous sub sections eg. KhanAcademy is considered as one piece of content and contains thousands of video resources. Content is discussed in more detail in section 3.5.

Content you might like

Area 2 uses a recommender system to display content the user may be interested in and is based on what his/her classmates previously rated good (ratings are discussed in area 3). The recommender system displays the three most relevant results. Here is an example; if

the user searches ‘notation’ the three top rated pieces of content for ‘notation’ will appear in a linear fashion below the search results.

Reflection activity

Area 3 contains a scaffolded reflection activity which comprises of a series of questions to encourage the student to engage in the metacognitive process. By engaging in this process the student should reflect on their learning process and see how they can improve in order to achieve their set out goals or targets. However, the scaffolded questions in the installed system for this evaluation did not suit and could not be edited so an alternative was chosen and is discussed in the following chapter.

Ratings

Area 4 gives a social aspect to MyPace. Currently the ‘like’ button is popular amongst social media and is a fun feature allowing the student the option to give their opinion if a piece of content was good by clicking the thumbs up or poor by clicking thumbs down. The user will only have the option to rate this content after he/she has viewed it within MyPace. If for some reason the user finds the content to be thumbs down they will be given the option to state if it was so because it was ‘too easy’, ‘useless’ or ‘too hard’. The collective class number of content rated for that week is displayed as a footer which helps indicate if students are or are not rating content.

The rating of this content is not mandatory but is encouraged as it is directly related to Area 2 which has been previously discussed and Area 6, discussed at the end of this page.

Avatars

Area 5 displays the avatars of all the class members of this particular signed up group. Those that are online are easily identified by having a green symbol attached to their avatar. It must be noted here that MyPace does not allow or have the feature to send private messages amongst classmates.

Content feed

Area 6 encourages the student to be active within the personalised learning system. The content feed shows all of the activity happening amongst the class in real time. When a user views some content it will display the students name or username along with the content he/she viewed. This allows classmates to see what content their peers are viewing and perhaps they might want to view the same. The content feed does not just show when

content is viewed but also displays the ratings of users and participation in reflection activities.

Figure 11: MyPace homepage

MyPace is web based and can be accessed in the school of the trials and registered students have the ability to access the system outside the school.

3.4 Architectural Overview of the Selected System

The MyPace system has been developed using the Liferay open source web portal. Within the system there are a number of portlets, a combination of which has been designed by different colleges. When looking at the interface these include:

- Search area
- Content you might like
- Reflection activity
- Rating
- Who's online
- Live Feed

The MyPace interface is developed by PERCOLATE staff using HTML and CSS with the backend of the site written in Java. The system uses AJAX so the pages do not require reloading, providing an uninterrupted experience for the user. The search functionality is based on Microsoft Bing search and uses the Heystaks social search API (http://www.heystaks.com/). In simplistic terms, the Heystaks system is essentially social search which allows improved results with user influence. On the following page a detailed schematic of the MyPace system can be viewed - courtesy of the PERCOLATE project, Trinity College Dublin. Copyright 2011, used with permission.

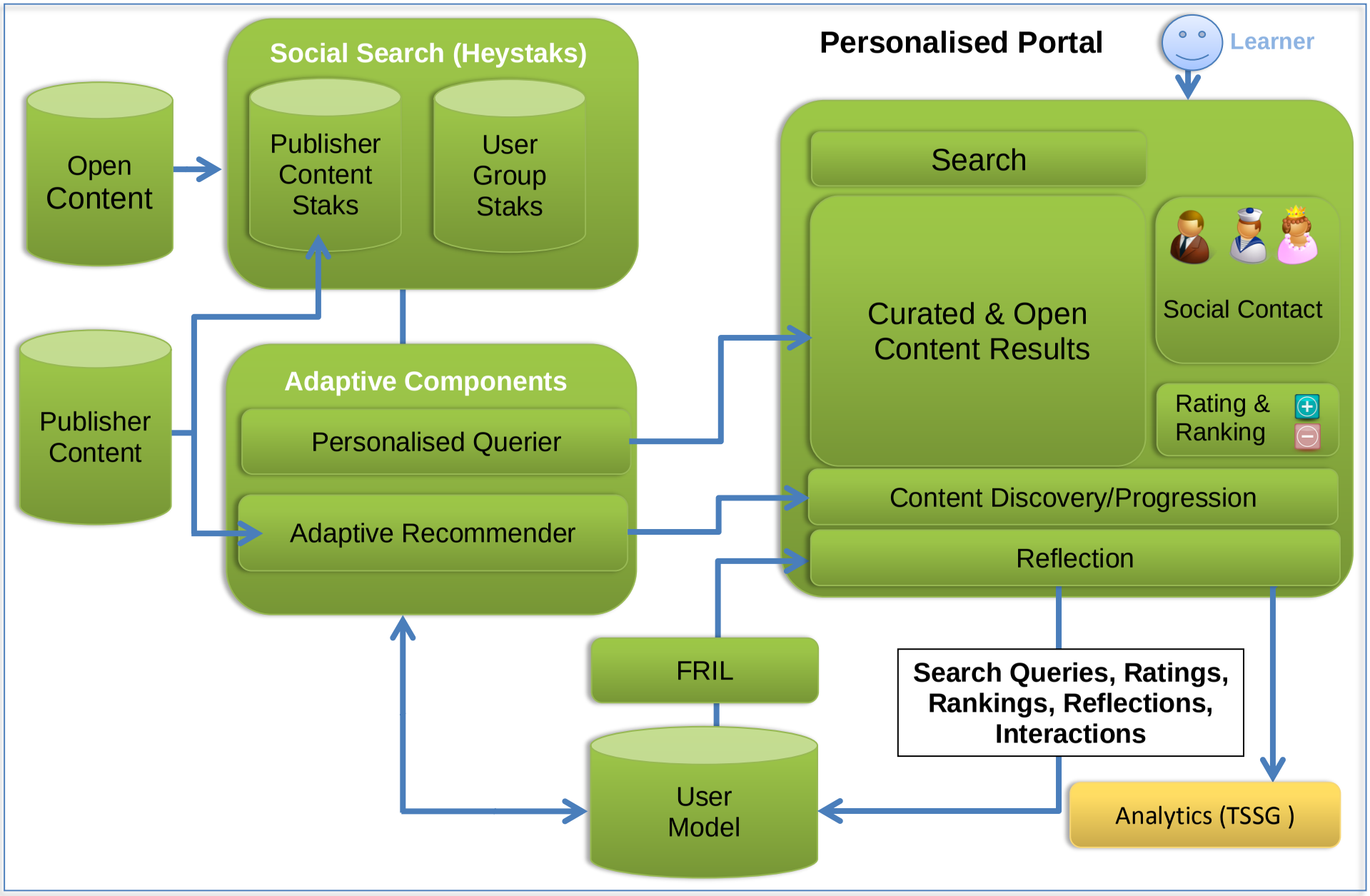


Figure 12: MyPace PLS schematic

3.5 Acquisition of the Content

Although the MyPace system seems ideal for the evaluation process it is ineffective without providing the appropriate results and content. In order for this to be a successful, interesting and worthwhile PLS, the content that is provided to the user must be relevant. This means it must have the following:

- Content applicable to introductory algebra
- Different mediums to engage the participants – games, quizzes, websites, animations, videos, eBooks
- Fun and different ways to learn algebra
- Various levels of difficulty catering for the weak and advanced

This installation of MyPace contains over 100 individual pieces of content for the user to choose from with much of it generously provided by HMH (a global US company, specialising in the development of e-learning solutions). Included in this particular MyPace system is a combination of carefully selected open source websites, games, quizzes, animations, videos and eBooks. As stated previously in this chapter, each piece of content can have numerous sub sections e.g. one website can have many pages, features and tasks yet only counts as a single piece of content. In appendix 8 the full list of URL's that were selected for inclusion can be viewed

3.6 Summary

In the initial stages of seeking the most suitable PLS it was deemed essential to have a system with the outlined requirements of section 3.2. MyPace covers all the aspects for the conducting of these trials and along with the acquisition of a good range and quality content from the author and HMH it is believed the participants have been provided with an effective PLS which will aid in the support of independent learning skills.

The following chapter describes the research methodology and data collection tools used during the study.

4. Research Methodology

4.1 Introduction

This chapter details the overall research design used in this study. A mixture of quantitative and qualitative methodologies was employed and justification is outlined in section 4.3. Following this, a description of the instruments used in collecting the data required to provide answers to the research question and sub questions are detailed. The chapter concludes by discussing all the facets for implementing the trials of the learning experience and provides a brief outline of the data analysis and findings to come.

4.2 Research Question

Before discussing the approach taken towards the research methods and analysis, it is worth mentioning again what exactly the study sought to determine. The primary question that underlies this study does not involve the evaluation of MyPace as a PLS although the functionality of the PLS is an imperative factor. The question which framed the research was to investigate:

How can personalisation support the practice of Independent Learning in 1st year Maths?

The study had the following underlying objective and questions:

- *Sub objective:* The main goal is to use personalisation to provide learning opportunities for practicing 'independent learning skills'. The intention is not to produce independent iearner's but an appreciation of the associated skills is one of the goals.
- *Sub question 1:* How does personalisation help to embellish the skills of independent learning in a secondary school within a closed curriculum that does not support SDL?
- *Sub question 2:* How can independent learning be supported when the students themselves are at entirely different levels of independence within one class?

4.3 Quantitative and Qualitative Data Analysis

The analysis of the collected data takes the form of the somewhat recently termed 'Mixed Methods Research', (Tashakkori and Teddlie 2003a), which combines and permits for comparison of both quantitative and qualitative methodologies. According to Creswell and Clark (2007), when using mixed analysis methods the data may either be concurrent or sequential. In the case of this study the data will apply concurrent mixed methods. Initially this involves the individual analysis of each dataset as outlined in the introductory text and diagrams of section 5.2 and subsequently the process of triangulation follows which entails the comparison of data results.(Gelo, Braakmann, & Benetka, 2008). The merging and comparison of the quantitative and qualitative analysis of the datasets allows for the interpretation of the findings to take place through the medium of discussion.

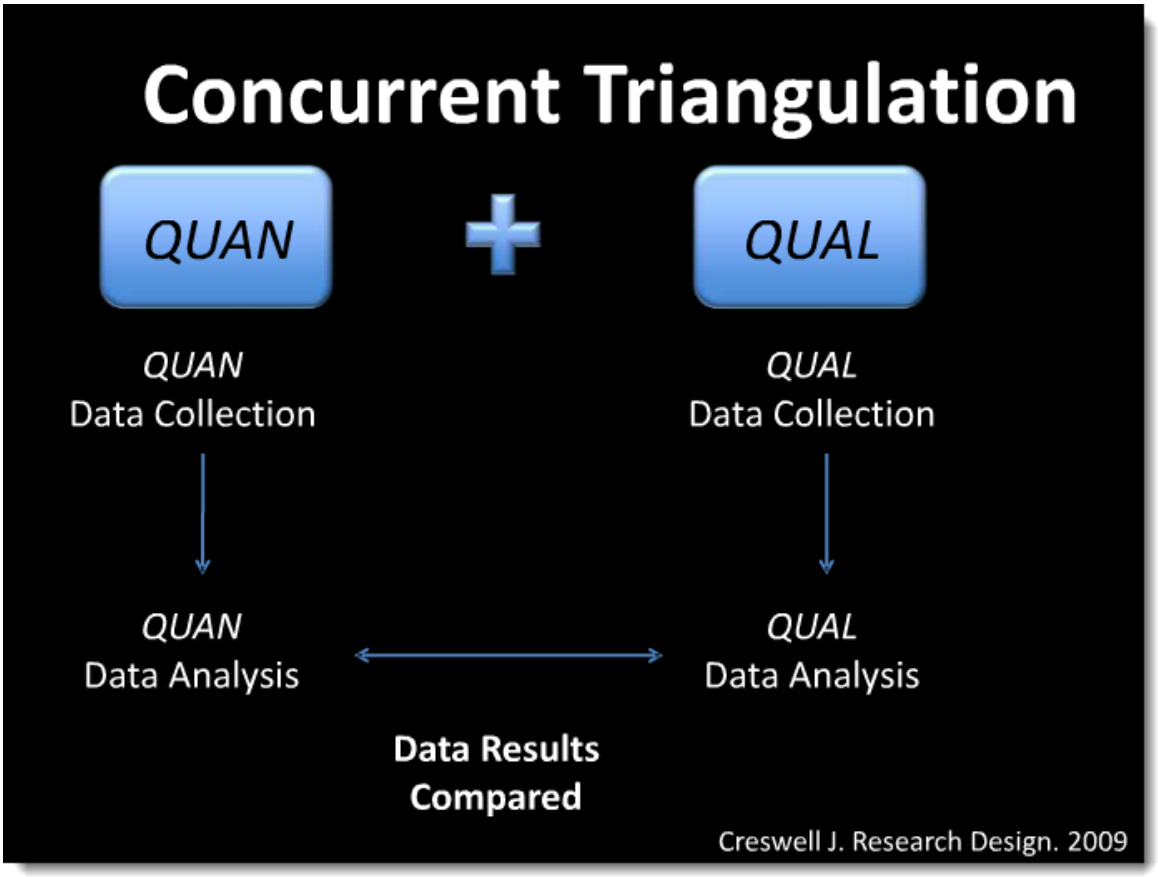


Figure 13: Concurrent triangulation – Creswell 2009

4.5 Data Collection Tools

"*Collecting and analyzing data are the concrete steps, which allow valid answers to the research questions."* (Scott-Baumann, 2008)

With the aim of adequately answering the quantified research question the data collection techniques for this study consisted of seven areas:

1. Pre questionnaire www.surveymonkey.net/s/mypacepre (Appendix 2)
2. Reflection journals with scaffolded questions (Appendix 3)
3. Researcher observations within the class and participant comments noted within class (Appendix 4)
4. Post questionnaire www.surveymonkey.net/s/mypacepost (Appendix 5)
5. End of topic algebra exam (Appendix 6)
6. Group discussion and feedback session (Appendix 7)
7. Collection of user data from the MySQL database of MyPace - time spent logged in, number of content rated, number of content reviewed (Appendix 8)

The variation of resulting data will provide an assortment of quantitative and qualitative data which will be further broken down into four datasets (discussed in the next chapter), thus supporting the eventual triangulation of these datasets leading to the case findings.

4.5.1 Pre and Post Questionnaire

Pre questionnaires (PrQ) and post questionnaires (PoQ) were completed using software available from surveymonkey.net which provided a secure and accurate way of tabulating the resulting responses. Participants completed the PrQ on the 23rd January, directly after the official introduction to the research while the post questionnaire was completed on the 9th February, the day after the MyPace trials concluded. The questionnaires sought to examine student's pre and post perceptions of the following:

- Preferred learning methods
- Learning through and with technology
- Perceived ability to be responsible for their own learning
- Reflecting to improve learning skills
- Level of fun involved with learning mathematics
- Identifying strengths and weaknesses

All participants were allocated sufficient time to complete both questionnaires

4.5.2 Participants Reflection Journal

In order to support the independent learning some level of learner reflection must take place. It was discussed in section 3.3 of the previous chapter (chapter three) that the existing reflection activity questioning in the MyPace system did not favour this research and the process involved to edit this, although it may seem like a basic task, would have been too time consuming. A solution to this was to provide participants with a reflection journal (see appendix 3) which contained scaffolded questioning. Participants were given indicated days to complete each reflection culminating on day 17, the 8th February.

4.5.3 Researcher Observations

While students were using MyPace during class time, the researcher/teacher became an observer and recorded the natural actions, reactions and comments of individuals. Along with student teacher conversations and meetings the observations gathered under the headings in the following diagram:

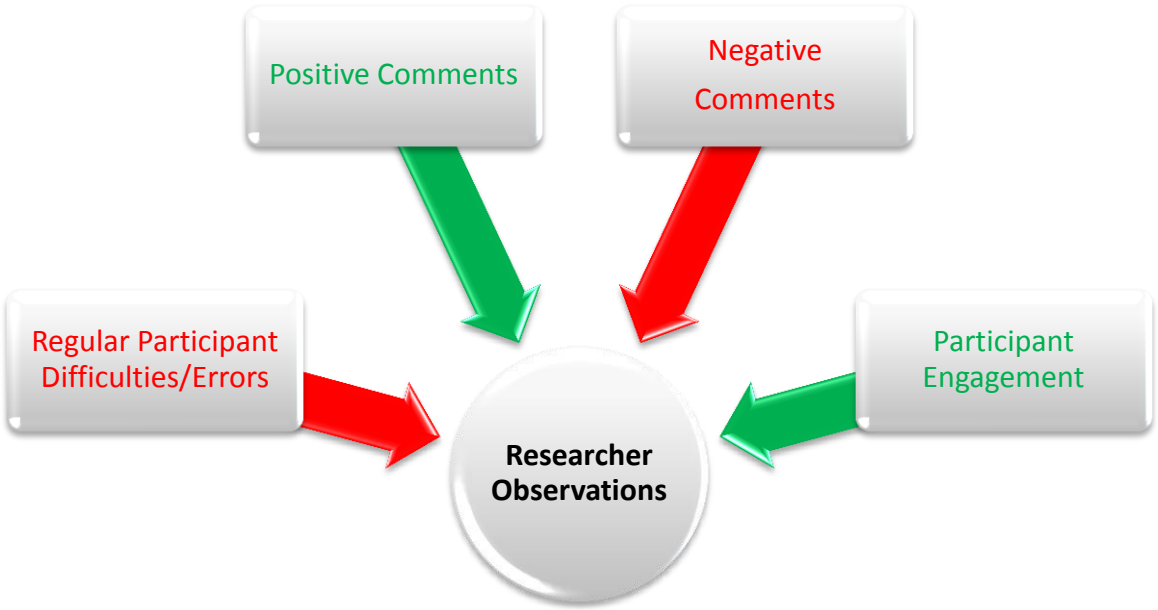


Figure 14: Researcher observation headings

The resulting data taken from daily observing helps reinforce the findings which are discussed in the following chapter.

4.5.4 Group Discussion and Feedback

On the concluding day of the trials an informal group discussion and feedback session took place in the computer room. The questions which instigated the discussion were taken from the post questionnaire (see appendix 5) and participants were given the freedom to voice their opinions primarily on learning through technology, setting their learning targets, becoming responsible for their own learning and using personalised e-learning in the future to study different subjects.

4.6 Implementation of the Learning Experience

The role of the researcher during the trial period outlined hereafter is to act as a facilitator as opposed to the traditional teacher.

The implementation process began in the early new year of 2012. Students were initially made aware of the research prior to the Christmas period in 2011 and informed that they would be given the option to opt in or out. Before the commencement of any trials all students were given an introductory lesson to explain what was involved in conducting the trials, why we were doing it and how we were going to go about the implementation.

4.6.1 Participants

The participating students in this study were a 1st year mathematics mixed gender group from a non-denominational VEC school in North County Dublin. One of the bases for choosing this particular group was the probability they would not have been susceptible to the rote and memorisation learning methods that are commonly associated with the customary Irish post primary school as earlier indicated in the Hyland report in the introductory chapter. Another significant factor was the ease of access the researcher had to this group, being the participant's mathematics teacher on a daily basis within the school setting.

The group consisted of 18 male and 11 female students, who all had their anonymity held in reserve to give participants the opportunity to be openly critical. (Creswell, 2008). Out of the 29 students, 2 opted not to have their results used for the purpose of the research but did take part in the trials.

4.6.2 Location and Duration of Trials

The trials were conducted in a North County Dublin post primary school. During the three week period allocated for the trials, participants took mathematics class in a computer lab instead of their base classroom. Along with using MyPace in school on a daily basis, participants had the ability to access the PLS online from home, outside of school hours including weekends.

Initially the commencement date was the 9th of January but due to difficulties getting the installation of MyPace up and running it was thought best not to rush and instead to delay the start date. This date corresponded with the same time period that is allocated in the mathematics departments' scheme of work for teaching the topic of algebra and due to the start date being delayed the topic of ratio and proportion was alternatively taught for two weeks. Ultimately the duration of trials spanned from Monday 23rd January 2012 to Friday 10th February 2012 (the Friday being the last day before mid-term break).

It should be noted that content on the topic, solving equations, was also uploaded to MyPace to cater for the possibility of students excelling and completing the algebra content before their peers.

4.6.3 Researcher Bias

At the time of this study, the author is the Information Communications Technology (ICT) coordinator within the school as well as teaching mathematics and technology. The researcher is the teacher of the participants, therefore having an existing rapport with the group. Nevertheless, it has been assured that any personal bias that may have influenced the results and findings of this study has been avoided.

4.6.4 Ethical Approval

In accordance with research conventions all questionnaires, participant information sheets, participant consent forms, parents' information sheets, parents' consent forms and board of management forms were all submitted for ethical approval. Approval was granted accordingly after some minor additions and alterations were requested upon the first submission (see appendix 12 for ethics approval form). However, there was a discovery by the researcher late into the study which drew cause for further ethical approval. The issue arose when it was discovered that not previously sought exam results needed to be used to

show comparison with the algebra examination result. This meant a supplementary consent form (appendix 11) had to be submitted for ethical approval and an additional set of forms had to be signed by both participants and parents/guardians.

4.6.5 Participant Guidelines

For the personalisation to be truly effective in supporting independent learning the participants had to be in total control of their own learning. Acknowledging this, students were given the guidelines and reminders below which were also displayed on the front of their reflective journal (RJ), see appendix 3. After each bullet the author gives justification for its inclusion:

- I am encouraged to rate content in MyPace after I have used it – *this will improve the recommender system results*
- Independent learning does not mean working on my own – *there is often a misconception that independent learning means working or learning in isolation*
- Remember to take notes and complete questions as I view content. I should use my maths copy– *ultimately the particpant must take a written examination and it would be unfair to base all the learning through technology (*e-learning*) until the state examinations board change the terminal examination structure from entirely pen and paper*
- Ask my classmates for help and assistance to solve problems – *students have the freedom to work collaboratively and move about when using MyPace, this is not the typical classroom scenario*
- I am encouraged to use the book along with MyPace system – *MyPace does not provide the content sequentially, therefore students will need to use their book to find the start, middle and end keywords to search for*
- Homework/tasks are assigned by me (using the book, using tasks in the MyPace system etc.) – *to become an independent learner one must set his/her own learning goals and targets*
- The MyPace system can be accessed at home at http://xxxxxx.scss.tcd.ie (site address must remain private in this paper as requested by the PERCOLATE team)– *the PLS is not just for use in school and participants are encouraged to use it outside of school hours in any location, it is up to the participant to take the responsibility to learn*

- Remember to watch an entire video or view an entire web page before judging/rating it, do not just skip through the content – *participants could become unfocussed and gain a bad habit of flicking in and out of content*
- I will sit an end of topic exam just like previous topics
- The teacher is available for any assistance required – *students that may struggle will not be left behind and the teacher is on hand to provide further guidance*

4.7 Conclusion

This chapter has described the methodology undertaken to answer the research question 'How can personalisation support the practice of Independent Learning in 1st year Maths?' and sub questions.

The following chapter 5 displays the resulting data obtained from the trials and discusses the main findings of the study.

5. Data Analysis and Findings of the Study

5.1 Introduction

The previous chapter discussed the methodologies undertaken in the research. This chapter follows on to show the results of analysing the data collected using the methods outlined in section 4.5. The combination of these data collection methods are further combined and ultimately seek to provide an answer to the research question: 'How can personalisation support the practice of Independent Learning in 1st year Maths?'

5.2 Dataset Interpretation

Before analysing the data the researcher evaluated each dataset individually to acquire an overall view of it (Creswell, 2008), under the following four categories:

Figure 15: Dataset categories

1. The Participant Results Table is derived from the following sources and discussed in depth in section 5.2.1
   - Previous exam results + average grade to date
   - Algebra exam result
   - Transcribed reflection journal comments
   - Confirmation of pre and post survey
   - MySQL database of content viewed
   - MySQL database of content rated

2. Questionnaires carried out using SurveyMonkey.net
   - Pre questionnaire
   - Post questionnaire

3. Final group discussion and feedback session

4. Researcher observations annotated throughout the trials

These four datasets are then used to triangulate the data to find validating evidence in order to answer the research question (Yin, 2006). Here, the convergence triangulation design (Creswell, 2003) is incorporated to compare datasets which is one of the most recognised approaches to mixed methods analysis, with its intention "*to obtain different but complementary data on the same topic*" (Morse 2003).The full process of data analysis which enables the author to reach findings can be viewed in the diagram that follows:

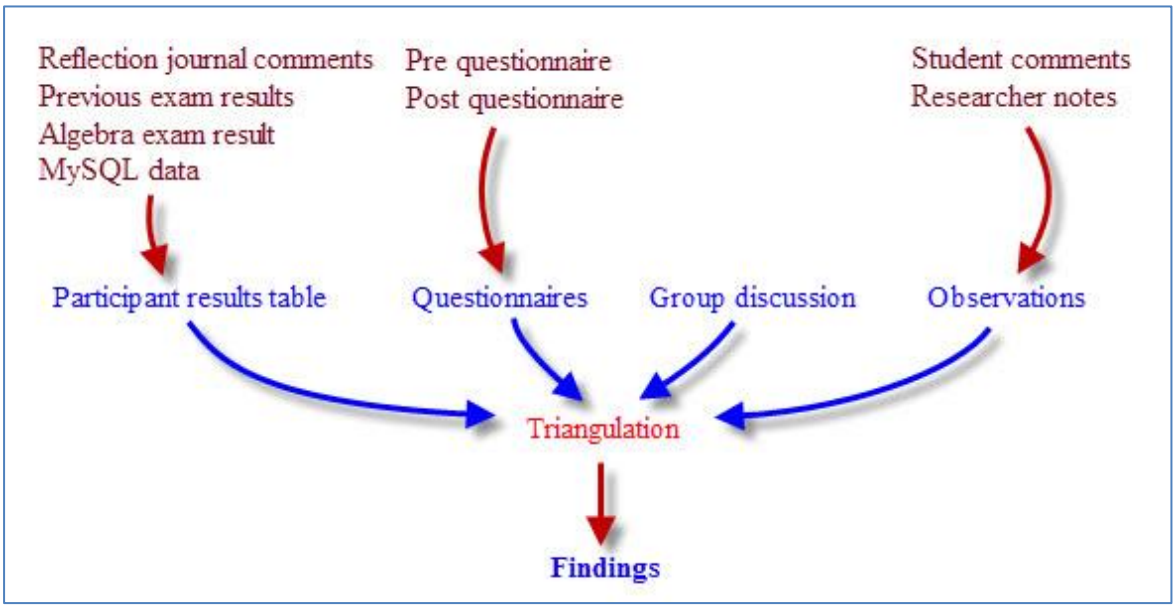


Figure 16: Process of data analysis

Here follows an interpretation for each outlined dataset

5.2.1 Participant Results Tables

Each of the twenty seven participants that took part had his/her MyPace data, relevant reflection journal comments, previous average results and algebra exam result tabulated into a one page document entitled a Participant Results Table (PRT) - abbreviated for the remainder of this paper.

The PRT allows the researcher to easily identify a student's overall participation in the research, evaluate if it had a positive or negative impact upon his/her learning and most importantly to highlight if the participants experience of using a PLS has encouraged to partake in further independent learning in the future.

How the PRT is constructed

The positive and negative user comments within the PRT are based upon responses to the scaffolded questions in the reflection journal (see appendix 3). The researcher has not detailed every comment from each participant but has instead chosen sentences and keywords which are most relevant and directly linked to the study (focusing on independent learning related terms) and the PLS.

An example of an included response: '*I am beginning to think differently about my learning and how I learn because I have to share my time properly and teach myself', Boyle 02*

An example of an excluded response: '*I found the connection bad today (not MyPace fault)', Boyle 05*

Other information included on each PRT comprises of:

- Participant's algebra exam result
- Previous average result based on the exams taken since the start of the school year
- Previous average result compared to algebra exam result (explained in next paragraph)
- Days absent during the research
- Individual MyPace statistics – total content viewed and number of content rated
- Confirmation of surveys taken
- Researcher comments and annotations on the participants involvement

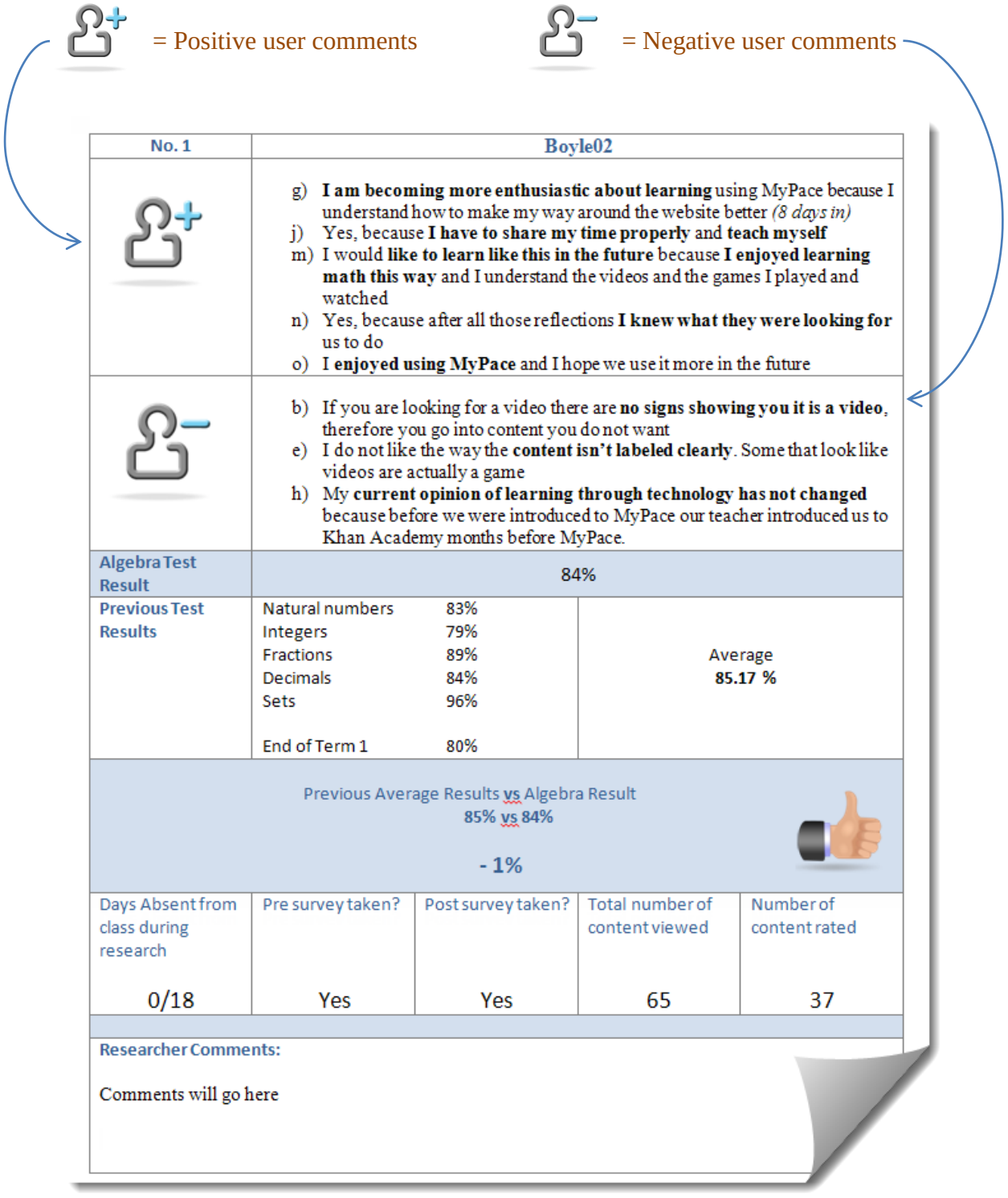


Figure 17: Participant Results Table

An important area and outcome within the PRT is the section comparing the participant's previous average result with their achieved algebra exam result. When comparing these two results the thumbs up and thumbs down images are used to show the students grade increase or decrease. However in this case achieving a lower percentage in the algebra exam does not always mean the participant receives thumbs down on their PRT.

The researcher has taken into account that algebra is one of the most difficult topics for a 1st year student to comprehend let alone allowing them to learn it independently using a PLS for the first time. Hence, it was considered unfair and demotivating to give the thumbs down image to a student if they achieved 1% less than their average. Therefore, if a student achieved within 10% of their previous average they are considered to have achieved a positive result and will receive a thumbs up in their PRT. This figure was derived from consultation with the author's mathematics department and agreeing a reflective allowance based on other years previous results was 10%.

Lastly, at the foot of each PRT is a comment section which allows the researcher to draw on all of the aforementioned information to make his or her own conclusions. The wide variety of information, both quantitative and qualitative allow the researcher to evaluate if the participants experience of using a PLS was positive and conducive to supporting independent learning skills ie. Did they think about how they learned? Did they take responsibility for their learning? Did they set themselves goals/targets?

5.2.2 Pre and Post Questionnaires

Pre and Post questionnaires provided a combination of both quantitative and qualitative data. The quantitative data was generated by SurveyMonkey.net and displayed in the graphical form of pie charts, allowing for the easy comparison of participants pre and post opinions.

The questionnaires sought to examine student's pre and post perceptions of the following:

- Preferred learning methods
- Learning through and with technology
- Perceived ability to be responsible for their own learning
- Reflecting to improve learning skills
- The level of fun and enthusiasm associated with learning mathematics
- Identifying personal strengths and weaknesses

Questions in the PrQ predominantly focused on gaining an insight into the current work load being done by the class, their opinion of the current mathematics course, difficulties they may be facing (if any), preferences when it comes to learning mathematics and their perceived ability to partake in this exercise.

The post questionnaire sought comparisons to these aforementioned questions along with seeking answers and opinions to: the participant preferences after using the PLS, recommendations and changes for using a PLS in future, recognising the importance of becoming an independent learner, evaluating how/if the PLS supported the development of independent learning skills (responsibility, reflection, goal setting) and finally if the experience was fun.

5.2.3 Researcher Observations

The observation notes took the form of the researcher simply hand noting on a daily basis the participants comments and actions which were considered relevant to the data collection. These observations are a combination of the participant's feedback on all aspects of MyPace and the process of independent learning along with the researchers remarks on how the study progressed on a daily basis.

5.2.4 Group Discussion

The group discussion took place on the final day of the trials after students had completed the post questionnaire and received their algebra examination results. The discussion involved everyone in a casual atmosphere with the MyPace site open on the interactive board to allow students to indicate towards certain areas of the system if needed. Students were encouraged to voice their real experiences and opinions of using the PLS over the past three weeks and all notable comments and contributions are listed in appendix 7.

5.3 Case Findings

When reviewing the literature the following four areas are repeatedly the main characteristics of an independent learner:

- accepts responsibility for the learning outcome
- is aware of their strengths & weaknesses
- is motivated to learn (self-motivated)
- reflects on the learning process in order to improve

The results from analysing the data which follows are founded on common themes.

The findings which follow are presented below three of these independent learning skills as headings which later contribute to answering the research sub questions and overall

question. The ability of a learner to be aware of their strengths and weaknesses is discussed in the following section 5.3.1.

5.3.1 Perceptions of e-Learning, Personalisation, and Learning Preferences

Evidence from the PrQ (Qs.9) shows 55.5% of students agreed they could learn mathematics by themselves using good resources from the internet (websites, videos, animations, games, quizzes etc.). This figure was positive and showed students had confidence in themselves to succeed at practicing independent learning skills. Some agreed for the following reasons:

> Ans. 1 "*I can do it slower*"
> Ans.14 "*I believe i could do the math learning on my own because I'm good with computers and i know some really good websites*"
> Ans.16 "*for the reason that if you went on to such sites as Khan Academy or YouTube and even MyPace, there are many videos and methods of how to learn math*"
> Ans.18 "*It would be just like a teacher telling you how to do a question and it is shown to you*"
> Ans. 21 "*it is a good way to learn because everyone does not learn at the same pace*"

25.9% were unsure of their opinion which is understandable for twelve and thirteen year olds who never participated in learning like this previously and who were apprehensive of what to expect according to questionnaire comments. The 18.5% of participants that did not agree with this question had similar fears of receiving misleading information and some showed the preference for being teacher instructed as the responses below confirm:

> Ans. 3 "*because it's easier when a teacher explains it*"
> Ans. 7 "*I don't know whether I like using the internet for studying because sometimes I can get very misleading websites*"
> Ans. 10 "*if i am stuck I need someone to talk me through it. I don't think I can get it on the internet*"
> Ans. 17 "*it would be too hard and we may get entirely wrong we might learn an American way we may get wrong information*"

This anxiety of participants 'not succeeding' was further emphasised in reflection journal comments, "*I am afraid I might not get a good grade in algebra*" Boyle 29, and also

discussed in the final group feedback session where a number of students agreed with their classmates comment "*I'm not sure if I will be able to do it, but I will try my best*".

E-Learning

It's apparent that many of this generation of students are growing up into a society that is tech orientated, not just at home but also in school, consequently supporting the smooth adaptation of e-learning amongst our technology enthused learners of today. 88.5%, the majority of the participants in this study back this up, agreed that when technology is introduced into a lesson it increases their attention (Qs.12). The responses to this question primarily agree because the introduction of technology into a lesson means "*…learning a new way is interesting and* ***fun***", "*…it's* ***fun*** *and I* ***don't get bored quickly***", " *it makes it* ***more interesting*** *to learn and not having to listen to the teacher the whole time*", "*it makes me* ***more active***" .

These statements provided a positive indication that participants would adapt to the personalisation aspect of this study as the core concepts of personalised learning outlined in the literature overlapped with these responses: fun, motivating and enhance the learner effectiveness.

Personalisation

An important factor in the classroom is to engage every student and often this can be difficult especially if a student is too shy or nervous to ask a question in front of their peers. Personalisation can help with this by engaging everybody and adapting the educational needs required to support the individual. Participants were questioned (Qs.10) in order to measure the level of current class engagement and involvement by stating that '*there are times in mathematics class I don't want to ask questions because I am too nervous or feel it may not be a suitable question'*. Although 40.7% disagreed with the statement and 11.1% were unsure, a majority 48.1% agreed with this, indicating there is certainly a requirement to somehow engage this high percentage of students that do not ask questions.

Following on from these findings, a case could be made that an alternative teaching and learning approach might be more suited to these students, perhaps working in a different setting outside of the classroom on their own. Although it has been clearly identified that independent learning is not about learning on your own (more commonly referred to as self-learning), one has to admit that certain aspects do involve solely the individual.

Question 7 in the PrQ provided further evidence on which to base this proposal and investigated what the individual student's learning preference was; '…to learn on my own rather than a classroom setting'. Coincidently, 40% were 'unsure of their opinion' which compares strongly to the previous Qs.6 where 38.5% were also unsure of the most suitable learning method for them. In addition to this are 32% of participants who feel they would prefer to learn on their own, thus strengthening the case to provide a personalised experience for this group alone. It has been taken into consideration that the participants may not have previously truly experienced learning on their own; therefore these results are just an indication.

As a final point in this section, a common occurrence amongst students is the difficulties they face when outside of school and completing homework/tasks. In today's environment where both parents are working harder and longer, students can often be left to their own devices. This is confirmed in Qs.11 where 38.5% agree or strongly agree that '*a difficult thing about learning mathematics is not having any help at home to solve problems'*. Personalisation can assist with this problem where the relationship between technology and e-learning can provide students the opportunity to choose what they learn, when they want to learn and where they wish to learn.

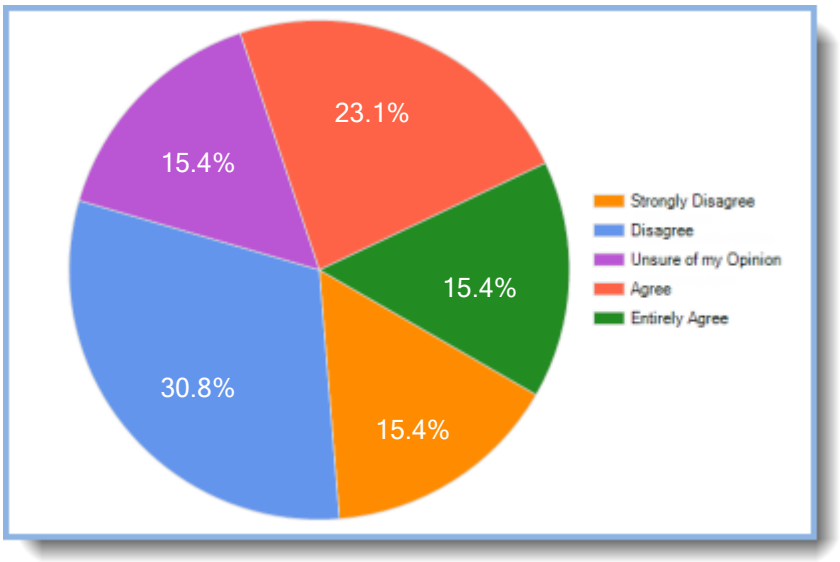


Table 1: Pre questionnaire Qs. 11 Chart

I think it is a great idea of using computers for a chapter and taking a break from the books, it's just that with independent learning I'm afraid that if I don't get something in algebra will the teacher revise over it with us? Boyle 16

Learning Preferences

Prior to the study the students were asked (PrQ, Qs. 6) if they believed learning from the book was the most suitable method for them. Taking into account that this is the most recurrent style of teaching and learning in the average school, the resulting chart found 38.5%, were 'unsure of their opinion'. This indicated that prior to the implementation the largest percentage of participants were not aware of their preferred learning methods, thus suggesting neither were they aware of their attributes as a learner.

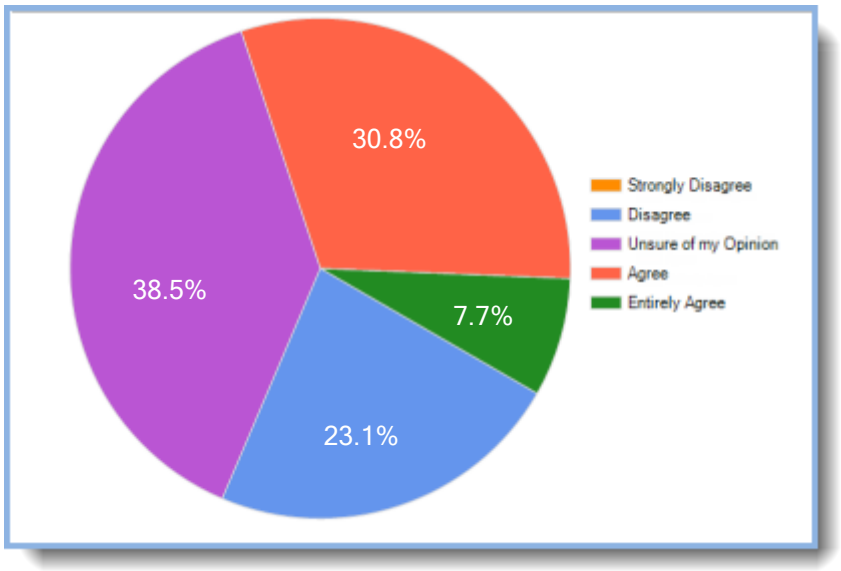


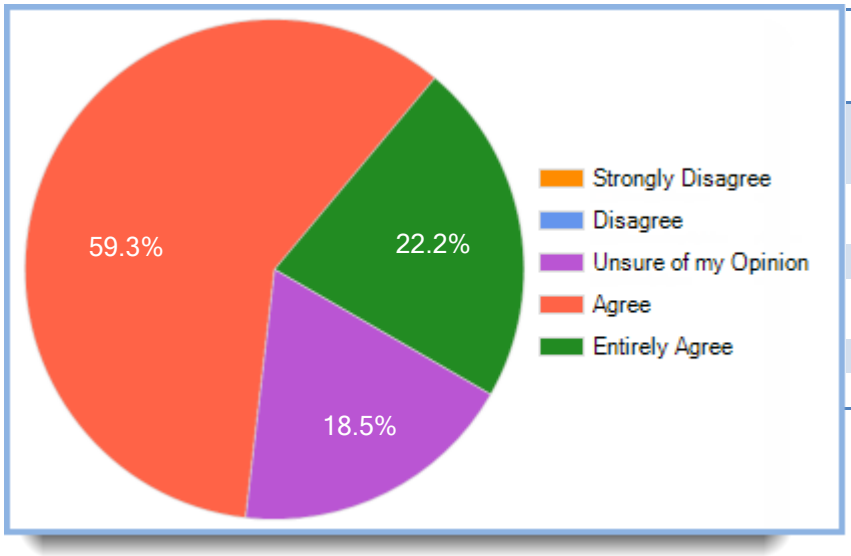
Table 2: Pre questionnaire Qs. 6 Chart

The post questionnaire followed on from this question and examined if students had become more aware of their strengths and weaknesses as learners after using the PLS and partaking in learning independent skills (Qs.12). Of course students themselves must be made aware of the attributes of a good learner and this is noted many times on the computer room walls where the study was conducted (figure 17 on following page).

- Must be focused
- Have excellent critical thinking skills
- Thinks about how they learn and how to improve their learning
- Does not give up and perseveres
- Willing to learn independently and take responsibility for their learning
- Has the ability to learn over a sustained period
- Obtains a passion for learning new things
- Willing to adapt to change

Figure 18: Strengths of a good learner

Remarkably, after the three weeks 81.5% of participants were now somewhat aware of their strengths and weaknesses as learners by agreeing to this statement and the remainder were unsure of their opinion.



Qs.12 I am now much more aware of my strengths and weaknesses as a learner.

Answer Options	Response Percent
Strongly Disagree	0.0%
Disagree	0.0%
Unsure of my Opinion	18.5%
Agree	59.3%
Entirely Agree	22.2%

Table 3: Post questionnaire Qs. 12 Chart

5.3.2 Adapting Responsibility – Theme 1

The fundamental skill to acquire for an independent learner is to be responsible for his/her own learning needs. Personalisation helps with this by placing the learner in control, hence shifting the main responsibility from the teacher to the student. The fact 55.5% agreed they could learn mathematics by themselves shows that participants in this study are at least willing to take responsibility for their learning, although this group had not yet demonstrated to the researcher if they had the capabilities or know how.

In the PrQ (Qs.13) participants had some of the following comments to make about taking the responsibility and monitoring their own learning:

Ans.4 "*I think it's a good idea so your teacher knows your ability"*

Ans.6 "*I feel that it is good and we will need the skills for the future in university because the teacher will not tell you everything you need to figure things yourself"*

Ans.10 "*I don't really think monitoring your own learning is a good idea because i think it's a bit confusing not having a teacher to ask questions too"*

Ans.12 "*I do not agree to monitoring my own learning because if I am not given homework from a teacher I may forget to study maths that evening. This means I will fall behind."*

Ans.18 "*It's not great choosing what work to do because we might choose to do none at all"*

Ans.20 "*I think it's a good idea because it gets me more interested in school and work"*

Ans.25 "*It's good, it shows me my weak and strong points"*

It can be seen from the comments that they are mixed, some being very positive and enthusiastic and some bearing on the cautious side. As this is the first time for most students to break away from the traditional classroom structure and not have all the information, notes and homework directly fed, these diverse responses were understandable.

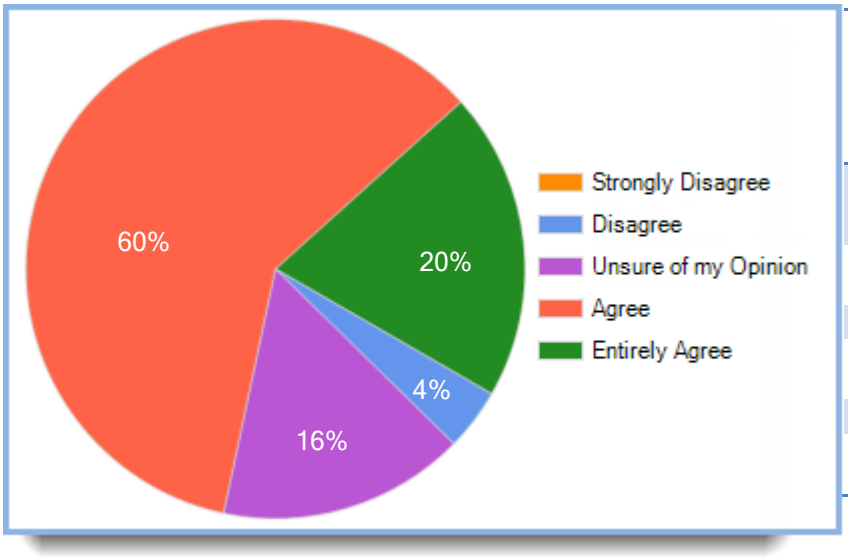
Throughout the trials the researcher observed that the participants took time to acquire this level of responsibility. Although it seemed to be swiftly adapted by many students, in certain cases it was not until near the examination that an approach was made towards the teacher to seek assistance.

Once the students began to use the MyPace system they began to take charge of their own learning of algebra. The reflective journal comments conveyed that whether participants were doing well in their own minds (or not doing well), they realised it was their responsibility to achieve their learning goal:

> "*I am learning differently because I'm not just listening I am doing, I am learning my way*" Boyle 07
>
> "*I think that it is a great way to see how far we can push ourselves to get what we want to get in maths it is important to know how to do it not just write the answer down.*" Boyle 23
>
> "*Yes I am thinking differently about my learning because working out of the book by myself makes me think twice about the question I am about to ask because I can find it out for myself,"* Boyle 26
>
> "*Speed up my work a bit because test is in a week or so and I still have a lot of notes to take down and learn*," Boyle 28
>
> "*I'm not going to get a good grade because I'm not trying hard enough*" Boyle 29 (this participants exam resulted +10% on their previous average)

Following on from the pretrial perceptions of becoming responsible for their own learning the PoQ investigated how participants had fared in being accountable for their learning throughout the three week duration of independent learning. A very high percentage, 65.4% agreed that after taking part in practicing independent learning skills, they would like to take part again in the future; implying participants coped with making responsible decisions to meet their own needs. Encouragingly from the researcher's perspective only 15.4% stated they would not like to take part again in the future and the remaining 19.2% were unsure.

These percentages are further supported by the response to Qs.15 in the PoQ. This question asked the participants if seeing the outcomes as a result of their taking responsibility for their learning was 'rewarding and satisfying'. In total an overwhelming majority of 80% agreed.



Qs.15 Being made responsible for my own learning and seeing the outcomes was very rewarding and satisfying	
Answer Options	**Response Percent**
Strongly Disagree	0.0%
Disagree	4.0%
Unsure of my Opinion	16.0%
Agree	60.0%
Entirely Agree	20.0%

Table 4: Post questionnaire Qs. 15 Chart

It is evident from this analysis that the anticipation of successfully practicing the skills of a responsible learner was somewhat mixed prior to the trials. However, the resulting answers and comments discussed that the feedback has been progressively positive. The majority of students agree that knowing how to monitor and be responsible for their learning is a worthy exercise as '*it is a great experience to have to be able to try teach yourself*' PrQ, Qs.13, Ans.19. However, it has to be noted that not each student's experience is the same nor is it always positive, some 'find *it quite hard'* PrQ, Qs.13, Ans.2, or believe they '*would have more knowledge on algebra if I had been taught by a teacher*', PoQ, Qs.18, Ans.3. In cases such as this, where students struggle to become liable for making their own decisions, personalisation plays a fundamental role in affording the teacher the opportunity to spend one to one time with this smaller number of students while many continue their learning autonomously.

5.3.3 Reflection – Theme 2

Engaging in the reflection process can be challenging for any learner, and it was no different for this group of new entrants to second level education. The literature identified the necessity to develop reflective and metacognitive capabilities amongst independent learners. This involved students completing a series of reflective journal inputs

with the intention of making the student decide whether their learning methods are right or wrong in order to improve their own learning.

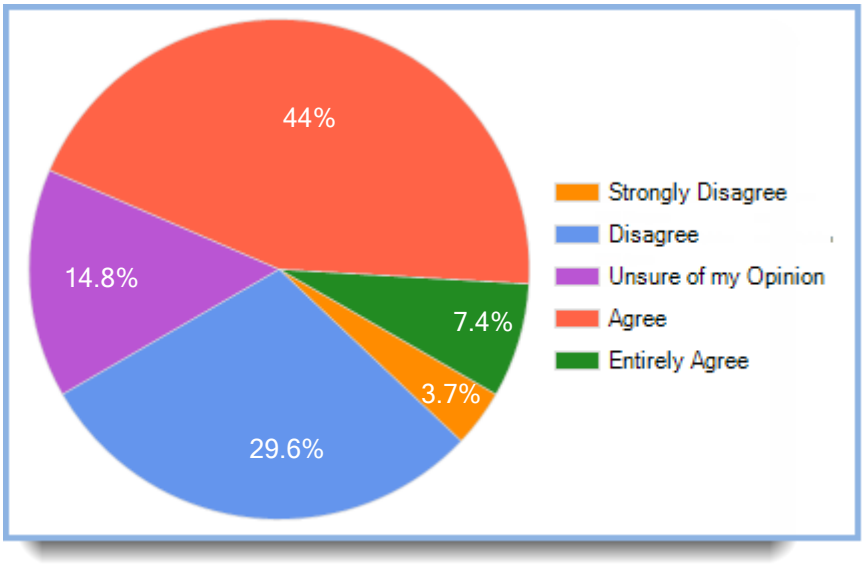


Table 5: Post questionnaire Qs. 11 Chart

During the post survey students were also asked (Qs.11 chart above) if the reflections helped with improving the way they thought about their learning. Although it has to be taken into account that the participants are twelve and thirteen years of age and engaging in the metacognitive process may not be a concept they are fully assured of the results showed mixed opinions. Over half of participants agreed the reflections were beneficial as they engaged in thinking about their learning (metacognitive process) but a large percentage, 33.3%, answered that the reflections did not prove beneficial, the remaining 14.8% were unsure of their opinion.

Researcher observations noted ‘some participants are failing to complete the reflective journal and need encouragement’. On random inspection of journals there were a number of students with sections not filled but the completion of these was not enforced by the researcher due to the responsibility of all areas of the learning being that of the participants.

The failure for these students to complete the reflection entries could perhaps account for the 33.3% not finding the reflections constructive and the 14.8% who were unsure of their opinion.

To conclude this section on participants’ engagement with the reflection process, the following mixed responses on the next page appeared in the journals:

"*I think reflecting helped me understand to look back at work that I was stuck or confused*" Boyle 06

"*I could look over the reflections and try harder*" Boyle 12

"*Yes I found reflecting beneficial because I find out where I need to improve my skills and I am doing a basic summary of what I did in math's at home and in school*" Boyle 18

"*The things I enjoy the most about MyPace is that you can reflect on your work*" Boyle 19

"*Yes, I found reflecting helped improve my independent learning skills because I could see my progress by looking back at the journal*" Boyle 19

"*Personally I didn't find reflecting on my learning skills helpful*" Boyle 21

"*I don't think reflecting on my learning helped me to improve my independent learning skills because I didn't read back over the reflections and didn't really see the point of my reflections*" Boyle 28

5.3.4 Self-Motivation – Theme 3

Inside the normal everyday classroom the student motivation is predominantly external orientated which sees students being rewarded, encouraged and punished as opposed to being intrinsically motivated which allows the student to set his/her own goals and tasks, take control of their learning and reflect on how they learned based on the learners own preferences and interests.

Personalisation and e-learning can contribute towards motivation in the sense that it is fun and new to the participants of this research, but for any successful independent learner the motivation must first come from within the individual. It should be remembered that the aim in this study is not to develop independent learners but instill some of the qualities of an independent learner already discussed.

Throughout the duration of the research it was apparent from observing, students' were much more enthusiastic about learning mathematics. A simple example is that students were always on time and eager to get seated and logged onto the computer – this does not

always happen when asked to open the text book. However this enthusiasm can also be contributed to the fact participants were learning mathematics through technology which was previously confirmed (in section 5.3.1) by 88.5% to increase their attention during class.

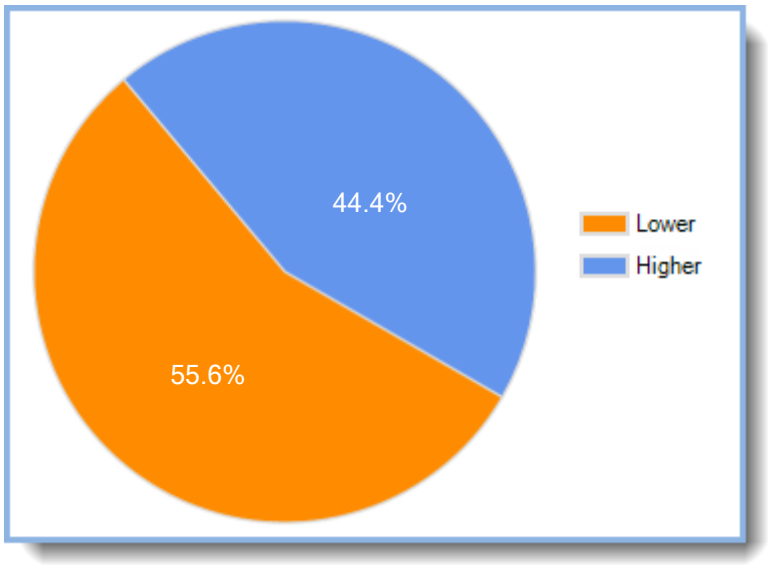
However, similar to taking responsibility and engaging in reflection, the participant reflection journal comments were predominantly positive and displayed that students were self-motivated towards learning this way, yet there still remained a minority of participants that did not feel motivated:

> "*I am more enthusiastic about learning from MyPace because I have gotten the concept of it and know what to look at and where I shall find it*" Boyle 05
> "*I think I am becoming less enthusiastic because I do not like some of the videos on MyPace*" Boyle 06
> "*I am becoming more enthusiastic about learning using MyPace because it has helped me understand notation and using letters in algebra*" Boyle 07
> "*I find I am less enthusiastic at home*" Boyle 09
> "*I love the idea of independent learning, I find it very boosting towards my confidence*" Boyle 10
> "*I am having lots of fun while learning. MyPace it's really helpful and fun"* Boyle 21
> "*I am becoming more enthusiastic because I am learning more for myself and doing a lot of exercises in my book*" Boyle 23
> "*I had a very successful day on MyPace. I found one video that went through mixed variables and I was very happy with it*" Boyle 26

5.3.5 Individual Grade Progression/Regression

To justify the implementation of these technological learning methods such as personalised e-learning within the schools of today, they are expected to accomplish similar and improved levels of student achievement over traditional teaching and learning methods. This is especially the case in Irish second level schools where students still must sit a "*written examination at the end of the Junior Cycle……dealing respectively with recall, instrumental understanding, relational understanding and application, together with the appropriate psychomotor (physical) and communication skills."* (Government of Ireland, 2011).

In order to assess if students effectively understood what they learned while using the MyPace PLS they were given the customary end of topic examination which indicates their level of algebra knowledge. All students sat the forty minute examination at the same time. Prior to receiving the exam results students were questioned in the PoQ on how they believed they performed compared to their previous average grade.



Qs.17 Before getting your results back, do you think you scored higher or lower in this algebra exam than the average you achieved in previous exams?

Answer Options	Response Percent
Lower	55.6%
Higher	44.4%

Table 6: Post questionnaire Qs. 17 Chart

From the resulting chart it shows the majority (55.6%) was not confident of achieving higher results and in this case the individual students would have had a clearer indication than the teacher as only they knew how much work was invested into learning the topic. However, on inspection of the final examination results, it was evident that the 44.4% of participants that showed confidence in improving did not reflect the actual increase.

Overview of Participants Results Tables

Number	Male/Female	Participant Number	Average Result %	Algebra result %	% + or -	
1.	Male	Boyle 2	85	84	- 1	
2.	Male	Boyle 3	65	54	-11	
3.	Male	Boyle 4	32	35	+4	
4.	Male	Boyle 5	89	89	0	
5.	Male	Boyle 6	69	59	-10	
6.	Male	Boyle 7	73	69	-4	

Figure 19: Overview of Participants Results Tables

In fact a very impressive 17/27 or 63% did improve on their previous average which consisted of six earlier results. The remaining 10/27 or 37% did not improve their result.

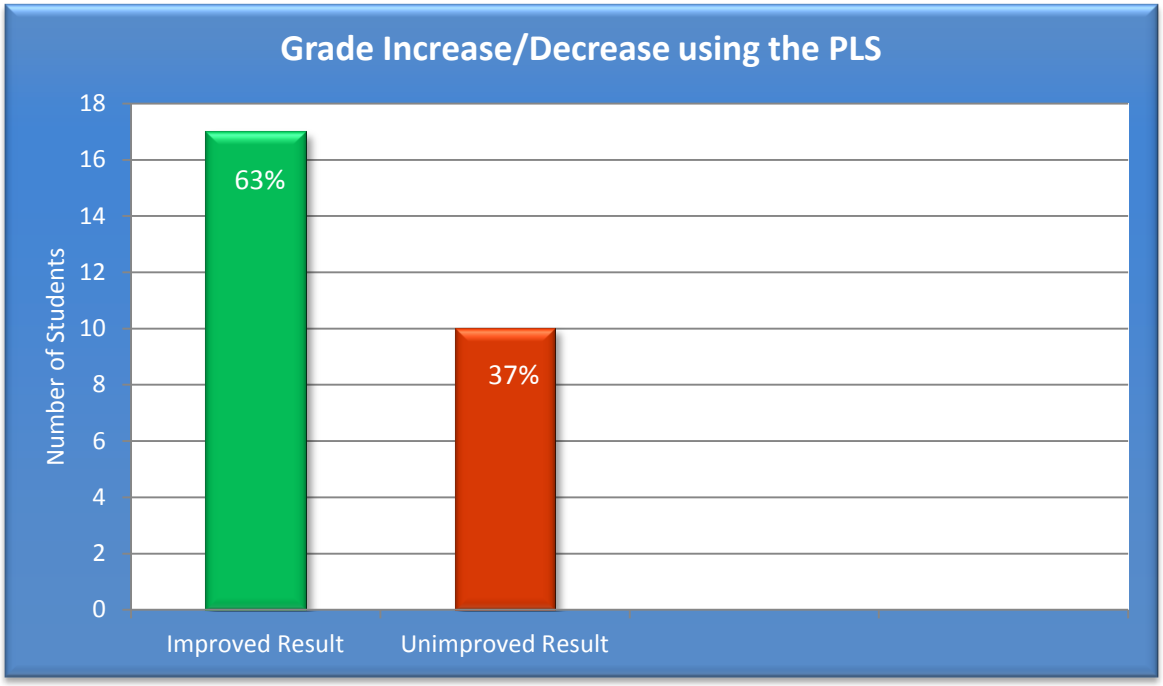


Figure 20: Grade Increase/Decrease using the PLS

Note: as outlined in section 5.2.1 students were afforded a -10% allowance to qualify for increase

For these 10 students the shift in learning from teacher-centred to learner-centred may have proved difficult, even more so as algebra is an abstract topic and regularly poses the most difficulties for any first year mathematics group. Nonetheless, this does not accurately indicate these participants are not suited to personalised learning or to becoming lifelong independent learners. A mixture of researcher observations and discussion feedback suggests the following could be possibilities for the 37% not improving:

- difficulties adapting to responsibility
- found algebra challenging to comprehend
- chose the wrong learning path
- not comfortable using the technology (prefers traditional methods)
- poor individual effort
- lack of determination

5.3.6 Recommended Future Learning Using Personalisation

Previous sections in this chapter have shown that the majority of participants adapted to the concepts of using the PLS to practice the outlined independent learning skills. However previous sections also highlighted that not every participant was self-motivated, comfortable with the responsibility or found the reflection process beneficial. During the final discussion and feedback session the researcher asked for a show of hands (see Appendix 18 for table) for those who would like to learn like this in the future; 20/27 (74%) said they would like to learn like this in the future and the remainder (26%) said 'no'.

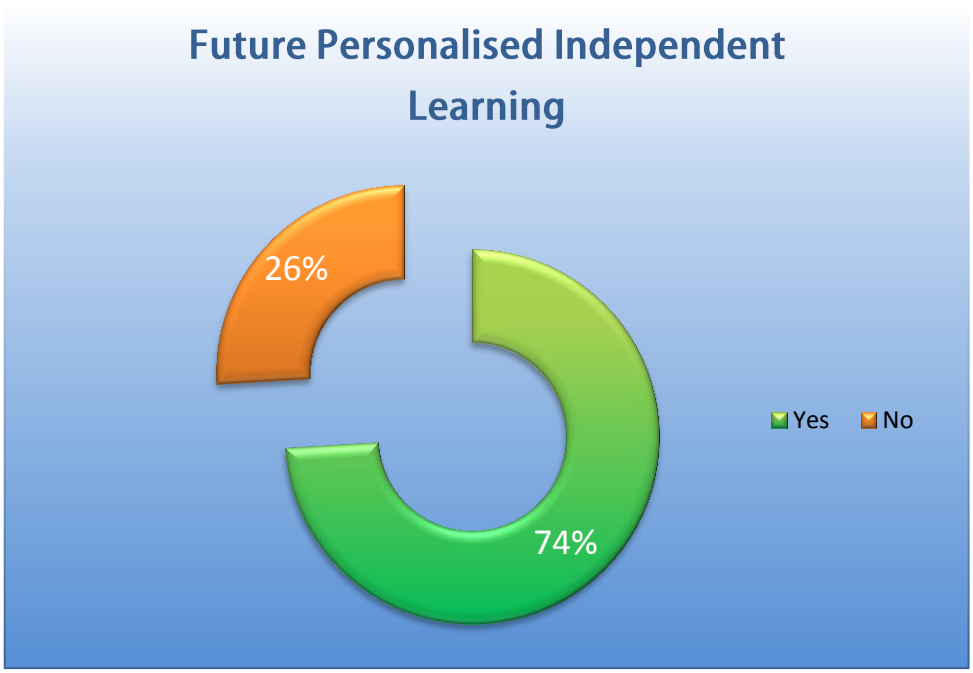


Figure 20: Future personalised independent learning

Reflection Journal comments (Day 17, Qs. m) again backed these figures providing majority of positive remarks and only a few negative:

"*I would like to learn in the future like this because it lets me learn the way I learn at my own Pace*" Boyle 05

"*Yes, I would like to learn like this in the future but I would still like to have my teacher teach me as well*" Boyle 10

"*I would not like to learn like this in the future as it will never be as good as someone teaching it to you*" Boyle 12

"*I would like to learn like this in the future because it means you can enjoy maths while learning and you are able to help friends if they need help*" Boyle 24

In addition to these comments the PoQ's final question (Qs.18), sought participant's overall thoughts/opinions on using MyPace or even a similar system for learning independently:

> Ans. 3 "*I think MyPace can be beneficial for some people but not for me I think that I would have more knowledge on Algebra if i had of been taught by a teacher."*
> Ans.6 "*I think it is a good way to prepare you for a higher level education that is why I would like to take part in this again in further years to come and maybe start using it for other subjects. But I used the book to learn and I think my pace is a good way to study for tests and to study for other subjects."*
> Ans.8 "*I think my pace is extremely good and anybody who gets a chance to use this system should!"*
> Ans.14 "*I strongly believe that using MyPace or something similar doesn't suit me because when i was learning algebra, i found it a tough topic but when the teacher explained one sum to me i began to get how to do algebra so i prefer a teacher explaining it on harder topics."*
> Ans.15 "*I would use the MyPace system again for other maths topics or even other topics in different subjects. I would recommend the MyPace system to other classes in our school or even to other schools*"
> Ans.20 "*I thought learning algebra independently was a good achievement and i would also like to use a system similar to MyPace for future topics in maths and even in different subjects.*"

Again these responses are in line with the preceding participant feedback: displaying positivity towards the PLS and independent learning and consistently showing that there are a small number of students that believe this method and style of learning does not suit them. In some cases students in fact reverted to using the text book or using it along with the MyPace system and favored this; "*It makes learning fun but i would like to use the book and MyPace evenly*" PoQ, Qs.18, Ans.26. This finding is furthered highlighted and discussed in the following chapter in more detail.

5.4 Summary

This chapter has shown method of data analysis and presented the main findings of the study which coincide with the sub objective and sub questions. In addition to this the researcher has also highlighted other significant findings which help contribute to answering the overall research question in the following and concluding chapter. This subsequent chapter will focus on answering and discussing the sub objective and sub questions along with the research question in detail before concluding the paper.

6. Discussion and Conclusions

6.1 Introduction

The previous chapter described the method of analysing the collected data and presented the findings of this data. This chapter begins by using the outcome of these findings in conjunction with the pertinent literature to discuss the sub objective and sub questions and ultimately provide a conclusion to the main research question. Following this the researcher outlines the unexpected findings and limitations of the study before finally concluding and recommending future research within the area of personalisation and independent learning.

6.2 Sub Objective and Sub Research Questions

6.2.1 Infusing Independent Learning skills through Personalisation

Sub Objective

The main goal is to use personalisation to provide learning opportunities for practicing 'Independent Learning skills'. The intention of this study is not to produce Independent Learners but an appreciation of the associated skills is one of the goals.

The findings would suggest that the majority of students undoubtedly engaged in the practise of fundamental independent learning skills through personalisation. As outlined in the literature, concentrated on within the data collection and investigated in the case findings, these four skills consisted of:

- Responsibility
- Self-Motivation
- Reflection
- Strengths and weaknesses

Examples of how the students adapted to and practised these skills along with recognising them as key ingredients for successful future learning are evident through a combination

of researcher observations, questionnaires, and reflections falling under the headings of these aforementioned skills:

Responsibility "*I am becoming more enthusiastic about the Mypace system as I am moving away from games and websites and more towards videos which are helping more*" RJ, Boyle 12, (g)

Self-Motivation "*Sir I like learning like this with MyPace, it feels good when I learn something like this without your help*", Observation

Reflection "*I am thinking differently about my learning because working out of the book by myself makes me think twice about the question I am about to ask because I can find it out for myself,"* RJ, Boyle 26, (j)

Strengths and Weaknesses After the trials 81.5% of students recognised that they had become more aware of their strengths and weaknesses as a learner, PoQ, Qs.12

Recognising the need to become more independent "*I feel that it is good and we will need the skills for the future in university because the teacher will not tell you everything you need to figure things yourself"* PrQ, Qs.13, Ans.6

The findings do however suggest that not all students had a positive experience when using personalisation to adapt independent learning skills, "*I didn't find this subject easy to learn I found it quite difficult understanding what to learn and learning independently. I think that MyPace is for a particular type of learner..... which didn't really help me*", PoQ, Qs.7, Ans.3 . This comment represents a minority yet determines that a small number of participants found it difficult to take the responsibility for their own learning and the knock-on effect of this meant that it also affected the learner's self-motivation. There are a number of possibilities for this failure/difficulty to adapt, a selection of which includes:

- Not choosing the correct learning path
- Making incorrect decisions
- Failure to take responsibility for their own learning
- Not engaging in the metacognitive process

It has been stressed at various stages throughout the paper that the objective of the research was not to develop independent learners by the end of this implementation. The

outlined skills that are central to lifelong independent learning cannot simply be instilled over a three week research period but are developed over a sustained length of time.

In keeping with this the literature identifies how it is important to acknowledge that a significant aspect of learning independently is to realise that making mistakes is a routine part of learning progression and not an indication of incompetence. Therefore just because a number of these participants did not adapt to this style of learning does not mean that they cannot try again or continue the practice of developing the necessary skills. Finally, it has to be recognised that these students have been accustomed to the rote and memorisation learning methods of the traditional primary level system for 8 years and asking them to take on a topic as abstract as algebra was always going to pose difficulties for a number of participants.

6.2.2 Using Personalisation in a Traditional Second Level Subject

Sub Research Question 1

How does personalisation play a part within a curriculum that does not support SDL?

The purpose of this sub question aimed to investigate if personalisation could actually have a place within the current Irish curriculum ie. can it effectively cover the course and have advantages over traditional methods.

Did all participants satisfactorily cover the course?

All participants who took part in the study effectually covered the full topic within the three week allocated time period. The findings did show that midway and towards the end of the topic a small number of participants chose to use the text book in conjunction with MyPace and one student who did not like using the MyPace system reverted back to the book.

"*I have also been working using my book and if I don't understand something I use MyPace to watch a video*" RJ, Boyle 20, (l)

"*....personally MyPace doesn't help me at all.my teacher, books and my friends are way better at helping me with my maths.*" PoQ, Qs.10, Ans 10

The findings also revealed that 63% of participants achieved increased examination results based on the average of their cumulative 6 examinations. The examination for this group of participants was identical to that of the other four 1st year classes in the same school, the prominent difference being the Boyle group used the PLS to learn algebra.
The researcher confidently anticipates from observations and feedback that the overall success rate amongst participants would continue to increase if they were to use MyPace for another topic, the reasons being:

- Participants learning from their mistakes
- Understanding the process from the very beginning
- Self-motivation to improve on previous result
- Improved ICT skills
- Building on independent learning skills
- Following topic being less demanding than algebra

Even though there was -10% allowance allowed to qualify for an increase this explicitly proves there is a justification to incorporate personalised learning in the form of MyPace or similar within this mathematics curriculum.

Advantages over traditional methods

Another reason for personalisation to be justifiably integrated is the benefits it should have over the traditional methods of teaching and learning. Already it has been demonstrated that personalisation can support features of SDL such as independent learning. In addition to this the findings have also revealed the following learner benefits:

- The levels of fun associated with learning mathematics is greatly increased
  "*I am having lots of fun while learning. MyPace it's really helpful and fun*" RJ, Boyle 21, (e).
  "*.. it means you can enjoy maths while learning and you are able to help friends if they need help*" RJ, Boyle 24, (m)

- "We learn by doing", Aristotle. Personalisation distances the learner from rote learning and involves the learner in experiential learning by allowing them to reflect and become actively involved in every learning step.

"*I feel happy that i am doing it by myself*", PrQ, Qs.13, Ans.3
"*I am learning differently because I'm not just listening I am doing, I am learning my way*", RJ, Boyle 7, (j)

- The learner is in the driving seat and in control of his/her learning, thus providing the opportunity to reflect and engage in the metacognitive process

"*I am thinking differently about my learning because working out of the book by myself makes me think twice about the question I am about to ask because I can find it out for myself*", RJ, Boyle 26, (j)

- Every learner is unique and learns differently to the next yet we continue to teach large classes in a one size fits all approach. Personalisation gives the learner personal choice of what they wish to learn, when to learn and the flexibility of where they want to learn.

"*Yes, I think MyPace is good and it helped me a lot and I like the way I can chose what to learn*" RJ, Boyle 8, (j)

In conclusion and to strengthen the answer to this question by further demonstrating how personalisation can fit into this curriculum, the reader should be aware the current junior and leaving certificate mathematics syllabi are in a transition phase which began in September 2011 and will be examined for the first time in 2014. The overall aim of this revised syllabus is to 'provide for an enhanced student learning experience' and increase numbers taking higher level mathematics for the Leaving Cert (Project Maths website).
Corresponding with some features of personalisation the Government of Ireland (2011) indicate that the introduction of Project Math's aims to get each individual student more critically thinking and involved in real life problem solving. The syllabus states "*the focus should be on the learner understanding the concepts involved, building from the concrete to the abstract and from the informal to the formal."* In line with what the Government is hoping to achieve personalised learning has these capabilities and much more as corroborated in this study.

6.2.3 Independent learning - Learner Preferences

Sub Research Question 2

How can independent learning be supported when the students themselves are at entirely different levels of independence within one class?

Coming into this study the participant's grade averages deviated greatly from 28% to 91% signifying a mixed ability group which is common to many classrooms. Bearing in mind this different level of individual ability it is interesting to note that the three lowest averages in the class prior to the study all improved on their previous average after engaging in the process of independent learning, this improvement can be viewed in the figure below.

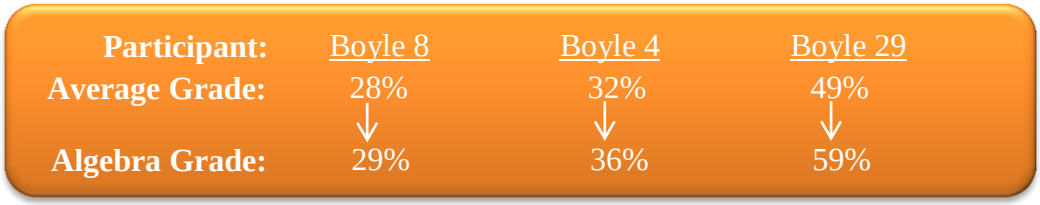


Figure 21: Three lowest averages improved

To support this process for all individual learners we need to have an indication of what preferences the students have when it comes to independent learning. To improve any product or evaluate any learning experience we must acquire the opinions and recommendations of those that tested and partook, in effect, the market research. The findings presented the following core points to be the preferences and recommendations of the participants:

- Use of the text book in conjunction with the PLS
- Not every individual is suited to this method of learning
- Some participants prefer to be teacher instructed
- This age group still require a certain amount of guidance and direction
- Moving at the learner's pace rather than the teacher's pace is unanimously favoured

Resulting from the data analysis there is no doubt that not every student instantly adapted to learning independently and throughout the findings this was stated by the researcher. To further support this process of independent learning the aforementioned recommendations should be taken into consideration for any future or further development of these skills.

6.3 Using Personalisation to Support Independent Learning

Research Question

"How can personalisation support the practice Independent Learning in 1st year Maths?"

To answer the research question we must be reminded that Kesten's definition along with Broad's reference to responsibility to describe independent learning is being used to base results upon. The literature provided the author with following amalgamated definition:

> "*That learning in which the learner, in conjunction with relevant others, can make the responsible decisions necessary to meet the learner's own needs*"

The first stage in answering this question is to distinguish what exactly the personalisation is required to support. To identify this, the aforementioned definition is used to validate the four areas associated with independent which have been discussed throughout this paper.

Self-motivation: '*That learning in which the learner,…*' – the focus is on 'the learner' as they are in control of their own learning, therefore must be self-motivated and enthusiastic
Responsibility: '*…can make the responsible decisions necessary…*' – the learner is accountable for the decisions he/she makes
Strengths and weaknesses: '*…to meet the learner's own needs*.' – to improve the learner must be aware of his/her strong and weak learning points
Reflection – although not directly related to this particular definition, it is a necessary process which the learner must involve himself/herself in to engage in the metacognitive process.

The second stage involves comparing the discovered features of personalisation derived from the literature and findings and aligning these under the four identified key features of independent learning in order to assess if and how they align. In the figure on the following page, the key independent learning attributes are in bold on the left hand side of the figure while the corresponding personalisation narrative is on the right.

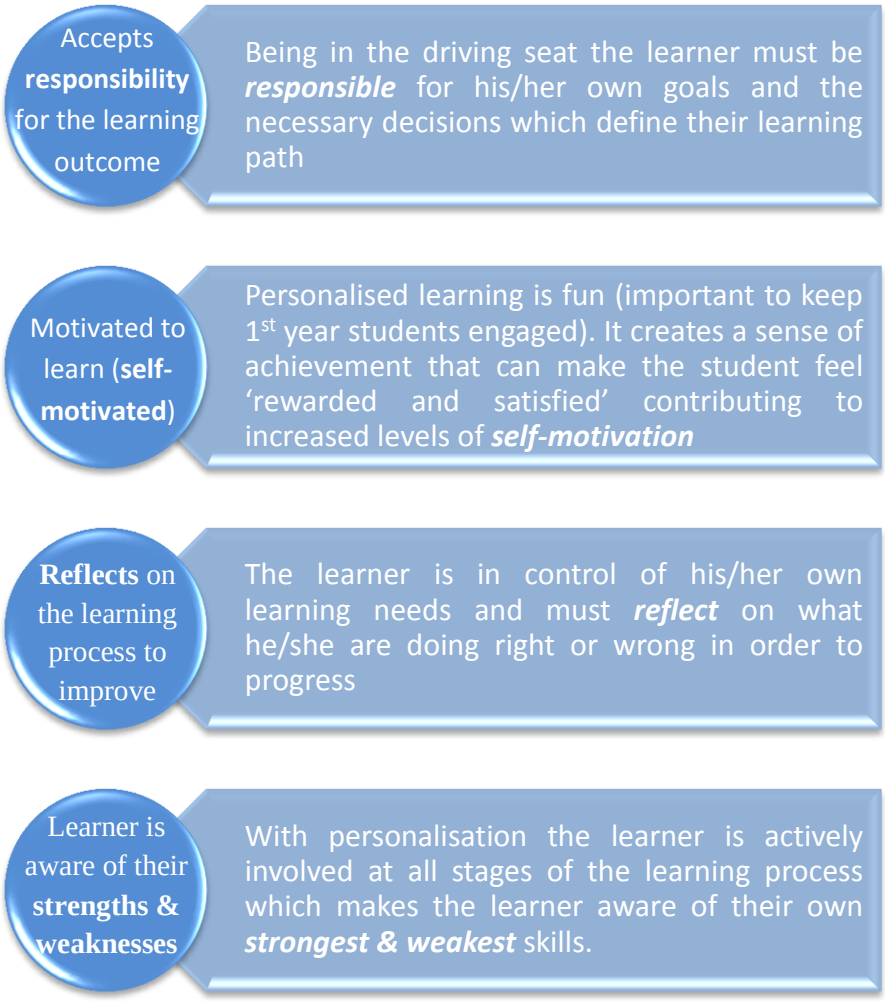


Figure 22: Aligned independent learning & personalisation features

Finally, in addition to evidently supporting independent learning skills, the findings exhibited that personalisation can also support independent learning amongst 1st year mathematics students with additional benefits such as:

- In a mixed ability class, for instance the one in this study, all students are forced to learn at the same pace. Personalisation allows the student to be comfortable at working at his/her own pace
- Students can easily become disengaged in the traditional classroom which involves didactic strategies. We learn by doing not solely listening and personalisation allows each student to become actively involved and practice doing.
- Personalisation provides a change of stimulus and an alternative from the text book. Participants in this study experienced enhanced learner satisfaction as prophesied in the earlier literature.

- The learner is generally tied to the learning methods of the teacher e.g. Text book, handouts, teacher presentations. Personalisation provides increased levels of choice to suit the learners preference.
- Improved efficiency. During the evaluation of the literature efficiency levels were shown to increase and in this study 63% increased in their algebra compared to their previous average grade.

6.4 Unexpected Findings

The outstanding unanticipated finding fell into the category of male vs female exam performance. The findings from section 5.3.5 signify that 17/27 or 63% improved on their result of which only three were female. Meaning the remaining six females unimproved in this algebra exam based on their previous average.

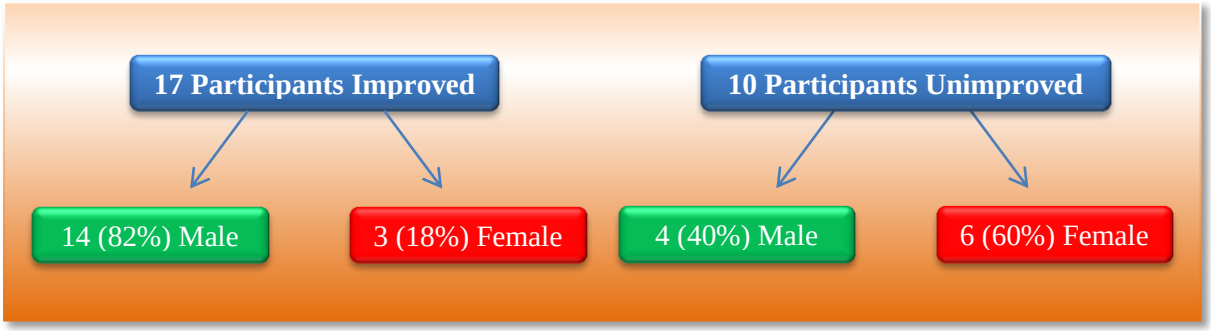


Figure 23: Male vs Female Examination Performance

This indicates that overall the female participants did not perform as well as their male counterparts for reasons which remain unexplained. Further to this, in the PoQ, the willingness for females to further participate in this type of learning was displayed in the figures where less than half, 4/9 or 44%, of females said they would like to learn like this in the future compared to 16/18 or 89% of males.

However, the researcher is aware that this was a small sample, thus no definite conclusions can be made from this statistic but does give rise to possible future research which is discussed in section 6.7 of this chapter.

Another notable finding was that participants did not like the American accents which were on the majority of the HMH video content. This sparked journal responses such as "*I hate the videos on the MyPace system because of the American accents, I lose concentration even so I cannot understand the information*", "*The videos on the system are not very good and are hard to listen to and follow as most of them are American*"

Boyle 09, and "*I think that they could simplify what they are saying and say it slower*" Boyle 10.

The dislike to accents was also made clear to the researcher in the final discussion and feedback session while it was also asked during the trials if there were 'alternative accents' to choose from. This point is highlighted within the concluding section of this chapter.

6.5 Limitations of the Research

Firstly, the results would have been strengthened if the research had been conducted over a longer period of time and encompassed a wider variety of topics. In addition to this the fact that only one group of participants were used in the research does not provide comprehensive data to base results upon. Ideally the research would have engaged all five classes of 1st year students in the study which would have delivered a wider array of data and allowed for greater levels of comparisons.

Secondly, although we are surrounded by technology at school and in our homes it is sometimes a teacher's expectation that today's entrants to second level education are already proficient with technology and using a computer; however this is not the case. ICT/Computers/Computer Science is currently not a second level subject within Irish second level schools (although a proposed syllabus by the Irish Computer Society is now in development), and is most often only offered as a transition year subject. This means that students' ICT skills have been provided up to this point in (a) primary school, (b) at home or (c) self-developed. An area that the researcher regrettably failed to test or examine before the trials was the participant's prior technical abilities and level of computer literacy. It was noted by the researcher in the observations that participants were at different levels of technical ability and this may have had a direct outcome on those participants that adapted more quickly. For example Boyle 10 comments "*I think that using MyPace is a great way of learning independently and also to get to know computers for people who are not used to them. I myself love computers and technology so I love this programme involving computers*", RJ, Boyle, (h).

Given that all participants were likely to be at different levels of ability, it is being proposed that for any future evaluation participants be given an introduction to ICT and the basics of online search. This can help by placing all participants on a level playing field from the start when it comes to using the technology.

6.6 Summary

This study demonstrated; 1) there is a requirement to encourage and support independent learning skills amongst young learners 2) there is a justified proposal to integrate personalised learning within the 1st year mathematics syllabus.

Findings revealed that students found the concept of accepting responsibility for their own learning was something that took a little getting used to. However the majority of students did adapt to personalised learning and excelled at practicing independent learning skills. For the students that did not adapt so seamlessly, the teacher had the time to sit down individually and discuss what was going right or wrong for them. In one instance the student preferred to entirely rely on the textbook and in alternative cases a small number used the text book in conjunction with the PLS. These one to one teaching opportunities were a result of the personalised learning system providing the resources/content for students to move at their own pace and the development of independent learning skills such as self-motivation to continue achieving.

By supporting these learning skills students are being afforded the opportunity to develop lifelong learning skills which will also significantly benefit the transition to third level where Irish non-presence rates are high.

In conclusion, personalisation is an additional technique to allow learners reach their targeted educational goals. Although personalisation has many additional benefits over traditional teaching and learning methods, discussed in section 6.3, the findings did identify that it may not be suited to every learner. This finding is attributable to an earlier statement saying 'all learners learn differently'. Throughout this study personalisation has been demonstrated to support independent learning skills along with higher order and critical thinking skills necessary for future learning. Finally, as well as presenting personalisation as a realistic learning technique for students it is also a tech-savvy method for teachers, who must encourage their 21st century learners to learn beyond the classroom walls.

"*If we teach today as we taught yesterday, we rob our children of tomorrow*", John Dewey

6.7 Recommendations for Future Research

The area of personalised learning and independent learning is topical amongst educators today. This study has presented the author with many thought provoking ideas and possibilities for future research but none more so than that of the unanticipated finding primarily discussed section 6.4.

Even though this participant sample was small the findings suggested that females underperformed in the examination compared to their male counterparts and overall were less conducive towards personalised learning. The author hypothesizes that due to males being more accustomed to playing computer games that they benefit from this in the form of increased cognitive development. Professor James Gee, a recognised researcher in this field from Arizona State University, identifies that game based learning can successfully challenge, motivate and teach individuals how to play thus having a positive bearing on cognitive development (Gee & Levine, 2009). Resulting from this the researcher proposes an interesting future survey is to investigate 'how cognitive development of regular video game players vs non video game players impacts on personalised learning'.

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8. Appendices

Appendix 1

Content used in this MyPace Installation

Open Source Websites

- www.gamequarium.org/dir/Gamequarium/Math/Algebra/ (useful algebra games)
- www.gamequarium.org/dir/Gamequarium/Math/Pre_Algebra/
- www.intmath.com/basic-algebra/basic-algebra-intro.php (maybe too advanced for beginners)
- www.helpalgebra.com (maybe too advanced for beginners)
- www.hippocampus.org(very good site with interactive tutorials)
- www.freemathhelp.com/introduction-to-algebra.html (the previous link directed to purchase algebra dvd tutorials, this is a nice intro to algebra)
- www.mathsnet.net/algebra/index.html (very good interactive algebra lessons & quizzes)
- www.quickmath.com/pages/modules/algebra/index.php (a good explanation of Algebra but ultimately wants you to purchase their software)
- www.themathleague.com/index.php?option=com_content&view=article&id=84&Itemid=67 (the previous link did not work, good info on here)
- www.aaastudy.com/equ.htm (lots of information + interactive quiz)
- www.mathsisfun.com/algebra (excellent content and graphically friendly)
- www.coolmath.com/algebra (good content)
- www.bbc.co.uk/schools/ks3bitesize/maths/algebra/ (excellent content and structure)
- www.math.com/homeworkhelp/Algebra.html (lots of text based content – useful)
- www.algebrahelp.com (a lot of information with good activities, worksheets and examples)
- www.khanacademy.org (almost too much video content – could be difficult to know where to start!!)
- www.skoool.ie/skoool/junior.asp?id=1571 (intro resources are good but much of the information is above this level)
- www.themathgames.com/our-games/like-terms-games/like-terms-quartet/league_-1/country_-1/countryNumber_-1 (fun algebra game)
- www.scoilnet.magicstudio.co.uk/interactive/view/54310 (good interactive game)
- www.scoilnet.magicstudio.co.uk/interactive/view/54311 (good interactive game)
- www.mathplayground.com/mathtv.html (excellent selection of well explained video tutorials)
- www.scoilnet.ie/Quiz.aspx?id=1145 (good maths quiz)
- www.wowmathsforum.org.uk/examples.cfm (provides links to well-presented and relevant PowerPoint displays)
- www.bbc.co.uk/schools/gcsebitesize/maths/ (very good quiz activities)
- www.thatquiz.org/tq-0/ (good algebra basic quiz)
- www.eformulae.com/mathematics/algebra.php (identifies some of the algebra formulae)
- www.educator.com/mathematics/pre-algebra/fung/writing-expressions.php (excellent video tutorial – most are subscription only on this site)
- www.bestdamntutoring.com/Math-and-Physics.html (best video tutorial site so far – all videos short and to the point)

- www.brightstorm.com/math/algebra/ (lots of video content – many of which is too advanced but the content at the start is relevant)
- www.cliffsnotes.com/math-study-guides.html (good content but can be tricky to find the relevant algebra)
- math.usask.ca/emr/menu.html (could be slightly confusing – consider putting this in at the end)
- www.oakroadsystems.com/math/#Algebra (ok)
- www.mathsisfun.com/ (great resources and information, the site is child orientated also)
- www.aplusmath.com/Games/PlanetBlast/index.html (basic algebra game for students)
- www.regentsprep.org/Regents/math/ALGEBRA/math-ALGEBRA.htm (good content but not laid out so well)
- www.free-ed.net/free-ed/math/algebramix/obsolete/brenan.asp (an online algebra book – content is good, some is too advanced)
- www.wtamu.edu/academic/anns/mps/math/mathlab/beg_algebra/ (lots of content – could be displayed better though)
- www.wyzant.com/Help/Math/Algebra/ (very good site, the information is well constructed)
- www.lessontutor.com/ltalgebra9home.html (not the easiest on the eye but could be useful)
- www.library.thinkquest.org/20991/home.html (some basic intro to algebra, some is too advanced and not well structured)
- www.aplusmath.com/Flashcards/index.html (nice flashcard games for algebra)
- www.mathsnet.net/algebra/l1_equation.html (Very good algebra games)

42 Websites

The URL's used for the remaining content is hosted in by the KDEG department of Trinity College Dublin and wishes to remain private.

Flash animations and games:

20 Animations & Games

Video Content:

Alg 1
Ed. Berger
Sub Chapter 1A - Topic 1.1

- Topic 1.2
- Topic 1.3
- Topic 1.4

Sub Chapter 1B - Topic 1.6

- Topic 1.8

Alg 1
Ms. L. Renfro Videos
Sub Chapter 2A - Topic 2.1

- Topic 2.2
- Topic 2.3
- Topic 2.4
- Topic 2.5

Alg 2
Ed. Berger
Sub Chapter 1A - Topic 1.1

- Topic 1.2
- Topic 1.4
- Topic 1.5

58 videos in total

Video Tutor

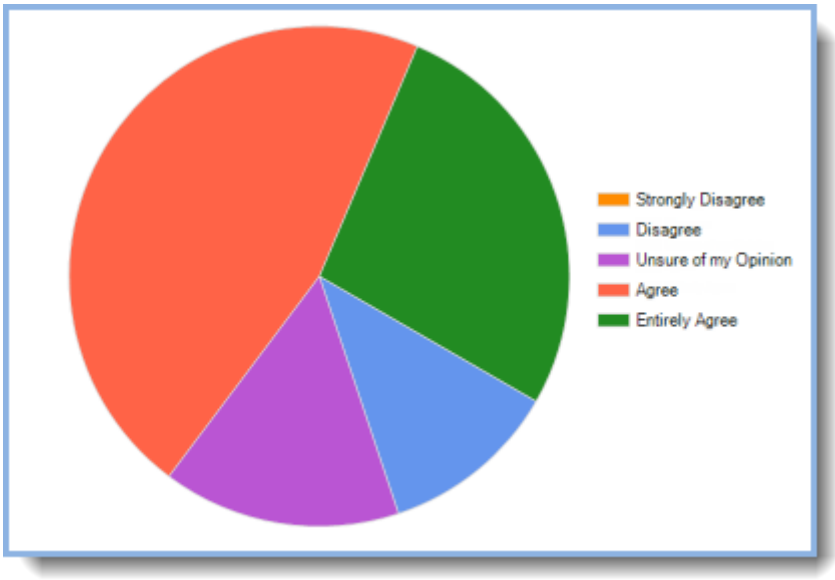
A wide selection of video lessons divided into separate books (Algebra Readiness, Pre Algebra, Algebra 1)

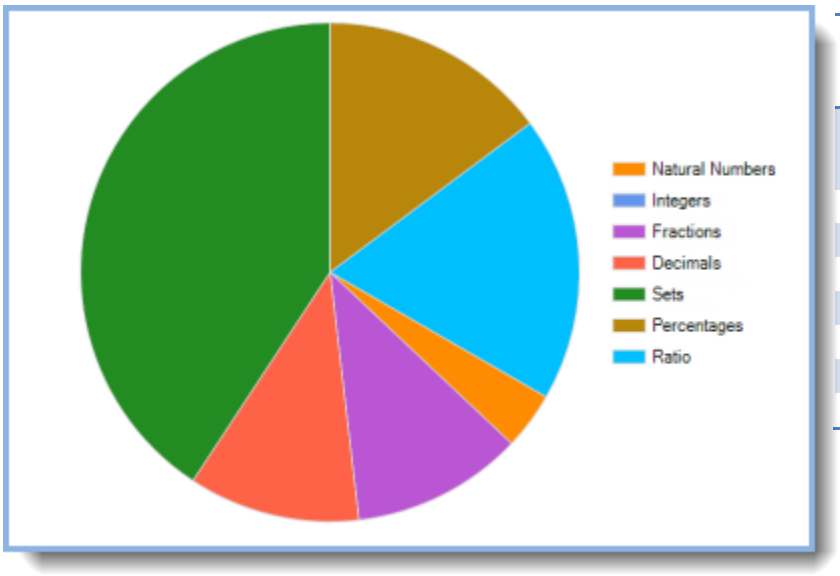
Appendix 2

Pre Questionnaire Results (27 Participants)

Qs.1 I clearly understand the first year mathematics course which I am currently studying.

Answer Options	Response Percent
Strongly Disagree	0.0%
Disagree	11.5%
Unsure of my Opinion	15.4%
Agree	46.2%
Entirely Agree	26.9%



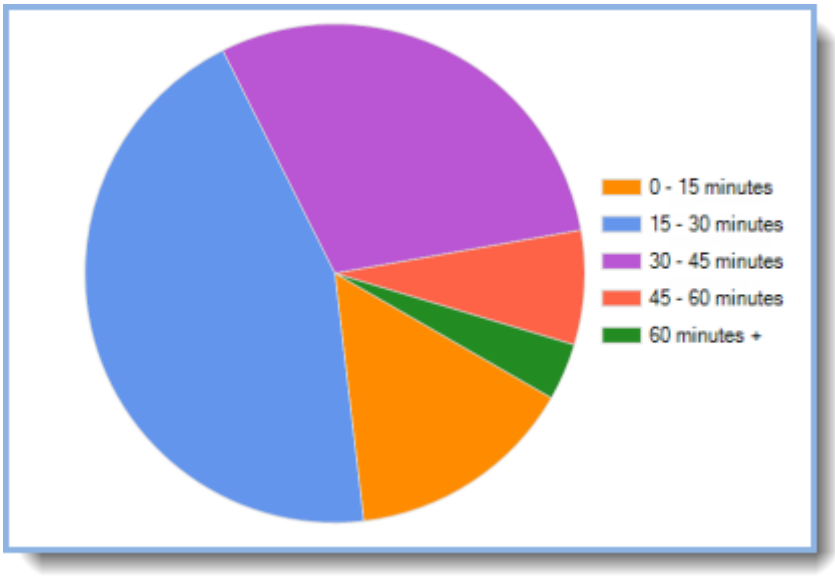


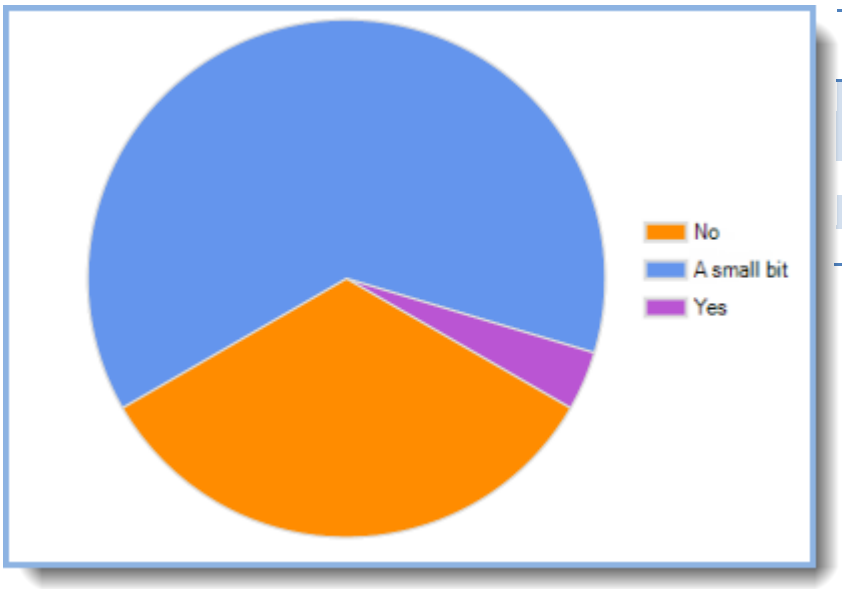
Qs.2 Which topic of the mathematics course has been your favourite so far?

Answer Options	Response Percent
Natural Numbers	3.7%
Integers	0.0%
Fractions	11.1%
Decimals	11.1%
Sets	40.7%
Percentages	14.8%
Ratio	18.5%

Qs. 3 On average how long do you spend doing mathematics homework each night?

Answer Options	Response Percent
0 - 15 minutes	14.8%
15 - 30 minutes	44.4%
30 - 45 minutes	29.6%
45 - 60 minutes	7.4%
60 minutes +	3.7%





Qs. 4 I have previously studied algebra

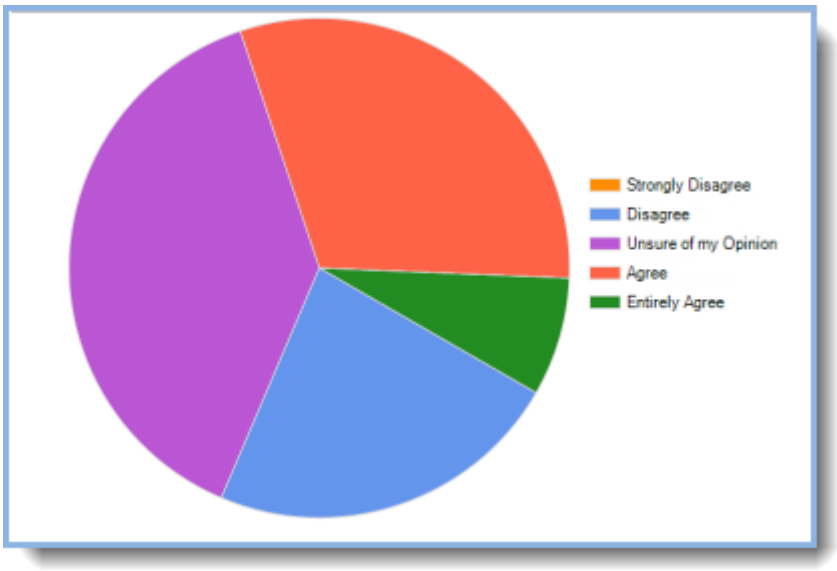
Answer Options	Response Percent
No	33.3%
A small bit	63.0%
Yes	3.7%

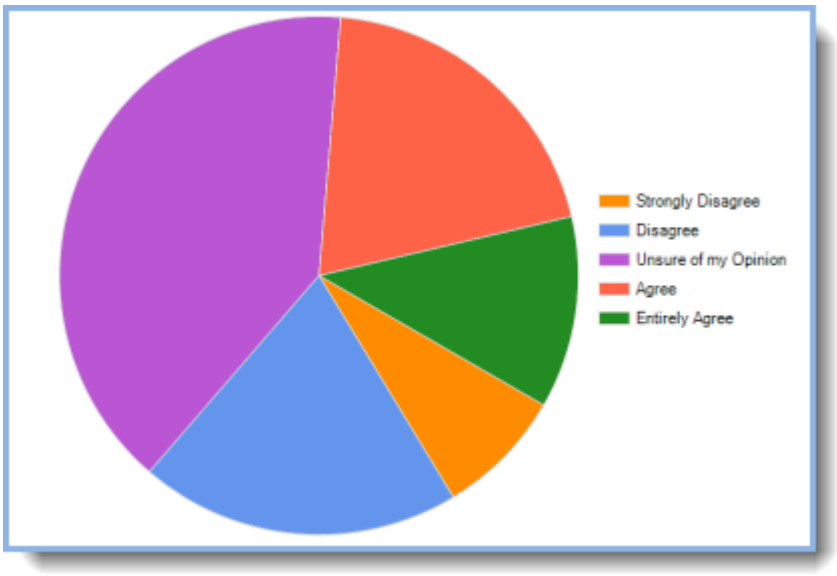
Qs. 5 What is your favourite subject so far in school, and why?

Number	Responses
1	art because it is just doing something i am good at and i know how to do it
2	My Favorite subject in school is math's because I enjoy doing sums and solving problems.
3	history because i like it
4	maths because it's interesting
5	cspe is my favourite subject cause its interesting subject and i wish we can have it more than 1 once a week
6	Science because i like learning about physics biology and chemistry .
7	French, because I got my best score on it in my exams!
8	My favourite subject in school is woodwork because I like doing the practical work.
9	Technology, because it is really interesting and fun when you're making new projects.
10	English is my favourite subject in school because I like writing stories and i think it is a very interesting subject
11	Metalwork, because it is fun, I get to use tools and projects are cool
12	Geography. Because it is interesting useful.
13	Maths because we use the computers sometimes and there is a lot of interesting topics so it is a lot of hard work
14	Technology - The subject is interesting and is new as I have not done it before in primary school
15	My favourite subject in school is math's because it's fun using the computer and i understand it.
16	Technology. it's fun with tools and i learn something new every day
17	I like math..... But my favorite subject in school would have to be technology because I know that in the future technology classes I should be working with computers... I like computers because I find it very simple to use, I also want to learn more about technology because I have an interest in media.... Cameras, computers, scripts etc.
18	Technical graphics because it is one of my only subjects that has anything i find interesting in it
19	cspe because it teaches me about my rights and responsibilities as a human.
20	my favourite subject in school so far is history because i find it very interesting
21	woodwork because i like it
22	Science :)
23	Technology - I like making and getting hands on instead of studying theory etc. Also I like this subject because I have not yet done anything like this in primary school and i prefer doing new things than doing old things.
24	History, i find is the most interesting because we can learn about all the different generations before us and what their lives where like
25	Technology, I like engineering
26	Science because i find biology very interesting
27	Science because it is interesting

Qs. 6 I believe learning from the teacher and book is the most suitable method of learning for me.

Answer Options	Response Percent
Strongly Disagree	0.0%
Disagree	23.1%
Unsure of my Opinion	38.5%
Agree	30.8%
Entirely Agree	7.7%



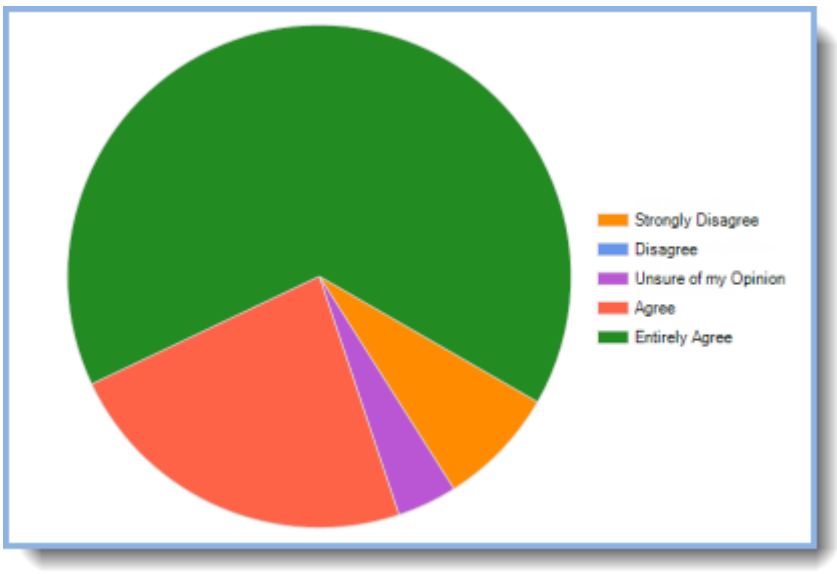


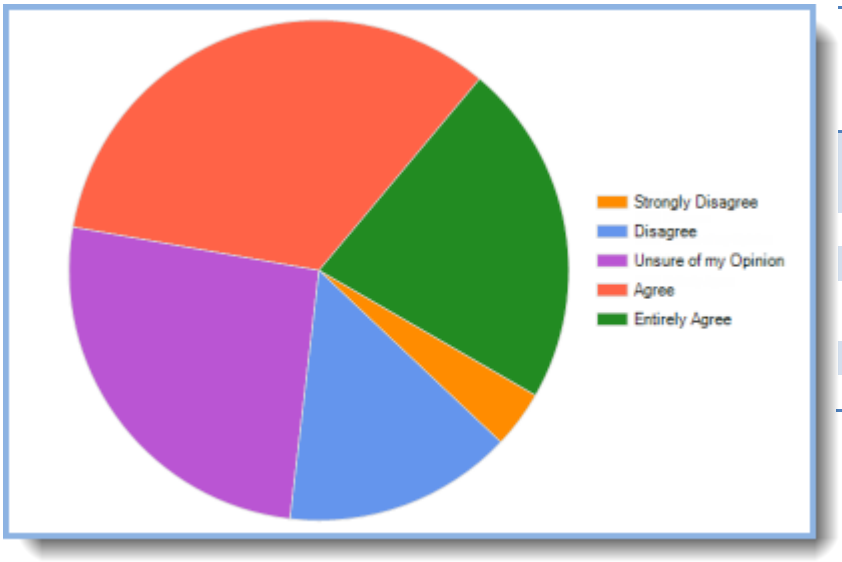
Qs. 7 I prefer to learn on my own rather than in a classroom setting

Answer Options	Response Percent
Strongly Disagree	8.0%
Disagree	20.0%
Unsure of my Opinion	40.0%
Agree	20.0%
Entirely Agree	12.0%

Qs. 8 Using technologies (Internet, tablets, smartphones, interactive board devices etc.) is an excellent way of learning within the classroom

Answer Options	Response Percent
Strongly Disagree	7.7%
Disagree	0.0%
Unsure of my Opinion	3.8%
Agree	23.1%
Entirely Agree	65.4%





Qs. 9 I believe I could learn mathematics on my own using good resources (websites, videos, quizzes etc.) from the Internet

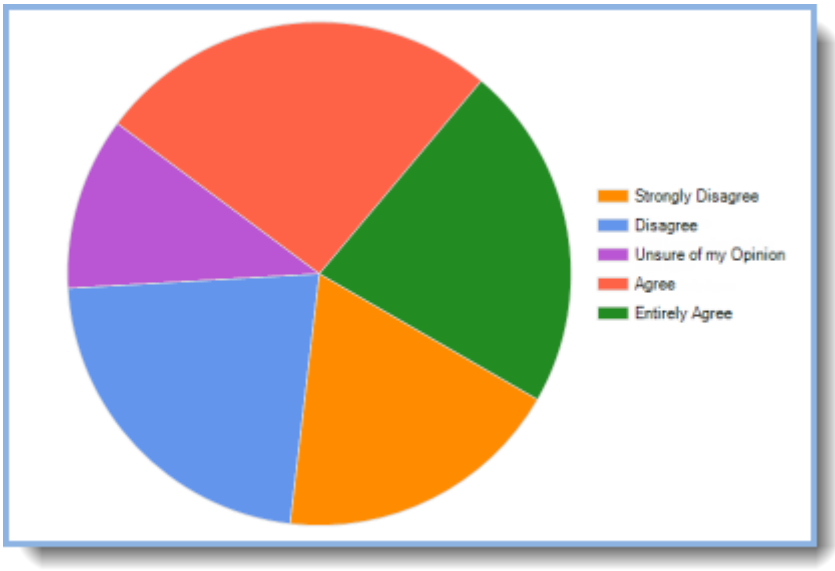
Answer Options	Response Percent
Strongly Disagree	3.7%
Disagree	14.8%
Unsure of my Opinion	25.9%
Agree	33.3%
Entirely Agree	22.2%

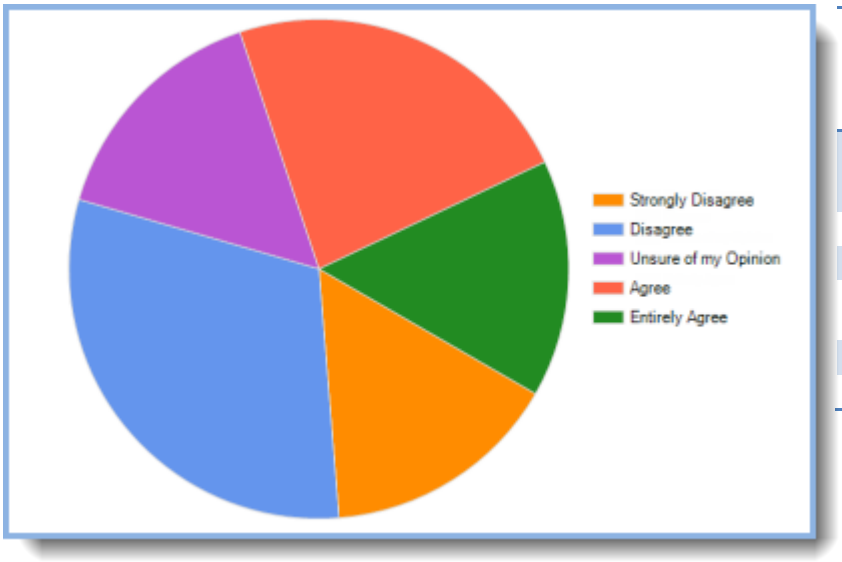
Please state why you selected the above answer (optional):

Number	Responses
1	I can do it slower and i know what I am doing in my work
2	Because I don't always get all of the information I've been given as I find it better when you can ask questions and get more help if you need it.
3	because it's easier when a teacher explains it
4	it helps me because its explains better
5	i like learning by myself but sometimes i need help
6	I would need some help throughout the coarse
7	I don't know whether I like using the internet for studying because sometimes I can get very misleading websites.
8	I am unsure because sometimes internet just gives out random/ incorrect information, so i would prefer to start off by a teacher telling me and then try doing it on my own.
9	i think it will be hard to learn from videos and websites because all of the websites and videos have all different methods of doing math and it is a bit confusing
10	I'm unsure because if i am stuck I need someone to talk me through it. I don't think I can get it on the internet
11	Because if a website or video etc. has the wrong information on it, you will continue to learn the wrong information and it will or may affect your future learning.
12	Because there is a lot of good educational websites and videos but you can still get help from the teacher and your class mates
13	There is good websites for you to look at that with games and videos
14	I believe i could do the math learning on my own because I'm good with computers and i know some really good websites.
15	there is a lot of information
16	I selected my answer for the reason that if you went on to such sites as Khan Academy or YouTube and even MyPace, there are many videos and methods of how to learn math, (any subject).
17	it would be too hard and we may get entirely wrong we might learn an American way we may get wrong information
18	It would be just like a teacher telling you how to do a question and it is shown to you.
19	i selected this answer because i have done it before and i find it very easy
20	because i find math hard
21	it is a good way to learn because everyone does not learn at the same pace
22	I could learn from the internet because i use the internet quite a lot at home.
23	you can go over it again or just skip it
24	i might not understand it

Qs.10 There are times in mathematics class that I don't want to ask questions because I am too nervous or feel it may not be a suitable question

Answer Options	Response Percent
Strongly Disagree	18.5%
Disagree	22.2%
Unsure of my Opinion	11.1%
Agree	25.9%
Entirely Agree	22.2%



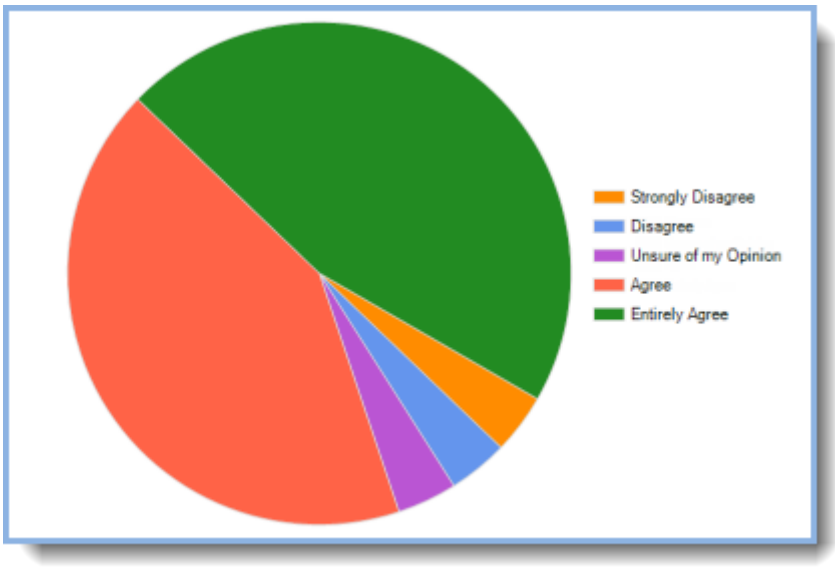


Qs.11 A difficult thing about learning mathematics is not having any help at home to solve problems.

Answer Options	Response Percent
Strongly Disagree	15.4%
Disagree	30.8%
Unsure of my Opinion	15.4%
Agree	23.1%
Entirely Agree	15.4%

Qs.12 Using technology (video, displays, internet, and interactive board) increases my attention and interest during a lesson.

Answer Options	Response Percent
Strongly Disagree	3.8%
Disagree	3.8%
Unsure of my Opinion	3.8%
Agree	42.3%
Entirely Agree	46.2%



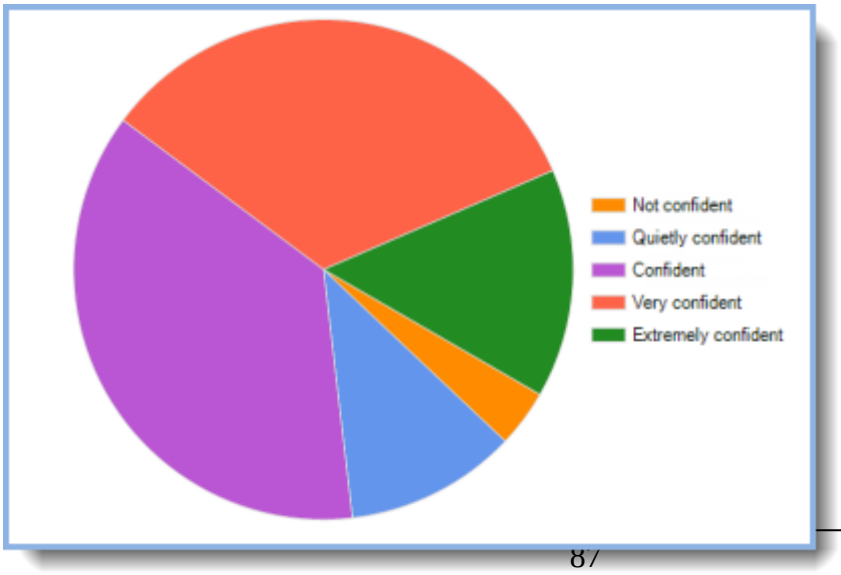
If you agreed to this previous statement please say why you agree (optional):	
Number	Response
1	I agree because it is really easy to learn and i can see how it is done
2	I agree to this because using technology often helps me to learn.
3	Because if a teacher is talking for ages people will stop listening but with MyPace you can click on loads of different videos
4	it helps and knowing things
5	it will help me enjoy learning math more
6	Because I understand what`s going on in class
7	Because it is good to take a break from the teacher or book for a while and learning a new way is interesting and fun.
8	i agreed to this statement because it is nice sometimes to do other stuff other than just listen to a teacher talking and working from a book
9	because I can see the writing more clearly and know how to get information for studying
10	I agree because kids are more interested in technology rather than books and will concentrate better with the videos, internet and displays.
11	The web is a good place to play math games and watch math videos and sometimes the text books are a bit boring
12	I entirely agree because it's fun and i don't get bored quickly.
13	there is a whole lot of answers at my fingertips
14	Because I love computers and devices.....
15	I disagreed because i lose attention and get bored and don't bother listening
16	I think because we are using the computers during math it makes everyone look forward to maths
17	I chose this because i have done it before and it has worked
18	Because i like technology (video displays,internet,interactive boards)
19	because it is fun and sometimes you don't understand something in maths and watching a video might be helpful
20	I agree to this statement because people find the text books quite boring ant this would mean a lot more attention during a lesson.
21	It makes it more interesting to learn and not having to listen to the teacher for the whole class
22	Because it makes me more active
23	Because it's more fun
24	I like using them to learn

Qs.13 How do you feel about monitoring your own learning using this new system which has been explained to you?	
Number	Response
1	I feel that it is ok and that I would have some videos to see at home and can learn on my own
2	I find it quite hard because I don't understand a lot of it.
3	I feel happy that i am doing it by myself
4	I think it's a good idea so your teacher knows your ability
5	It can help me get better and understanding things
6	I feel that it is good and we will need the skills for the future in university because the teacher will not tell you everything you need to figure things yourself
7	I guess I feel ok, if I need to I will ask questions
8	I think the layout of the new system will help me become more independent on my maths homework and study.
9	I think this is a brilliant idea because it can show improvement and how you are getting along with the areas. Another thing is with technology you can now do amazing things with bits of information so you can get the computer to tell you what to focus on your study more.
10	I don't really think monitoring your own learning Is a good idea because i think it's a bit confusing not having a teacher to ask questions too
11	I can see the areas I need to work on. I can see what my classmate saw.
12	I do not agree to monitoring my own learning because if I am not given homework from a teacher I may forget to study maths that evening. This means I will fall behind.
13	I think it is a good idea because you can actually see how much you have learned and improved and you don't need to try and keep up with others you do it at your own pace.

14	I think it is very good because you can browse the internet on your own. You can also ask the teacher if you are stuck.
15	I would love to try a new system because it would be interesting.
16	I think it's a great opportunity to learn new things
17	I found this learning process new to me at the start of using it, but after a while I found I found it easy, a good way of learning, interesting, suitable.
18	It's not great choosing what work to do because we might choose to do none at all
19	I feel that it is a great experience to have to be able to try to teach yourself how to do a sum or a question
20	I think it's a good idea because it gets me more interested in school and work
21	I find it good
22	I think that it is very good because when you are in collage you will be learning independently
23	I like this type of learning because I have control of my learning and that I can do what I want to do.
24	I find it good to learn from my own mistakes and learn at home to
25	Its good, it shows me my weak and strong points
26	Independent
27	I think it's a great idea and will allow give me a new experience

Qs.14 Have you anything to add or suggest in relation to the teaching or learning methods of this mathematics course? (optional)

Number	Response
1	Use objects when teaching it will increase the students interest in learning and they will like to learn more about the topic
2	I believe that this would be a big investment but if every table had a tablet fixed into it, you could be able to go and to research really easy or do work with the tip of your fingers. I believe this is a great idea for future education.
3	I don't have anything to add, I think the mathematical course is fine
4	You could talk to the other people online
5	I think forcing students to learn off fraction, decimals and percentages is wrong and student should know how to convert from one to the other. This means you have to learn less but can still answer questions correct in the test.
6	I think that we should try to use more technology like interactive boards and computers to get everyone involved.
7	The text books could have the way to do the sum at the back of the book
8	Teachers should do fun activities on the computer, using the white board, smart board and anything that is fun for kids.
9	I think that the people who create the videos could simplify what they are saying, because some things can be confusing....
10	I don't like it because it is not very fun and we can't get on very much because of the bad server in the school
11	I would suggest using computers in mathematics more because it gets the class more involved in the lesson.



Qs.15 Using the scale below, please rate your perceived ability to participate in Independent Learning

Answer Options	Response Percent
Not confident	3.7%
Quietly confident	11.1%
Confident	37.0%
Very confident	33.3%
Extremely confident	14.8%

Appendix 3

Participant Reflection Journal

MyPace

- I am encouraged to rate content in MyPace after I have used it
- Independent learning does not mean working on my own
- Remember to take notes and complete questions as I view content. I must have my copy at all times
- Ask my classmates for help and assistance to solve problems
- I am encouraged to use the book along with MyPace system
- Homework/tasks are assigned by me (using the book, using tasks in the MyPace system etc.)
- The MyPace system can be accessed at home at http://xxxxxxxx.scss.tcd.ie
- Remember to watch an entire video or view an entire web page before judging/rating it, don't just skip through the content
- I will sit an end of topic exam just like previous topics
- I can complete this journal by typing it or hand writing

Student Signature_____

Researcher Signature_____

Handout Date_____ Collection Date_____

Username: _____

Password: _____

MyPace Website address: http://kdeg-vm-45.scss.tcd.ie/

Week 1 (23rd – 29th January)

Day 1 – Monday 23rd January

An Introduction to MyPace and the explanation of what I will be doing over the next three weeks

Notes: _____

Day 2 – Tuesday 24th January

Average number of content I viewed today (including at home): 1 2 3 4 5 6 6+

Did I rate content today: Yes / No

The thing(s) I enjoyed the most about my first use of MyPace (if any): _____

The thing(s) I disliked the most about my first use of MyPace (if any): _____

Any additional comments or notes from today: _____

Day 5 – Friday 27th January

Average number of content I viewed each day this week (including at home): 1 2 3 4 5 6 6+

Did I rate content every day this week: Yes / No

After my first week what are the thing(s) I enjoy the most or find useful about using MyPace (if any): _____

After my first week what are the thing(s) I dislike the most or find difficult about using MyPace (if any): ____

Any ad

Week 2 (30th January – 5th February)

Day 9 – Tuesday 31st January

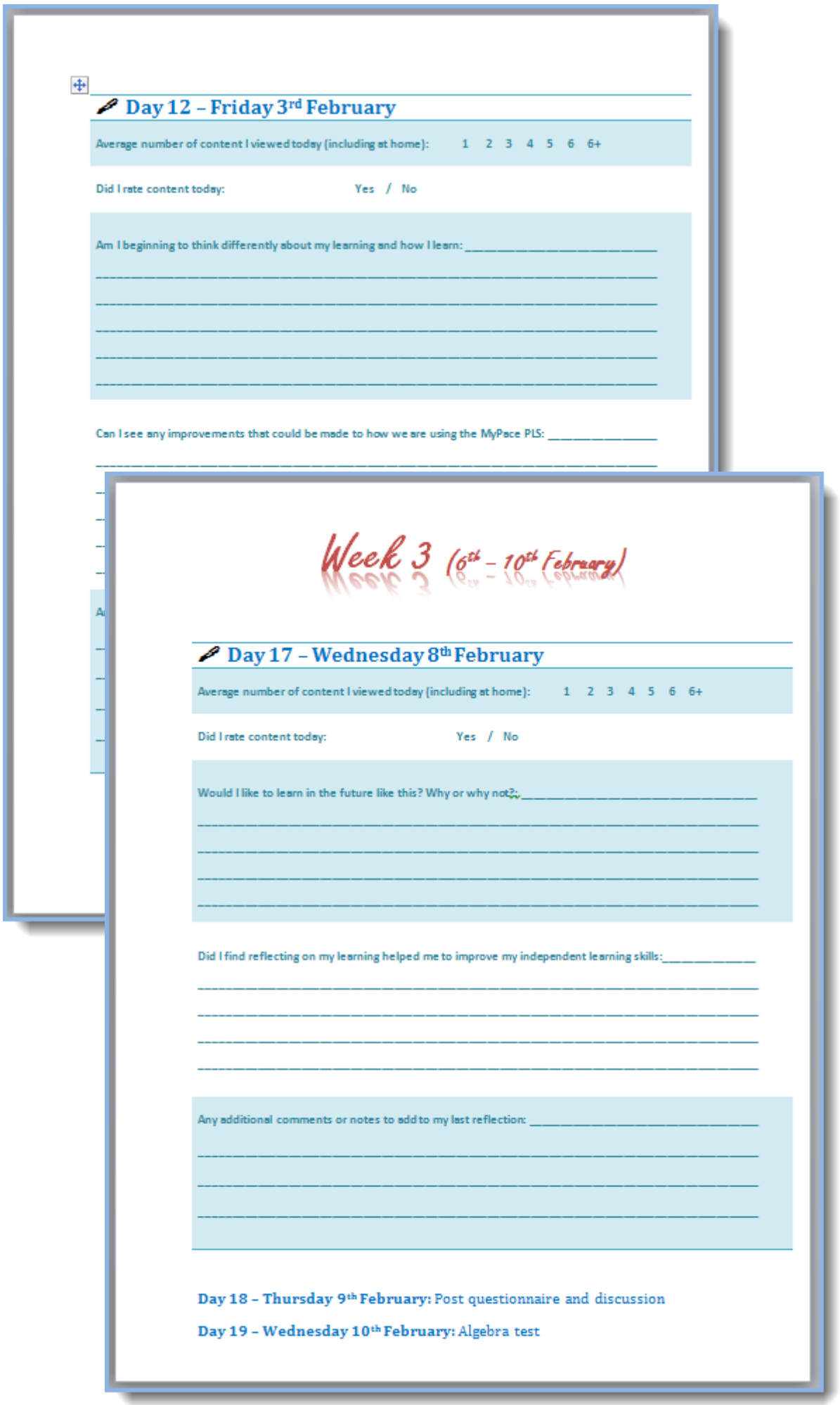
Average number of content I viewed today (including at home): 1 2 3 4 5 6 6+

Did I rate content today: Yes / No

Am I becoming more enthusiastic or less enthusiastic about learning using the MyPace personalised learning system:

What is my current opinion of learning through technology and has it changed since using MyPace:_____

Any additional comments or notes since my last reflection: _____



Day 12 – Friday 3rd February

Average number of content I viewed today (including at home): 1 2 3 4 5 6 6+

Did I rate content today: Yes / No

Am I beginning to think differently about my learning and how I learn: _____

_____

_____

_____

_____

_____

Can I see any improvements that could be made to how we are using the MyPace PLS: _____

_____

Week 3 (6th – 10th February)

Day 17 – Wednesday 8th February

Average number of content I viewed today (including at home): 1 2 3 4 5 6 6+

Did I rate content today: Yes / No

Would I like to learn in the future like this? Why or why not?: _____

_____

_____

_____

_____

Did I find reflecting on my learning helped me to improve my independent learning skills: _____

_____

_____

_____

_____

Any additional comments or notes to add to my last reflection: _____

_____

_____

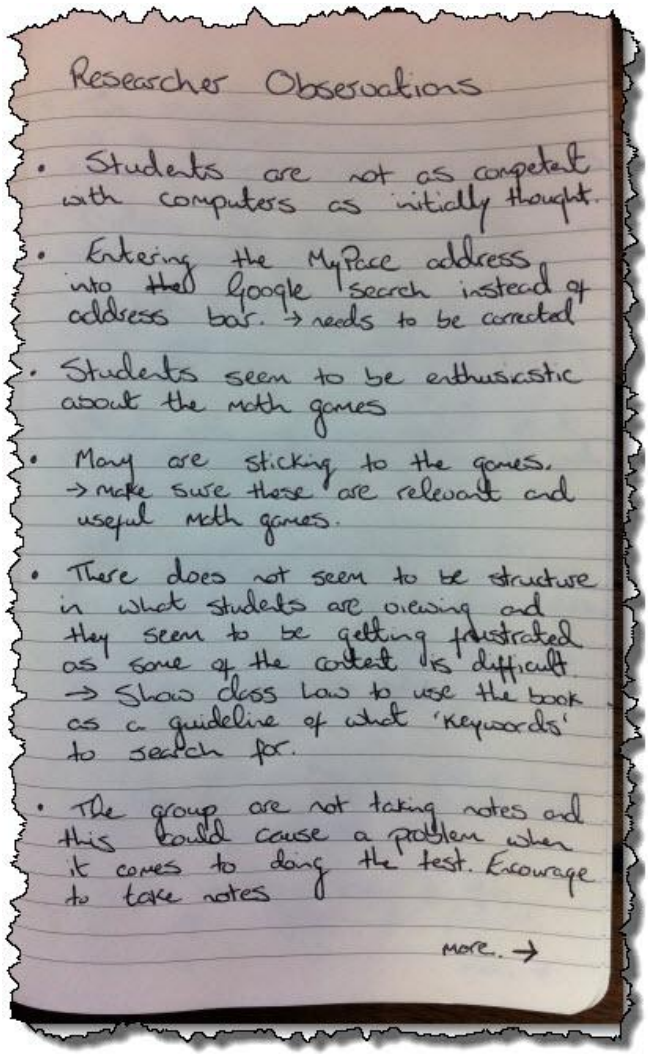
_____

Day 18 – Thursday 9th February: Post questionnaire and discussion

Day 19 – Wednesday 10th February: Algebra test

Appendix 4

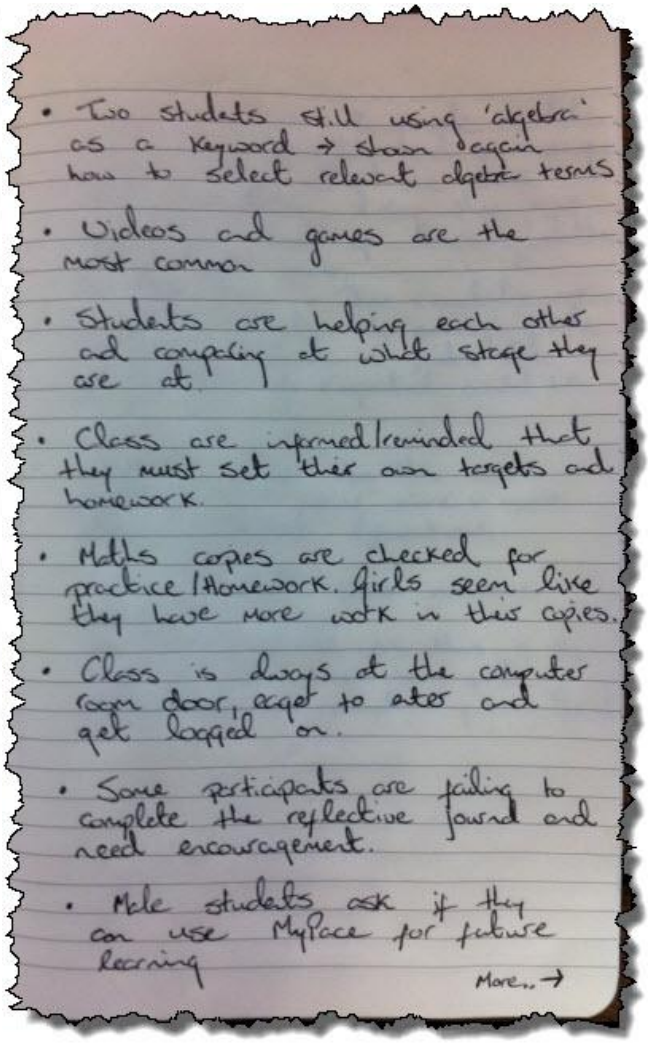
Researcher Observations



Researcher Observations

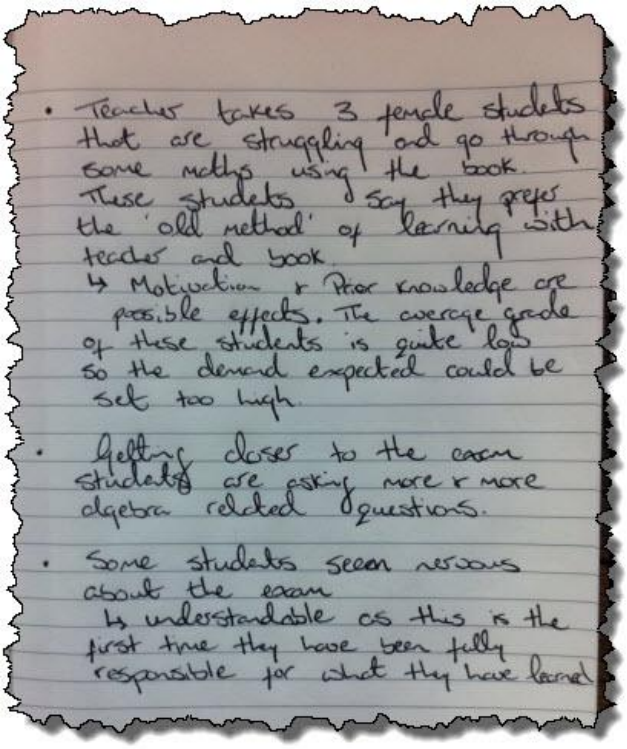
- Students are not as competent with computers as initially thought.
- Entering the MyPace address into the Google search instead of address bar. → needs to be corrected
- Students seem to be enthusiastic about the Math games
- Many are sticking to the games. → make sure these are relevant and useful Math games.
- There does not seem to be structure in what students are viewing and they seem to be getting frustrated as some of the content is difficult. → Show class how to use the book as a guideline of what 'keywords' to search for.
- The group are not taking notes and this could cause a problem when it comes to doing the test. Encourage to take notes

more. →



- Two students still using 'algebra' as a keyword → show again how to select relevant algebra terms
- Videos and games are the most common
- Students are helping each other and comparing at what stage they are at.
- Class are informed/reminded that they must set their own targets and homework.
- Maths copies are checked for practice/homework. Girls seem like they have more work in their copies.
- Class is always at the computer room door, eager to enter and get logged on.
- Some participants are failing to complete the reflective journal and need encouragement.
- Male students ask if they can use MyPace for future learning

More... →



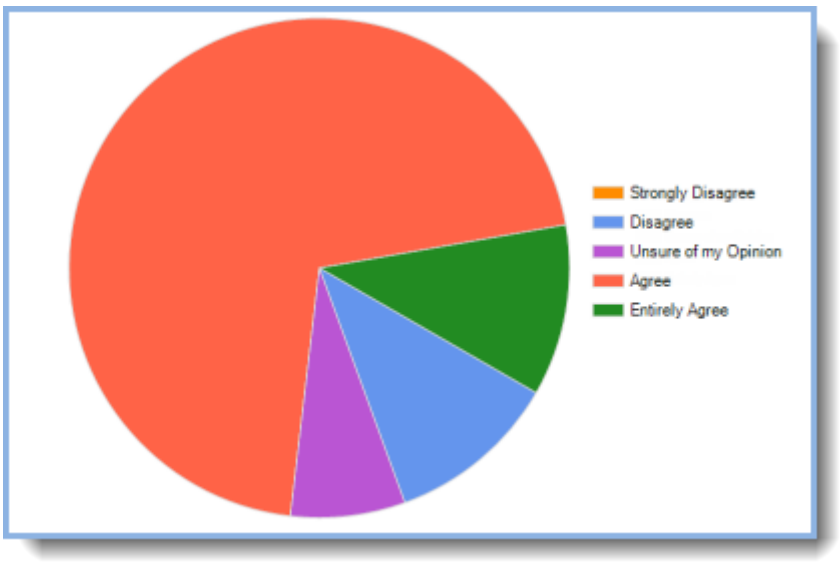
- Teacher takes 3 female students that are struggling and go through some maths using the book. These students say they prefer the 'old method' of learning with teacher and book.
  ↳ Motivation + Prior knowledge are possible effects. The average grade of these students is quite low so the demand expected could be set too high.
- Getting closer to the exam students are asking more + more algebra related questions.
- Some students seem nervous about the exam
  ↳ understandable as this is the first time they have been fully responsible for what they have learned

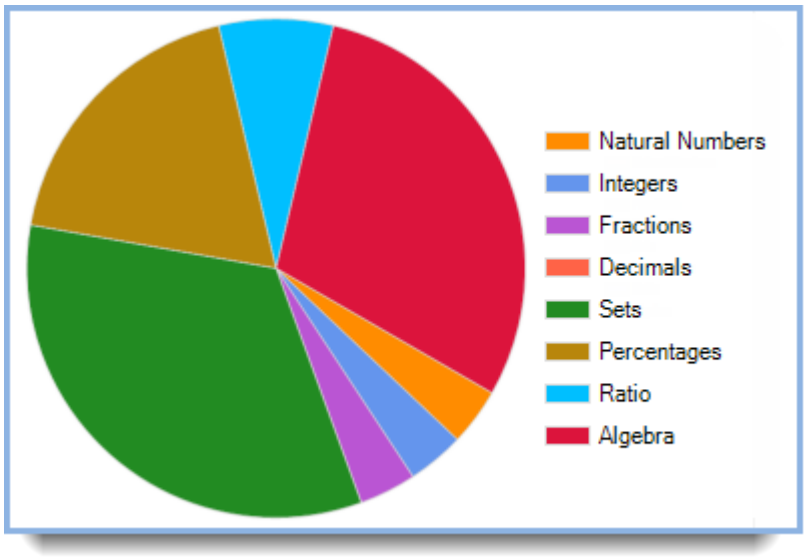
Appendix 5

Post Questionnaire Results (27 Participants)

Qs.1 I clearly understand the first year mathematics course which I am currently studying.

Answer Options	Response Percent
Strongly Disagree	0.0%
Disagree	11.1%
Unsure of my Opinion	7.4%
Agree	70.4%
Entirely Agree	11.1%





Qs.2 Which topic of the mathematics course has been your favourite so far?

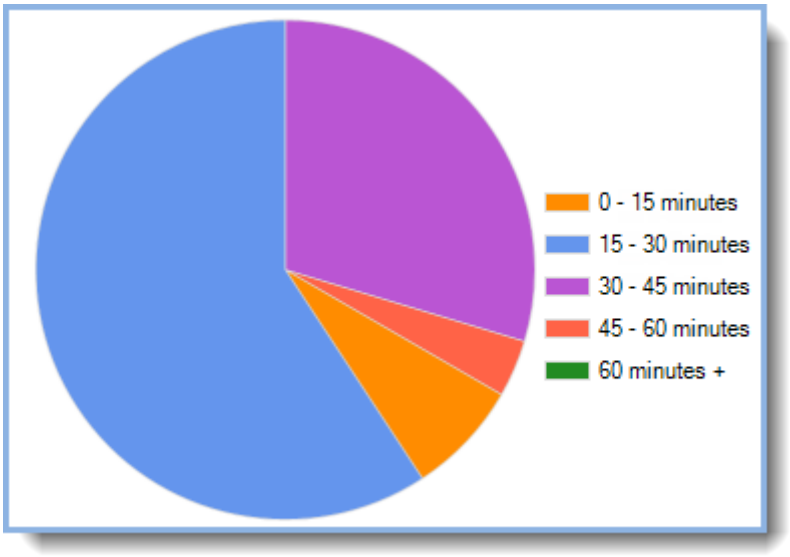
Answer Options	Response Percent
Natural Numbers	3.7%
Integers	3.7%
Fractions	3.7%
Decimals	0.0%
Sets	33.3%
Percentages	18.5%
Ratio	7.4%
Algebra	29.6%

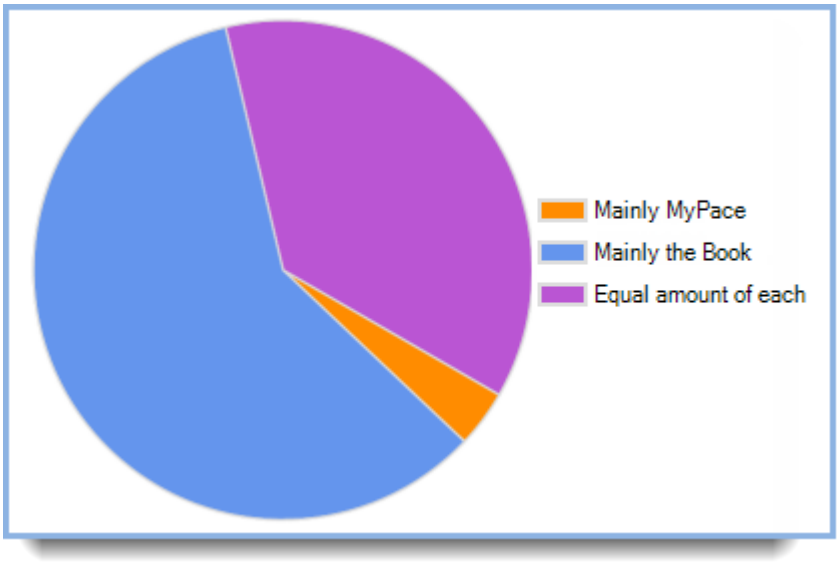
	Please state why you chose this topic as your favourite:
1	because it was easy
2	its new to me and fun to learn
3	Because I find it very Interesting, and my primary school teacher Mr. X taught us it in 6th class, this makes it easier for me to learn it.
4	I choose this topic because I'm good at percentages and i understand it well.
5	It teaches you how to be logic and also mixes in with the topics of Ratio, Fractions and Decimals.
6	Because they are different from other maths problems.
7	i understand it well and i think its enjoyable topic
8	Algebra because we were doing Independent learning!
9	Percentages are my favourite because it was easy to do and i just enjoyed doing the sums.
10	I found it easy and that's why i liked it. it was explained extremely well and was simple to understand
11	algebra cause i think it really easy and in know how to do this thanks to my pace
12	I liked algebra because it was a challenge to do and it wasn't as hard as i thought it would be.
13	because it is easy

14	I have chosen that sets it my favourite because it was easy and fun.
15	The topic SETS was both interesting and fun and it was the first time I had ever done sets
16	Because I understand it and it was the easiest for me because I knew some of it already.
17	it's easy and i understand it the most.
18	this is my favourite topic so far because i find it easy
19	This is my favourite because I liked using the MyPace system in my learning because it allows me to go at my on speed of learning.
20	This is my favourite because i got the highest grade out of all my maths tests.
21	i thought it was easy
22	i found this topic easier to understand than all the others
23	Because it was the easiest so far
24	algebra is easier for me now because i used the MyPace system and i liked it because of the games
25	because we used a fun way of learning
26	I chose this Topic as I enjoy doing percentages.
27	It was fun to learn using MyPace and I understood it clearly

Qs.3 On average how long did you spend doing algebra study/work each night?

Answer Options	Response Percent
0 - 15 minutes	7.4%
15 - 30 minutes	59.3%
30 - 45 minutes	29.6%
45 - 60 minutes	3.7%
60 minutes +	0.0%



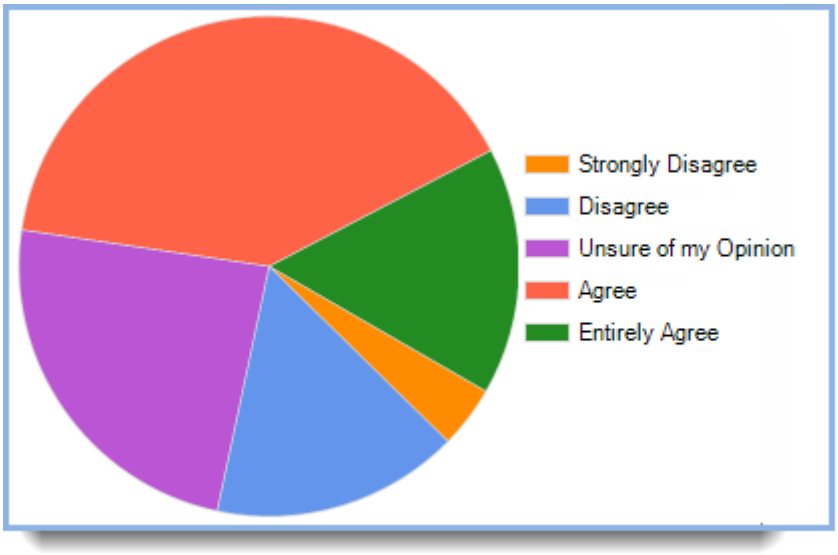


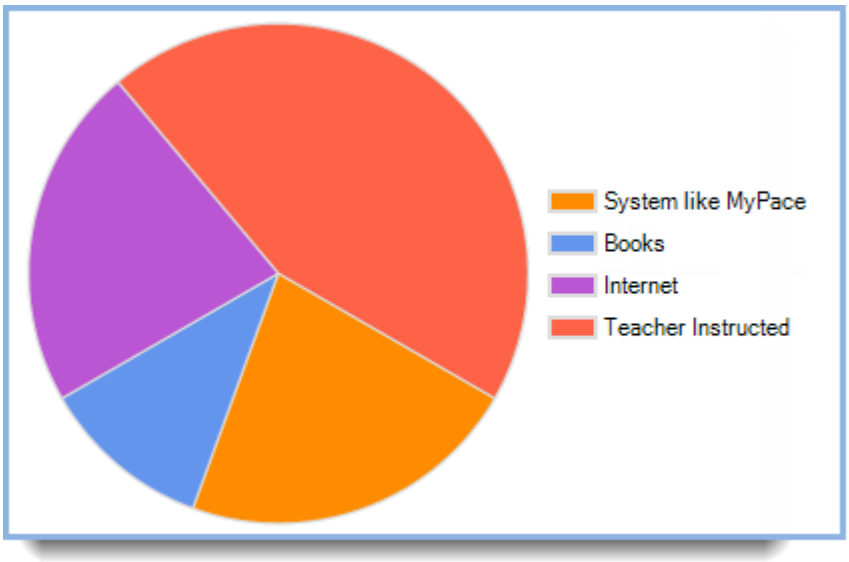
Qs.4 Did you mainly use the MyPace system or the Book for studying at home?

Answer Options	Response Percent
Mainly MyPace	3.7%
Mainly the Book	59.3%
Equal amount of each	37.0%

Qs.5 I believe using a personalised learning system similar to MyPace is a great way for me to learn in the future.

Answer Options	Response Percent
Strongly Disagree	4.0%
Disagree	16.0%
Unsure of my Opinion	24.0%
Agree	40.0%
Entirely Agree	16.0%



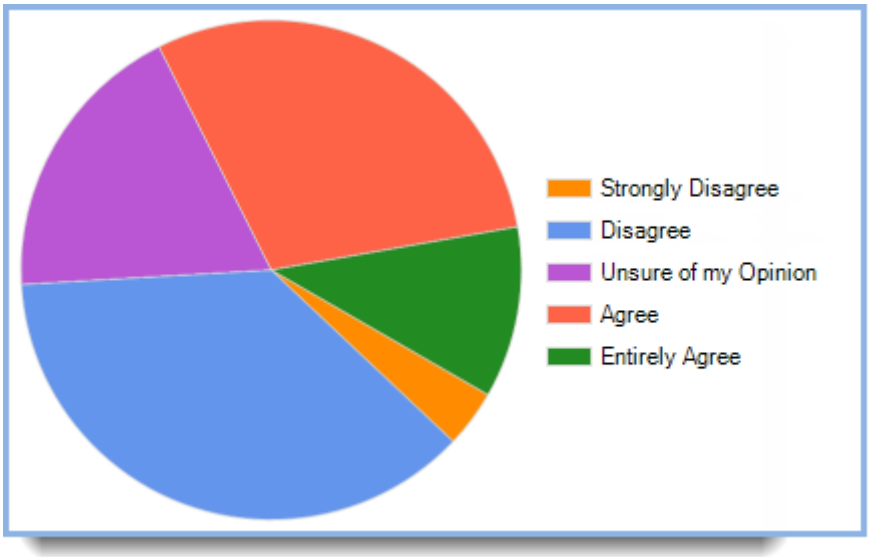


Qs.6 After taking part in this research I believe the following method is best suited for me to learn independently

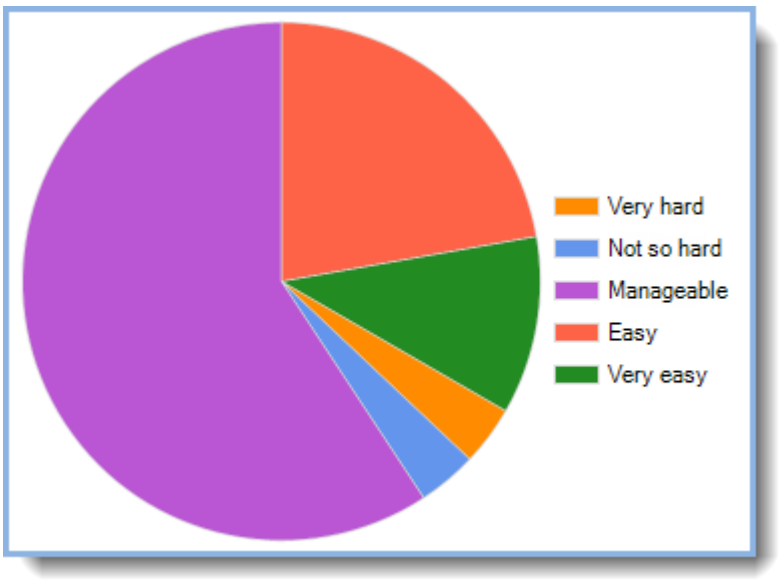
Answer Options	Response Percent
System like MyPace	22.2%
Books	11.1%
Internet	22.2%
Teacher Instructed	44.4%

Qs. 7 I found that I understood this topic better than the previous ones I have studied

Answer Options	Response Percent
Strongly Disagree	3.7%
Disagree	37.0%
Unsure of my Opinion	18.5%
Agree	29.6%
Entirely Agree	11.1%



	Please state why you selected the previous answer (optional)
1	because i under stood it
2	this was the hardest category
3	I didn't find this subject easy to learn I found it quite difficult understanding what to learn and learning independently,I think that MyPace is for a particular type of learner..... which didn't really help me. I think that the makers of the my pace system should add more subjects to this program and simplify the learning process with the words which they use.... for example when you search something in the my pace search bar, a large amount of videos and games come up .... but none are based on starting algebra... It seems as if they just jump straight into the learning process without a starting point.
4	It was really hard to do maths without your teacher explaining it to you i found algebra super hard.
5	I did not understand this topic more than previous topics as I found that I went at a slow pace at first but had to cram information in the last few days before the test.
6	I still am a bit unsure on some of the algebra topics and I fully understand the rest of my maths work that I have studied since the start of the year.
7	because algebra i think it was easy then the pervious one
8	I agree because i took the examples i got and turned into a way i understood.
9	I did well in my test but was not very good on the topic i found it quite hard to learn/understand without the help and support of a teacher
10	I found it easier because i had videos to look at and they went step by step so i knew what to do
11	I understood all the topics and algebra wasn't any different.
12	The topic is harder than all the other topics and has lots of theory in it. in that way it was harder
13	I disagree because i prefer learning a hard topic by a teacher explaining
14	The MyPace system was good for watching algebra videos and playing algebra games but I also used the book for some notes and questions
15	I tried to understand it but I found it confusing because of MyPace. I think I would have understood it if it was instructed by my teacher.
16	It's easier to work from the book because you then know what you have to study and not have to go looking for it on the internet or websites.
17	I selected this answer because i understood this topic better than the ones i have studied so far
18	I thought this because i was able to learn what i have difficulty with and when i had the difficulty with it.
19	It was harder than all the other topics.
20	I thought it was really hard
21	I find that a lot of the topics are easier or harder than this one
22	It was too hard
23	I agree because when using MyPace it made it easy for me to learn
24	I find it easier When the teacher explains it to me.

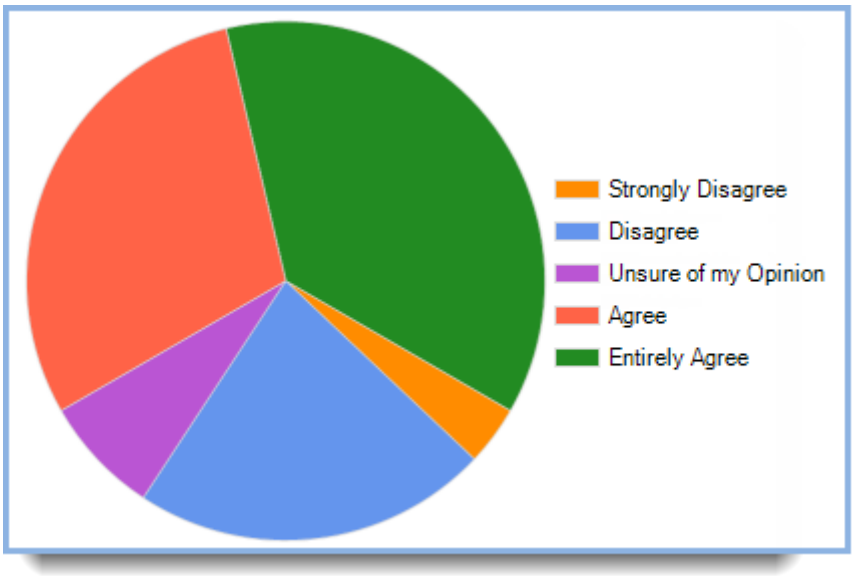


Qs.8 Making my own decisions on what to learn and when to learn was:

Answer Options	Response Percent
Very hard	3.7%
Not so hard	3.7%
Manageable	59.3%
Easy	22.2%
Very easy	11.1%

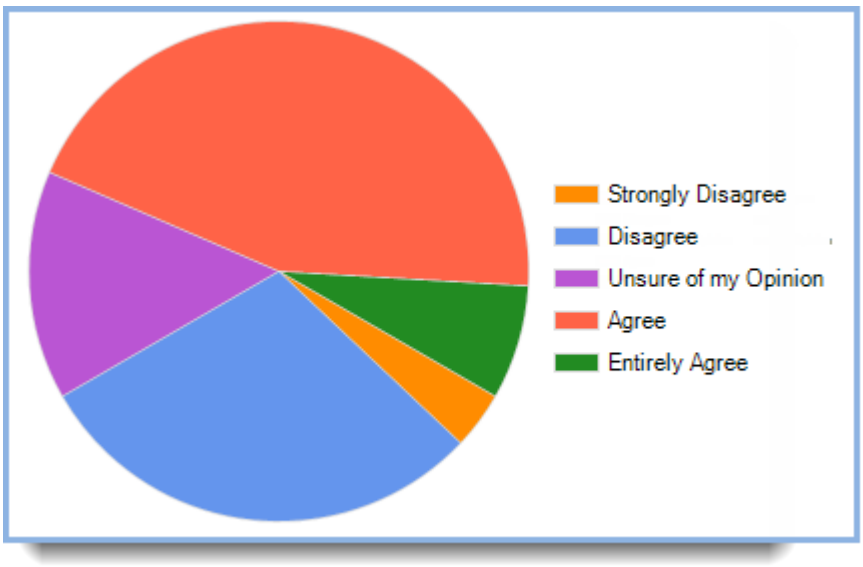
Qs.9 It was exciting, fun and enjoyable using MyPace to learn

Answer Options	Response Percent
Strongly Disagree	3.7%
Disagree	22.2%
Unsure of my Opinion	7.4%
Agree	29.6%
Entirely Agree	37.0%



Qs.10 If you were asked to use the MyPace system to learn the next topic in mathematics what would you say? Please give a reason for your answer

1	Yes because it was good
2	I would say yes because it's fun and people improve
3	If I was asked to use the MyPace system for my next subject, I would say no, because I find it more beneficial for a teacher to be standing in front of you...
4	I wouldn't be happy because personally MyPace doesn't help me at all.my teacher, books and my friends are way better at helping me with my maths.
5	I would protest to using the MyPace system for the next topic in maths as I think I would disimprove at maths. I prefer to be taught rather that teach myself.
6	I would say yes because it was a good experience using it.
7	Yes i would cause it helped me a lot with algebra so it will help on the next topic
8	Yes because I had fun learning at my own speed
9	I would say that it would be a great idea cause i think it helped me do the last topic well
10	No because I didn't learn anything from it I just used the book to do it all this was because of the issue I had with the people in the videos and good videos were difficult to pick out of the rubbish that was in there i used some games which were helpful to begin but looking back i believe i could have done better if i was in a class I would base this answer on the fact that the MyPace system was a huge disappointment
11	Yes i would use it because it is a better way of learning once the teacher can help as well i would
12	I would say no because i didn't like MyPace because the videos on it weren't very helpful
13	I would say yes because it's a great use of nowadays tech and is easy to use.
14	I would not use MyPace for the next maths topic because I found it quite hard to find information while learning algebra
15	I would use the MyPace system again because the videos were interesting and I understood what the videos were showing me
16	yes it good
17	I would say no because I find it more understandable when our teacher is teaching us.
18	I would say yes because it was enjoyable to use the MyPace while learning but i would sometimes prefer to use the book for questions and problems and studying
19	i would say yes because i enjoyed using MyPace
20	I would say yes because i thought the videos and the notes at the side bar very helpful.
21	No because i prefer a teacher teaching me.
22	It would depend on the topic because this topic was very hard
23	I would not like to use the MyPace system anymore because i prefer the book to study from rather than the internet
24	it would depend on the chapter
25	yes because it was easy and fun to learn
26	i would like that it helps me learn
27	I would say yes depending on what the next topic is...

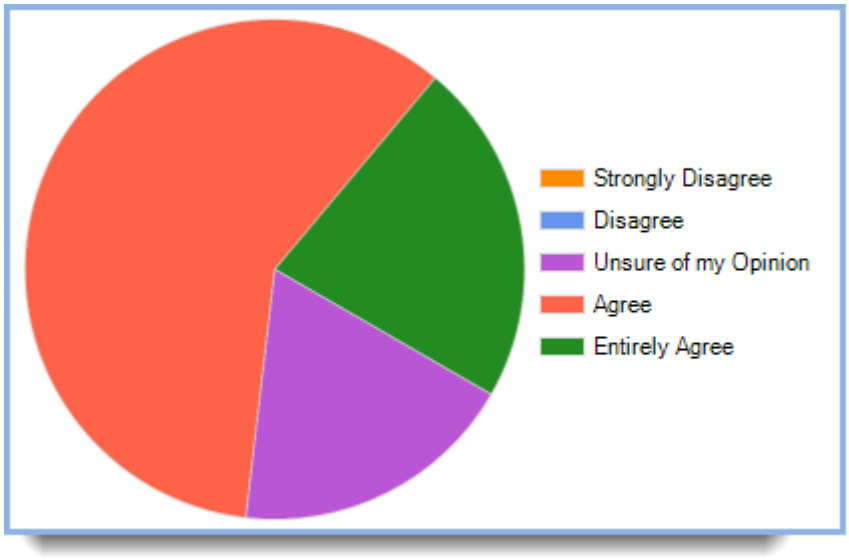


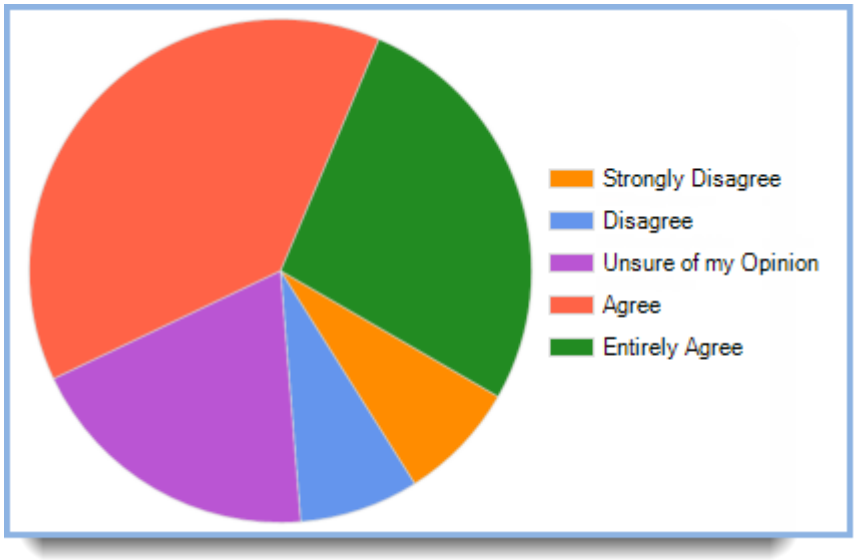
Qs.11 Completing the reflections helped me to improve the way I thought about my learning

Answer Options	Response Percent
Strongly Disagree	3.7%
Disagree	29.6%
Unsure of my Opinion	14.8%
Agree	44.4%
Entirely Agree	7.4%

Qs.12 I am now much more aware of my strengths and weaknesses as a learner.

Answer Options	Response Percent
Strongly Disagree	0.0%
Disagree	0.0%
Unsure of my Opinion	18.5%
Agree	59.3%
Entirely Agree	22.2%



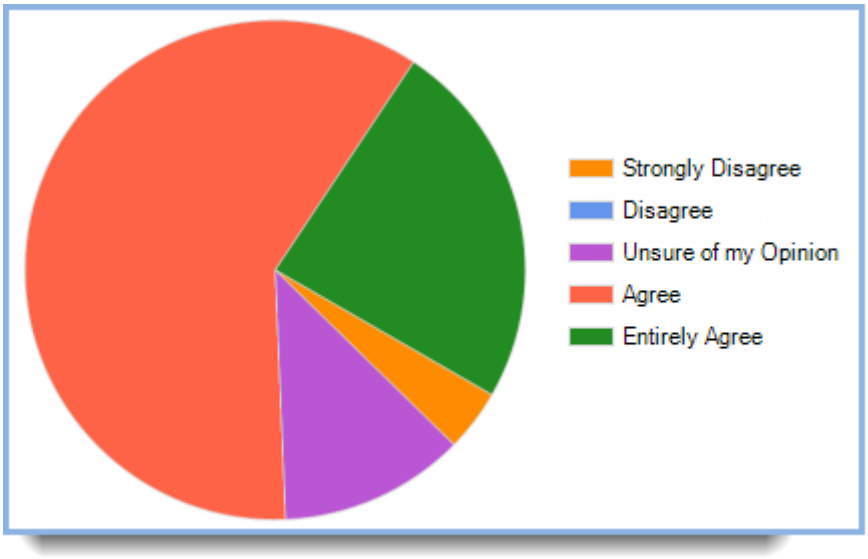


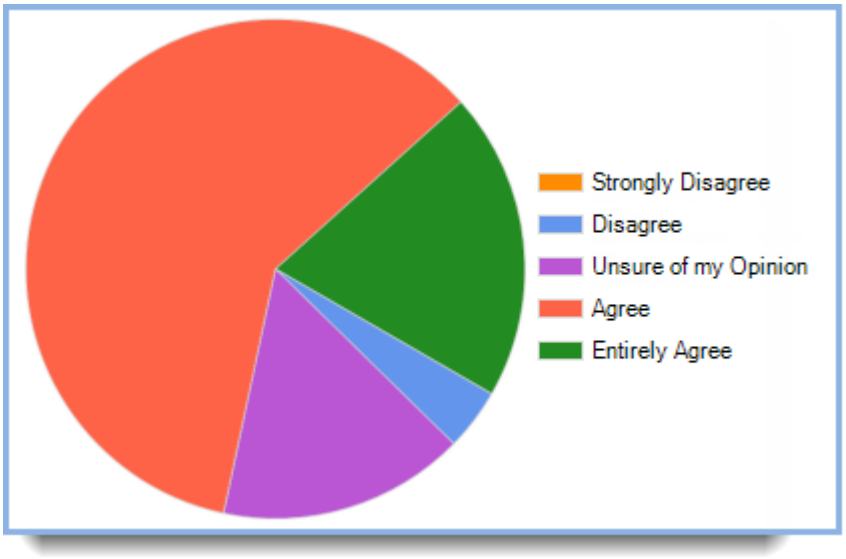
Qs.13 Now that I have taken part and know what Independent learning is, this is something I would like to take part in again in the future

Answer Options	Response Percent
Strongly Disagree	7.7%
Disagree	7.7%
Unsure of my Opinion	19.2%
Agree	38.5%
Entirely Agree	26.9%

Qs.14 I believe regularly taking part in developing my independent learning skills will benefit me in later school years

Answer Options	Response Percent
Strongly Disagree	4.0%
Disagree	0.0%
Unsure of my Opinion	12.0%
Agree	60.0%
Entirely Agree	24.0%



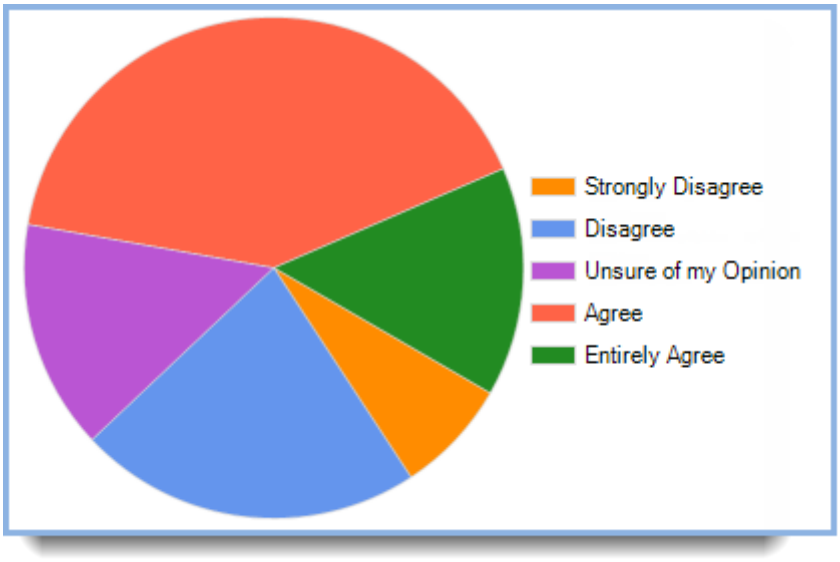


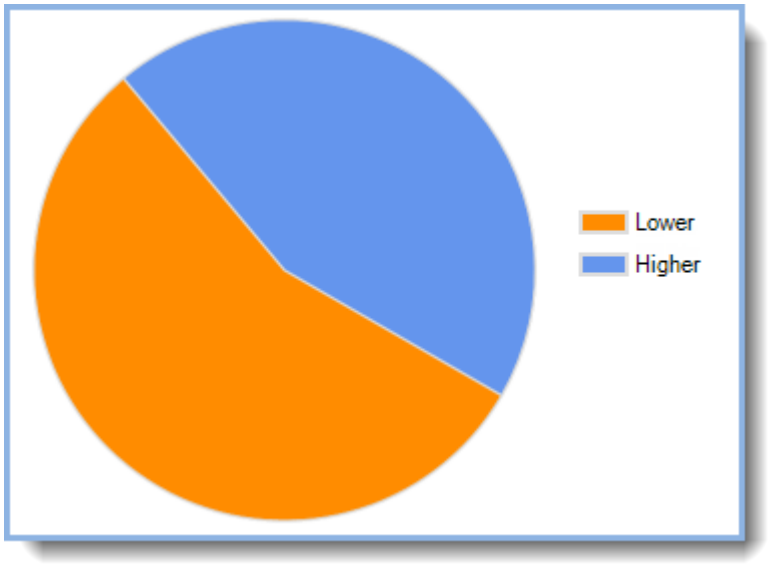
Qs.15 Being made responsible for my own learning and seeing the outcomes was very rewarding and satisfying

Answer Options	Response Percent
Strongly Disagree	0.0%
Disagree	4.0%
Unsure of my Opinion	16.0%
Agree	60.0%
Entirely Agree	20.0%

Qs.16 I believe I can achieve similar if not higher results again if I use the MyPace system.

Answer Options	Response Percent
Strongly Disagree	7.4%
Disagree	22.2%
Unsure of my Opinion	14.8%
Agree	40.7%
Entirely Agree	14.8%





Qs.17 Before getting your results back, do you think you scored higher or lower in this algebra exam than the average you achieved in previous exams?

Answer Options	Response Percent
Lower	55.6%
Higher	44.4%

Qs.18 Before we began the research you were asked 'How do you feel about monitoring your own learning using this new system which has been explained to you?'. Now that you have taken part what are your overall thoughts/opinion on using MyPace or a system similar to this to learn independently?

1	It was good that we could do it ourselves
2	I think it is great opportunity
3	I think MyPace can be beneficial for some people but not for me I think that I would have more knowledge on Algebra if i had of been taught by a teacher.
4	I wouldn't like to use MyPace again because as i said before it doesn't help me. I thought MyPace was boring and not helpful. I thought my book was more helpful and teacher.
5	I do not think that we should use a PLS in the future as it does not teach us as well as a teacher.
6	I think it is a good way to prepare you for a higher level education that is why I would like to take part in this again in further years to come and maybe start using it for other subjects. But I used the book to learn and I think my pace is a good way to study for tests and to study for other subjects.
7	Overall i think our teacher explained it to us really well and it is great to learn with each other and encourage each other
8	I think my pace is extremely good and anybody who gets a chance to use this system should!
9	I thought it was a great way to learn on my own cause there were videos that explained everything clearly and if you wanted to take notes there were notes you could take down on the bottom.
10	I would not be happy to try it again because instead of using my pace to learn algebra i had to use the book even though i got the job done i defiantly feel more comfortable with a book and a teacher with me
11	I think it should be in all schools because kids would know what to do and can listen without messing going on in class so they just put the headphones in and listen to them
12	I thought MyPace would be much better than it actually was. I was a bit disappointed about using MyPace as it took a long time to find good or helpful videos
13	It is great and is easy to use. It would be good if you could talk though!
14	I strongly believe that using MyPace or something similar doesn't suit me because when i was learning algebra, i found it a tough topic but when the teacher explained one sum to me i began to get how to do algebra so i prefer a teacher explaining it on harder topics.
15	I would use the MyPace system again for other maths topics or even other topics in different subjects. I would recommend the MyPace system to other classes in our school or even to other schools
16	yes its good
17	I wouldn't like to use it again because it's more understandable when our teacher is teaching us but I do like the idea of independent learning although I wouldn't use MyPace again.
18	It is good to be an independent learner because it will help you when you're in college and have to take notes and study. I still think that a book is easier to learn from because you know what you have to do and study and what to expect in tests. Overall the MyPace system was very good and I would use it in the future.
19	My overall opinion about using MyPace is good because i really enjoyed using MyPace
20	I thought learning algebra independently was a good achievement and i would also like to use a system similar to MyPace for future topics in maths and even in different subjects.

21	I liked it but i prefer learning as a class then on MyPace or the book.
22	I really think it has benefited me and helped me on some questions that i found hard
23	I did not find the MyPace system as useful as learning from a teacher or studying from the book
24	Its good and it will benefit me when further on in school
25	MyPace is a brilliant website to help the learning of students
26	It makes learning fun but i would like to use the book and MyPace evenly
27	I thought it was ok but I did not understand some parts of algebra as it was hard to find something online that you weren't sure about.

Appendix 6

End of Topic Algebra Exam

Algebra Exam – 1st Year Maths

Name: _____

Qs. 1 *(Total 28 marks)*

A. (*8 marks)* **Each symbol stands for a number. Write down its value:**

i. Δ + 6 = 13

Answer:_____

ii. □ - 8 = 4

Answer:_____

iii. 7 □ ● = 42

Answer:_____

iv. ◊ ÷ 6 = 5

Answer:_____

B. *(8 marks)* **If ● = 7 and Δ = 4, find the value of each of the following expressions**

i. ● + 6

Answer:_____

ii. ● - 3

Answer:_____

iii. 40 ÷ Δ

Answer:_____

iv. Δ □ 8

Answer:_____

C. *(12 marks)* **Each letter below stands for a number. Find the value of each letter.**

i. c + 12 = 14

Answer:_____

ii. f – 5 = 12

Answer:_____

iii. 2 □ g = 44

Answer:_____

iv. h ÷ 4 = 4

Answer:_____

v. a + a = 30

Answer:_____

vi. p + p + p= 15

Answer:_____

A. (*8 marks*) Simplify the following:

i. $5x - 2x$

Answer:_____

ii. $6b - 2 + b - 4$

Answer:_____

iii. $2ab + c + 5ab - 4c$

Answer:_____

iv. $5k + 3 - 4k + 6 + k - 4$

Answer:_____

B. *(10 marks)* 6x + 4y – 6 is an expression

i. Name the two variables in this expression

Answer:_____

ii. Why are they called variables

Answer:_____

iii. Write down the coefficient of x

Answer:_____

iv. Write down the constant in the expression

Answer:_____

v. Write down the constant in the expression

Answer:_____

C. *(12 marks)* If a = 5 and b = 3, find the value of:

i. $b - a$

Answer:_____

ii. $5a - 2b$

Answer:_____

iii. $6ab - 2a$

Answer:_____

iv. $6a - 2b + 2a$

Answer:_____

iii. $(2a + 3)(3a - 2)$

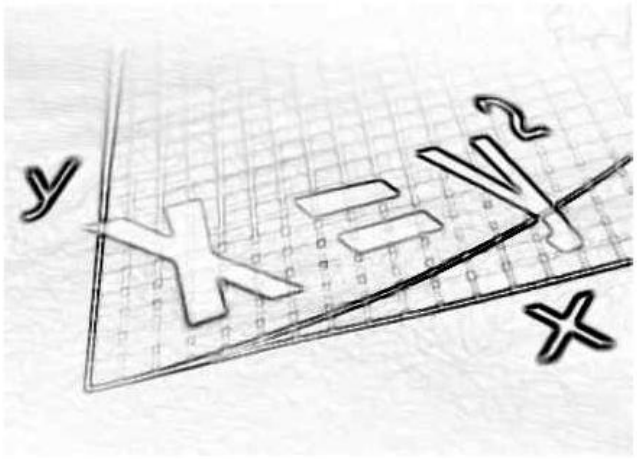
Answer:_____

iv. $(2a - 3c)(3b - d)$

Answer:_____

i. $(2x + y)^2$

Answer:_____



Please hand up your rough work sheets with your test!

Appendix 7

Group discussion and feedback

- Students enjoyed the experience
- It was fun to do something different
- General consensus is that everyone likes working and learning through technology
- It was difficult to know where to start using MyPace
- The content was mixed – some easy, some very hard to understand
- Need to show different levels of difficult or a succession of content to work through
- Some of the videos were useless
- Students did not like American accents
- Good the way you could see what other people are viewing
- Needed the book to understand what to study or search for
- Many ended up using the book as well as MyPace
- Students were worried about the test because they weren't sure if they had enough work done or studied the correct things
- Students were mainly attracted to the videos and the games
- Working at your own pace is better
- This was a difficult topic, many students believe they would do much better learning a different topic and find it much easier
- Students like the idea of independent learning and recognize that it is important to practice the skills of responsibility, reflection and self-motivation for lifelong learning
- All are aware that independent learning is NOT learning on your own
- 19/25 raised their hands to learn the next topic using MyPace and further practicing their independent learning skills

Appendix 8

MySQL User Data

User name	Total views	Total ratings
boyle02	65	37
boyle03	62	37
boyle04	61	58
boyle05	64	39
boyle06	40	15
boyle07	30	29
boyle08	83	25
boyle09	35	33
boyle10	66	54
boyle11	65	56
boyle12	20	11
boyle13	84	13
boyle14	41	28
boyle15	66	60
boyle16	34	31
boyle17	66	48
boyle18	35	25
boyle19	47	40
boyle20	59	56
boyle21	80	79
boyle22	66	54
boyle23	37	32
boyle24	60	37
boyle26	15	7
boyle27	29	20
boyle28	56	9
boyle29	76	53

Appendix 9

School of Computer Science and Statistics
Research Ethical Application Form

Part A

Project Title: **Using Personalisation to Support Independent Learning**

Name of Lead Researcher (student in case of project work): **David Ganly**

Name of Supervisor: **Prof. Vincent Wade**

TCD E-mail: **dganly@tcd.ie** Contact Tel No.: **0879104693**

Course Name and Code (if applicable): **MSc Technology and Learning**

Estimated start date of survey/research: **9th January 2012**

I confirm that I will (where relevant):

- Familiarize myself with the Data Protection Act and guidelines www.tcd.ie/info_compliance/dp/legislation.php;
- Tell participants that any recordings, e.g. audio/video/photographs, will not be identifiable unless prior written permission has been given. I will obtain permission for specific reuse (in papers, talks, etc.)
- Provide participants with an information sheet (or web-page for web-based experiments) that describes the main procedures (a copy of the information sheet must be included with this application)
- Obtain informed consent for participation (a copy of the informed consent form must be included with this application)
- Should the research be observational, ask participants for their consent to be observed
- Tell participants that their participation is voluntary
- Tell participants that they may withdraw at any time and for any reason without penalty
- Give participants the option of omitting questions they do not wish to answer if a questionnaire is used
- Tell participants that their data will be treated with full confidentiality and that, if published, it will not be identified as theirs
- On request, debrief participants at the end of their participation (i.e. give them a brief explanation of the study) Verify that participants are 18 years or older and competent to supply consent.
- If the study involves participants viewing video displays then I will verify that they understand that if they or anyone in their family has a history of epilepsy then the participant is proceeding at their own risk
- Declare any potential conflict of interest to participants.
- Inform participants that in the extremely unlikely event that illicit activity is reported to me during the study I will be obliged to report it to appropriate authorities.
- Act in accordance with the information provided (i.e. if I tell participants I will not do something, then I will not do it).

Signed: .....*David Ganly*..... Date: .....**07/12/2011**.....

Lead Researcher/student in case of project work

Part B

Please answer the following questions.		***Yes/No***
Has this research application or any application of a similar nature connected to this research project been refused ethical approval by another review committee of the College (or at the		**No**
Will your project involve photographing participants or electronic audio or video recordings?		**No**
Will your project deliberately involve misleading participants in any way?		**No**
Is there a risk of participants experiencing either physical or psychological distress or discomfort? If yes, give details on a separate sheet and state what you will tell them to do if they should		**No**
Does your study involve any of the following?	Children (under 18 years of age)	**Yes**
	People with intellectual or communication difficulties	**No**
	Patients	**No**

School of Computer Science and Statistics
Research Ethical Application Form

Details of the Research Project Proposal must be submitted as a separate document to include the following information:

1. Title of project
2. Purpose of project including academic rationale
3. Brief description of methods and measurements to be used
4. Participants - recruitment methods, number, age, gender, exclusion/inclusion criteria, including statistical justification for numbers of participants
5. Debriefing arrangements
6. A clear concise statement of the ethical considerations raised by the project and how you intend to deal with them
7. Cite any relevant legislation relevant to the project with the method of compliance e.g. Data Protection Act etc.

Part C

I confirm that the materials I have submitted provided a complete and accurate account of the research I propose to conduct in this context, including my assessment of the ethical ramifications.

Signed: .....*David Ganly*..... Date:.....**07/12/2011**.....
Lead Researcher/student in case of project work

There is an obligation on the lead researcher to bring to the attention of the SCSS Research Ethics Committee any issues with ethical implications not clearly covered above.

Part D

If external ethical approval has been received, please complete below.

External ethical approval has been received and no further ethical approval is required from the School's Research Ethical Committee. I have attached a copy of the external ethical approval for the School's Research Unit.

Signed: ..... Date: .....
Lead Researcher/student in case of project work

Part E

If the research is proposed by an undergraduate or postgraduate student, please have the below section completed.

I confirm, as an academic supervisor of this proposed research that the documents at hand are complete (i.e. each item on the submission checklist is accounted for) and are in a form that is adequate for review by the SCSS Research Ethics Committee

Signed:  Date: .....7/12/2011.....

Completed application forms together with supporting documentation should be submitted electronically to research-ethics@scss.tcd.ie Please use TCD e-mail addresses only. When your application has been reviewed and approved by the Ethics committee hardcopies with original signatures should be submitted to the School of Computer Science & Statistics, Room F37, O'Reilly Institute, Trinity College, Dublin 2.

Appendix 10

Participants Information Sheet

Participants Information Sheet

This passage will be read to participating students by the researcher (David Ganly)

As some of you may already know I am currently doing a Masters in Technology and Learning in Trinity College Dublin. As part of this course I must conduct (carry out) a research project (this can mean searching for new facts or coming up with new ideas and ways to do things). I will be doing this research with this mathematics class but first of all I will give you a little more information about the project.

This project plans to find out if a web based personalised learning system (PLS) could support Independent Learning Skills amongst new entrants to second level education. Now firstly let me explain what a web based system is – in this case it is a website which we will be using that is all online on the internet which means we must have internet access to use the system.

Secondly a PLS in this case is the website which we will use and instead of just finding all of the information on the website it will help you to find some of the information and point you in the right direction.

Thirdly the thing that we are trying to increase/build upon/support is called 'Independent Learning Skills' – these are skills which you develop which allow you to take responsibility for your own learning and has a less importance on the teacher (me) directing/teaching you. You also decide what is best for you to learn.

This PLS will allow you to log in with a provided username and password and will give the freedom to learn at your own pace/speed using the systems search function (similar to Google which you are all familiar with) to provide resources/information (website pages and educational video). For the purpose of this research you will be using this MyPace system to learn independently the topic of introductory algebra. You will use the MyPace system for the duration/length of three weeks starting the 9th of January and be given the traditional/normal methods of homework and end of topic examination.

All information that is collected will be anonymous (no one will know your information results) and stored in accordance with the Data Protection Act at Trinity College, Dublin. Your participation in the research can only take place with you and your parents' permission. Participation is voluntary and you may withdraw/leave from the project at any time for any reason without penalty. Any information already recorded will be removed in this instance.

1

David Ganly MSc. Technology & Learning dganly@tcd.ie

If you decide to take part you will undertake the following activities:

- Initial questionnaire on how you feel the current teaching system works for them
- Use of the technology in a real life classroom and home environment
- Regular feedback after each use will be recorded
- A weekly reflection on how this new learning experience is/is not benefiting you
- End of topic test on algebra
- Group discussions and student preferences for future learning
- Post questionnaire on aspects of the PLS that did/did not work for you

Please note: If you do not consent to participating in this study, you will still be allowed to take part in the activity without having your data recorded.

David Ganly MSc. Technology & Learning dganly@tcd.ie

Appendix 11

Participants Consent Form

Participants Consent Form

I _____ (name of participant) agree to take part in the MyPace research project and consent for my mathematics teacher (Mr. D. Ganly) to use my information and results collected from the MyPace system.

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

Data Protection:

I agree to Trinity College Dublin storing any personal data 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.

Participant Name	
Signature of Participant	
Date	
Signature of Project Leader	
Date	

1

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Appendix 12

Supplementary Consent Form

Supplementary Participants Consent Form

I _____ (name of participant) agree and consent for my mathematics teacher (Mr. D. Ganly) to use my previous test results in mathematics since the beginning of this academic year 2011/2012 in order to show comparison with my recently achieved algebra result using the MyPace system. I have been made aware that this research contributes to the requirements of an MSc qualification which is currently in progress.

I understand that I may withdraw from the research project at any time should I wish to do so. This can be for any reason and without penalty. I also understand that if I request, the researcher will ensure that all personal data which has been collected about me will be deleted, without penalty.

Data Protection:

I agree to Trinity College Dublin storing any personal data 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.

Ethical considerations:

I (Mr. D. Ganly) confirm that I will (where relevant):

- Familiarize myself with the Data Protection Act and guidelines http://www.tcd.ie/info_compliance/dp/legislation.php;
- Tell participants that any recordings, e.g. audio/video/photographs, will not be identifiable unless prior written permission has been given. I will obtain permission for specific reuse (in papers, talks, etc.)
- Provide participants with an information sheet (or web-page for web-based experiments) that describes the main procedures
- Obtain informed consent for participation. Should the research be observational, ask participants for their consent to be observed
- Tell participants that their participation is voluntary
- Tell participants that they may withdraw at any time and for any reason without penalty
- Give participants the option of omitting questions they do not wish to answer if a questionnaire is used

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Mr. D. Ganly MSc. Technology & Learning dganly@tcd.ie

Appendix 13

Parents and Guardians Information Sheet

Parents & Guardians Information Sheet

19th Jan 2012

Dear Parents/Guardians,

I would request just a few minutes of your time. As part of my final year of a Master of Science in Technology and Learning with Trinity College Dublin I am required to conduct a research project and would like to invite your son/daughter to take part in this project. The evaluation is due to commence on the 23rd of January 2012 and the Principal (Ms. Laffoy) and the school Board of Management has granted permission to conduct this beneficial research amongst the 1st Year class Boyle students of Donabate Community College.

The research project I am conducting is entitled; *Using Personalisation to Support Independent Learning*

This project intends to determine if a web based personalised learning system (PLS) could support Independent Learning Skills amongst new entrants to second level education. The MyPace system is a collaborative effort developed between The Knowledge and Data Group of Trinity College Dublin, NUI Galway, UCD and Waterford IT.

This PLS allows students to log in with a provided username and password and gives the freedom to learn at their own pace using the systems search function to provide resources (open source web pages, educational video, animations and HMH sponsored content). For the purpose of this research students will use the MyPace system to learn independently the topic of introductory algebra. Students will use the MyPace system for the duration of three weeks starting the 23rd of January and be given the traditional methods of homework and end of topic examination.

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David Ganly MSc. Technology & Learning dganly@tcd.ie

Participants in the research will undertake the following activities:

- Initial questionnaire on how they feel the current teaching system works for them
- Use of the technology in a real life classroom and home environment
- Regular feedback after each use will be recorded
- A weekly reflection on how this new learning experience is/is not benefiting them
- End of topic test with these results being compared with previous tests
- Group discussions and student preferences for future learning
- Post questionnaire on aspects of the PLS that did/did not work for them

All information that is collected will be anonymous and stored in accordance with the Data Protection Act at Trinity College, Dublin. Your child's participation in the research can only take place with your permission. Participation is voluntary and you may withdraw your child from the project at any time for any reason without penalty. Any information already recorded about your child will be removed in this instance. If you decide at the end of the project, you would not like your child's data used for research purposes, please inform me and I shall destroy their data.

If you have any queries or hesitations at any stage please contact me using the details below. If you would like your child to participate, please return the attached consent form as soon as possible.

Yours sincerely,

_____

David Ganly

Please note:

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

If you or your child does not consent to participating in this study, your son/daughter will still be allowed to take part in the activity without having their data recorded.

David Ganly MSc. Technology & Learning dganly@tcd.ie

Appendix 14

Parents and Guardians Consent Form

Parents & Guardians Consent Form

I _____ (name of parent/guardian) consent for _____ (name of son/daughter), who is under the age of 18 to take part in this research project.

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. I have also been informed how I can contact the research team. I understand that I may withdraw my son/daughter from the research project at any time should I wish to do so. This can be for any reason and without penalty.

Data Protection:

I agree to Trinity College Dublin storing 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.

Son/Daughter Name	Eg. Mary Smith
Signature of Son/Daughter	
Signature of Parent/Guardian	
Date	
Signature of Project Leader	
Date	

1

David Ganly MSc. Technology & Learning dganly@tcd.ie

Appendix 15

Principal and Board of Management Information Sheet

Principal and Board of Management Information Sheet

01st Dec 2011

Dear Principal & Board of Management,

I am currently completing a Master of Science in Technology and Learning with Trinity College Dublin. As part of this course I am required to conduct a research project and with your permission I would like to conduct my research project using the 1st Year Boyle students from Donabate Community College. The research project I am conducting is entitled; *Using Personalisation to Support Independent Learning*

This project intends to determine if a web based personalised learning system (PLS) could support Independent Learning Skills amongst new entrants to second level education. The system being used is named MyPace which is a collaborative effort developed between The Knowledge and Data Group of Trinity College Dublin, NUI Galway, UCD and Waterford IT.

This PLS allows students to log in with a provided username and password and gives the freedom to learn at their own pace using the systems search function to provide resources (open source web pages, educational video and HMH sponsored content). For the purpose of this research students will use the MyPace system to learn independently the topic of introductory algebra. Students will use the MyPace system for the duration of three weeks starting the 9th of January and be given the traditional methods of homework and end of topic examination.

Participants in the research will undertake the following activities:

- Initial questionnaire on how they feel the current teaching system works for them
- Use of the technology in a real life classroom and home environment
- Regular feedback after each use will be recorded
- A weekly reflection on how this new learning system is/is not benefiting them
- Group discussions and student preferences for future learning

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David Ganly +353 (0) 879104693 MSc. Technology & Learning dganly@tcd.ie

Parents will be asked to give permission for their children to take part in this study and the students will also be requested to sign a consent form. Students will be able to withdraw from the study at any time if requested. I enclose a copy of the information sheet and consent form for parents and children.

Ethical permission will be sought from Trinity College Dublin prior to the conduction of this project and I enclose a copy of the application to the Ethics Committee for your perusal. I will be supervised by Prof. Vincent Wade from Trinity College Dublin and the data collected will be stored in compliance with Data Protection Act. Participating parents, the Principal and the Board of Management may request copies of this data at any stage.

I hereby request your permission to conduct my research in this school. Participation in this research is voluntary and you may withdraw the school from this project at any time and for any reason. Withdrawal will not have any consequence or penalty. Any information already recorded in this instance will be destroyed.

If you have any queries at any stage please do not hesitate to contact me.

Yours sincerely,

_____

David Ganly

Please note:

As this research involves the use of computers, children with epilepsy cannot take part in either the learning activity or research study.

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Appendix 16

Principal and Board of Management Consent Form

Principal and Board of Management Consent Form

The board has been provided with an information sheet that outlines the activities which each student will take part in, how any data will be collected and stored. Details of the research team have also been provided.

The board understands that it may withdraw the school from the project at any time should it wish to do so for any reason and without penalty.

School Name & Address	Donabate Community College, Portrane Road, Donabate, Co. Dublin
School roll number	761040
Signature of chair of Board of Management	
Date	
Signature of Principal	
Date	
Signature of Project Leader	
Date	

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Appendix 17

Scaffolded Questions + Participant Result Tables + Overview

Scaffolded Reflection Questions

The following is the list of scaffold questions which helped students complete their reflections, these responses were in turn used in the positive and negative sections within the PRT.

Day 2 – Tuesday 24th January

a) The thing(s) I enjoyed the most about my first use of MyPace (if any):
b) The thing(s) I disliked the most about my first use of MyPace (if any):
c) Any additional comments or notes from today:

Day 5 – Friday 27th January

d) After my first week what are the thing(s) I enjoy the most or find useful about using MyPace (if any):
e) After my first week what are the thing(s) I dislike the most or find difficult about using MyPace (if any):
f) Any additional comments or notes from this first week:

Day 9 – Tuesday 31st January

g) Am I becoming more enthusiastic or less enthusiastic about learning using the MyPace personalised learning system:
h) What is my current opinion of learning through technology and has it changed since using MyPace
i) Any additional comments or notes since my last reflection:

Day 12 – Friday 3rd February

j) Am I beginning to think differently about my learning and how I learn:
k) Can I see any improvements that could be made to how we are using the MyPace PLS:
l) Any additional comments or notes since my last reflection:

Day 17 – Wednesday 8th February

m) Would I like to learn in the future like this? Why or why not?
n) Did I find reflecting on my learning helped me to improve my independent learning skills:
o) Any additional comments or notes to add to my last reflection:

Participant Results Tables

Note: Boyle01 & Boyle05 did not have their results recorded

No. 1	Boyle02
	g) **I am becoming more enthusiastic about learning** using MyPace because I understand how to make my way around the website better *(8 days in)* j) Yes, because **I have to share my time properly** and **teach myself** m) I would **like to learn like this in the future** because **I enjoyed learning math this way** and I understand the videos and the games I played and watched n) Yes, because after all those reflections **I knew what they were looking for** us to do o) I **enjoyed using MyPace** and I hope we use it more in the future
	b) If you are looking for a video there are **no signs showing you it is a video**, therefore you go into content you do not want e) I do not like the way the **content isn't labeled clearly**. Some that look like videos are actually a game h) My **current opinion of learning through technology has not changed** because before we were introduced to MyPace our teacher introduced us to Khan Academy months before MyPace.
Algebra Test Result	84%
Previous Test Results	Natural numbers 83% Integers 79% Fractions 89% Decimals 84% Sets 96% End of Term 1 80% Average **85.17 %**
Previous Average Results **vs** Algebra Result **85% vs 84%** **- 1%** 	

Days Absent from class during research	Pre survey taken?	Post survey taken?	Total number of content viewed	Number of content rated
0/18	Yes	Yes	65	37

Researcher Comments:

No. 2	Boyle03
	a) All the cool games, they were very tricky and fun. Some of them were too hard so I could not play them d) **The things I enjoyed was doing puzzles and playing the games**. I tried some games that I did not quite understand but I found some very fun. f) **I will try to figure out how to play hard games for next week**. I think MyPace is good. I sort of understand algebra g) Yes, because **I know what to do at home and at school** and I am watching more videos at home and understand them. **h) I think independent learning is good because if I am stuck I could still ask the teacher to help me** n) If I get a chance **I would definitely do the independent learning again**, it was really fun
	b) I did not like the way that there were hardly any videos and if there was they were no good. e) Sometimes the computer will not load and MyPace is very slow to load, **some of the games are really hard** m) No, because I know it was good and it was fun but **I prefer being taught the normal way in the classroom by my teacher**
Algebra Test Result	54%
Previous Test Results	Natural numbers 60% Integers 60% Fractions 89% Decimals 50% Sets 90% End of Term 1 41% Average **65 %**
Previous Average Results **vs** Algebra Result **65% vs 54%** **- 11%** 	

Days Absent from class during research	Pre survey taken?	Post survey taken?	Total number of content viewed	Number of content rated
0/18	Yes	Yes	62	37

Researcher Comments:

No. 3	Boyle04			
	a) The learning by myself j) Yes, I think it is better because **I can learn myself** m) Yes, because its brilliant because **I can learn at my own pace**			
	k) No not really			
Algebra Test Result	35%			
Previous Test Results	Natural numbers 41% Integers 47% Fractions 19% Decimals 32% Sets 22% End of Term 1 29%		Average **31.67 %**	
Previous Average Results **vs** Algebra Result **32% vs 36%** **+ 4%** 				
Days Absent from class during research 6/18	Pre survey taken? Yes	Post survey taken? Yes	Total number of content viewed 61	Number of content rated 58
Researcher Comments:				

No. 4	Boyle05
	a) I liked the idea of the videos showing the notes and work at the side d) I find the **suggestion and rating system really useful** g) I am **more enthusiastic about learning** from MyPace because **I have gotten the concept** of it and know what to look at and where I shall find it h) I think **learning through technology** should be adapted to all subjects as it **gets the student more interested and involved** j) **Yes, I am thinking differently to how I learn**. I find taking notes off the MyPace system and writing them in my hardback to use in my sums really useful k) I am finding MyPace SUPER m) **I would like to learn In the future** like this because it lets me learn the way I learn at my own Pace n) **I found reflecting on my work helpful** to improve my independent learning skills
	e) I find loading up videos still difficult
Algebra Test Result	89%
Previous Test Results	Natural numbers 96% Integers 85% Fractions 78% Decimals 89% Sets 98% End of Term 1 86% Average **88.67 %**
Previous Average Results **vs** Algebra Result **89% vs 89%** **0%** 	

Days Absent from class during research	Pre survey taken?	Post survey taken?	Total number of content viewed	Number of content rated
0/18	Yes	Yes	64	39

Researcher Comments:

You can see from this student's feedback that he/she has embraced the concept of learning through technology. His /her results reflect their enthusiasm

No. 5	Boyle06
	a) I found the MyPace system was helpful with the tutorials and videos c) I liked the layout of the videos and found them easy to access d) I found that the **MyPace system helped me to get a clearer view of algebra** f) I found that asking my teacher or classmates, I could understand some of the videos on the MyPace system much more easily than before j) **I think my learning has become more developed** in the way has by using the book and the MyPace system m) **I would like to keep learning like this** because it helped me to be able to go back over what I have done n) I think reflecting helped me understand to look back at work that I was stuck or confused
	b) **I disliked some of the content because it was too hard** or useless for the topic we were studying g) I think **I am becoming less enthusiastic because I do not like some of the videos an MyPace** h) I do not think my learning has changed i) Tonight **I used my book instead of MyPace**
Algebra Test Result	59%
Previous Test Results	Natural numbers 72% Integers 86% Fractions 81% Decimals 35% Sets 83% End of Term 1 59% Average **69.33 %**
Previous Average Results **vs** Algebra Result **69% vs 59%** **-10%** 	

Days Absent from class during research	Pre survey taken?	Post survey taken?	Total number of content viewed	Number of content rated
0/18	Yes	Yes	40	15

Researcher Comments:

No. 6	Boyle07
	a) Is that it has a lot of content and you can see what other people rated g) I am becoming more enthusiastic about learning using MyPace because it has helped me understand notation and using letters in algebra h) I still think learning through technology is great because there is lots of content like video games j) I am learning differently because I'm not just listening I am doing, I am learning my way k) I have seen an improvement in my work and how I understand the work m) I think I would like to learn like this in the future because when you learn by yourself it gets in your head n) Yes, I thought reflecting on my learning helped me to improve
	b) Some content is irrelevant and useless
Algebra Test Result	69%
Previous Test Results	Natural numbers 79% Integers 76% Fractions 52% Decimals 74% Sets 91% End of Term 1 66% Average **73 %**
Previous Average Results **vs** Algebra Result **73% vs 69%** **-4%** 	

Days Absent from class during research	Pre survey taken?	Post survey taken?	Total number of content viewed	Number of content rated
2/18	Yes	Yes	30	29

Researcher Comments:

Comments will go here

No. 7	Boyle08
	a) Is the videos because **some videos really help me to solve my maths work** d) I enjoyed most of the games and videos **e) I am starting to get algebra** h) At home I use MyPace a little bit but I also use YouTube videos j) Yes, **I think MyPace is good and it helped me a lot and I like the way I can chose what to learn** m) Yes because MyPace helped me a lot and I understand it but there is still a little bit I need to know
	b) A bit of the games because they don't explain the maths game they just say complete the game below **c) Some videos are really hard to understand**
Algebra Test Result	29%
Previous Test Results	Natural numbers 29% Integers 25% Fractions n/a Decimals n/a Sets 36% End of Term 1 24% Average **28.48 %**
Previous Average Results **vs** Algebra Result **28% vs 29%** **+1%** 	

Days Absent from class during research	Pre survey taken?	Post survey taken?	Total number of content viewed	Number of content rated
2/18	Yes	Yes	83	25

Researcher Comments:

Comments will go here

No. 8	Boyle09
	a) I enjoyed getting to use a computer for maths and the games on the system d) The games on the system we can use are helpful **f) I am finding independent learning easier to manage but I still prefer using the classroom and book** g) Yes, **I am becoming more enthusiastic about learning at my own pace** but I still do not like the MyPace system j) I find that **I have mastered the ability to learn independently and I am progressing faster through algebra** **m) I would not have gotten on as well in the exam as I did only using MyPace**
	b) The **videos on the system are not very good and are hard to listen to and follow as most of them are American** c) I am **not very sure how I am going to learn algebra as I have made no progress so far. I definitely prefer using the book and the classroom** d) The videos although sir says we should watch them , they are useless e) **The videos are useless** even though we are supposed to use them so I have been forced to use the book to learn and games to practice new things we've learned h) **I hate the videos on the MyPace system because of the American accents**, I lose concentration even so I cannot understand the information **i)** I find **I am less enthusiastic at home** k) Now **I am not even trying to find videos on MyPace so I am just using the book**
Algebra Test Result	91%
Previous Test Results	Natural numbers 97% Integers 83% Fractions 96% Decimals 90% Sets 94% End of Term 1 83% Average **90.5 %**
Previous Average Results **vs** Algebra Result **91% vs 91%** **0%** 	

Days Absent from class during research	Pre survey taken?	Post survey taken?	Total number of content viewed	Number of content rated
0/18	Yes	Yes	35	33

Researcher Comments:

No. 9	Boyle10
	a) It was easy to use, **I found MyPace interesting and I also enjoy and understand it** d) The things I liked on MyPace were the Khan Academy and coolmath.com which has a wide variety of games to play **g) I love the idea of independent learning, I find it very boosting towards my confidence.** h) I think that **using MyPace is a great way of learning independently** and also to get to know computers for people who are not used to them. I myself love computers and technology so I love this programme involving computers i) I find it easier to use because I can see what my fellow students have been viewing, which can be helpful in ways j) **I am starting to feel more comfortable in independent learning.** It has taken me a while to get familiar with the MyPace system, but I am able to use it now and I am finding it very helpful. m) Yes, **I would like to learn like this in the future but I would still like to have my teacher teach me as well.**
	b) It took quite a long time to find what I needed to see e) **I find it hard to use MyPace.** I find it very hard for me to find videos , I can only find games which are not very useful until you have an idea of the subject k) I think that they could simplify what they are saying and say it slower l) **I think learning with my teacher is better because sir knows where to start in algebra** but when you are **using MyPace you could look up the hardest part of algebra first** n) I thought that **MyPace was no help whatsoever**
Algebra Test Result	69%
Previous Test Results	Natural numbers 36% Integers 73% Fractions 92% Decimals 79% Sets 57% End of Term 1 74% Average **68.5%**
Previous Average Results **vs** Algebra Result **69% vs 69%** **0%** 	

Days Absent from class during research	Pre survey taken?	Post survey taken?	Total number of content viewed	Number of content rated
0/18	Yes	Yes	66	54

Researcher Comments:

No. 10	Boyle11
	a) **I could go at my own pace** and content was good **c) I am confident about using the internet to learn algebra** d) I am starting to understand MyPace more and **I am finding algebra easier** f) **I am learning algebra quicker than before** and I understand how to use MyPace more **g) I am becoming more enthusiastic using MyPace. I am confident about a test** h) I think the MyPace system is very good
	b) It was **hard to understand and some were too advanced** k) If it told us why someone rated something bad or good l) I am **doing better with the book at the moment** m) **No, I would not like to learn like this in the future** because I don't think I did as good as I have on other tests
Algebra Test Result	63%
Previous Test Results	Natural numbers 82% Integers 67% Fractions 67% Decimals 79% Sets 100% End of Term 1 80% Average **79.17%**
Previous Average Results **vs** Algebra Result **79% vs 63%** **-16%** 	

Days Absent from class during research	Pre survey taken?	Post survey taken?	Total number of content viewed	Number of content rated
0/18	Yes	Yes	65	56

Researcher Comments:

No. 11	Boyle12
	a) People can like or dislike content meaning others will be lead in the right direction g) I am becoming more enthusiastic about the Mypace system as I am moving away from games and websites and more towards videos which are helping more h) I still prefer learning from a book but using technology is also good. I think the MyPace system is better than I did at the start n) Yes I do think this as I could look over the reflections and try harder
	b) If you don't understand something and videos and games don't help you will probably fall behind of everyone else in the class. c) I prefer the traditional learning as opposed to MyPace d) I don't enjoy MyPace or find anything useful about it e) The idea of MyPace is good, in theory. In practice, nothing beats your teacher standing at the top of the class explaining it to you. I find it easier to learn out of the book if I have to do it on my own. f) I don't think I am going to do well in my end of section test as the personalised learning system is not working for me k) Only use videos as people stray away to non-educational games m) I would not like to learn like this in the future as it will never be as good as someone teaching it to you.
Algebra Test Result	82%
Previous Test Results	Natural numbers 86% Integers 93% Fractions 95% Decimals 78% Sets 100% End of Term 1 60% Average **85.33%**
Previous Average Results **vs** Algebra Result **85% vs 82%** **-3%** 	

Days Absent from class during research	Pre survey taken?	Post survey taken?	Total number of content viewed	Number of content rated
0/18	Yes	Yes	20	11

Researcher Comments:

No. 12	Boyle13
	a) I enjoyed being able to use the computer to learn because **I like using technology and videos** d) I find being able to work on my own is useful **g) I am becoming more enthusiastic about using MyPace** h) My current **opinion about using technology to learn has changed for the better since using MyPace** i) I use MyPace at home more than in school j) I am **beginning to think differently about how I learn** m) I would **like to learn like this in the future because I think it is fun** n) **I do think reflecting on my learning has improved my independent learning** skills
	none
Algebra Test Result	52%
Previous Test Results	Natural numbers 96% Integers 67% Fractions 64% Decimals 54% Sets n/a End of Term 1 67% Average **58%**
Previous Average Results **vs** Algebra Result **58% vs 52%** **-6%** 	

Days Absent from class during research	Pre survey taken?	Post survey taken?	Total number of content viewed	Number of content rated
0/18	Yes	Yes	84	13

Researcher Comments:

No. 13	Boyle14
	a) **It's very helpful**, the videos have explained algebra perfectly m) **No** I would not like to learn like this in the future, **because it is harder using a computer**
	e) I dislike that the videos use dollars g) I am becoming **less enthusiastic about using Mypace**
Algebra Test Result	31%
Previous Test Results	Natural numbers 67% Integers 62% Fractions n/a Decimals 34% Sets 84% End of Term 1 27% Average **54.8%**
Previous Average Results **vs** Algebra Result **55% vs 31%** **-24%** 	

Days Absent from class during research	Pre survey taken?	Post survey taken?	Total number of content viewed	Number of content rated
3/18	Yes	Yes	41	28

Researcher Comments:

No. 14	Boyle15
	a) **I enjoyed that you can see what your other classmates view and rated**. It gives you a wide choice of games and videos d) You can see loads of helpful videos and websites g) **I am becoming more enthusiastic because I became to understand the concept of algebra.** The videos are very good h) Good, **it makes students learn for themselves** m) **Yes I would like to learn in the future like this** because it is good.
	j) No, **I liked the way I learned before** n) No, I found it easy to learn without it
Algebra Test Result	85%
Previous Test Results	Natural numbers 97% Integers 83% Fractions 94% Decimals 85% Sets 93% End of Term 1 86% Average **89.67%**
Previous Average Results **vs** Algebra Result **90% vs 85%** **-5%** 	

Days Absent from class during research	Pre survey taken?	Post survey taken?	Total number of content viewed	Number of content rated
0/18	Yes	Yes	66	60

Researcher Comments:

No. 15	Boyle16
	a) **I enjoyed learning algebra online using MyPace** because there are so many videos to choose from c) **I think it is a great idea of using computers for a chapter and taking a break from the books**, it's just that with independent learning I;m afraid that if I don't get something in algebra will the teacher revise over it with us? **d) I feel that I have progressed in algebra as maths professors are teaching me** **f) I am enjoying MyPace and learning independently. It is a great experience** g) **I am becoming more enthusiastic about learning** using the MyPace system as I feel algebra has come clearer to me i) **My Pace is good for finding out how to solve a** sum rather than looking at the examples in the book n) I found **reflecting on my learning helped me improve on my independent learning skills**
	b) There is **too much content that is useless** and its quite hard to find what you are looking for e) After my first week of using MyPace **I disliked when I didn't get a section of algebra in my book so I go onto MyPace and can't find a suitable video**. k) Adding a better search engine on it and adding a chat bar to post anything you feel about MyPace to the public m) **I would not like to learn again like this because I found it very tough when I didn't get something in algebra** and if I search it on the internet, there is a lot of rubbish on it that is useless
Algebra Test Result	69%
Previous Test Results	Natural numbers 97% Integers 78% Fractions 95% Decimals 63% Sets 100% End of Term 1 83% Average **86%**
Previous Average Results **vs** Algebra Result **86% vs 69%** **-17%** 	

Days Absent from class during research	Pre survey taken?	Post survey taken?	Total number of content viewed	Number of content rated
0/18	Yes	Yes	34	31

Researcher Comments:

No. 16	Boyle17
	a) I enjoy seeing new websites and learning new things on MyPace d) I enjoy the activities on MyPace g) **Yes I am becoming more enthusiastic**, it is getting very easy for me and my learning m) Yes, because I found it easy and simple
	i) Yes, **sometimes I find it hard to find content on MyPace**
Algebra Test Result	54%
Previous Test Results	Natural numbers 63% Integers 69% Fractions 41% Decimals 59% Sets 61% End of Term 1 35% Average **54.67%**
Previous Average Results **vs** Algebra Result **55% vs 54%** **-1%** 	

Days Absent from class during research	Pre survey taken?	Post survey taken?	Total number of content viewed	Number of content rated
3/18	Yes	Yes	66	48

Researcher Comments:

Comments will go here

No. 17	Boyle18

<table>
<tr><td>  </td><td>a) Sometimes recommended games or videos come up on my web page. Some of the games and videos were quite useful and interesting
d) The rating of content was good because when some people rated it good you could have a look at it
f) I think the MyPace system is both interesting and fun to use. I would recommend it to others classes in the school or different schools.
g) I am becoming more enthusiastic about learning using the MyPace PLS because the videos and games are extremely interesting and very, very useful.
h) I thought it was a good way of learning subjects through technology and now I think it is extremely good to learn through technology with websites like the MyPace system
j) I am beginning to think differently about my learning because now you don’t just have to use textbooks and workbooks all the time, you can browse the internet for maths or any other subject.
m) Yes, I would like to learn like this in the future maths topics or any other subjects because they are interesting and worked really well for me personally
n) Yes I found reflecting beneficial because I find out where I need to improve my skills and I am doing a basic summary of what I did in maths at home and in school.
l) I used the book to finish the last two sections</td></tr>
<tr><td>  </td><td>b) Some of the games and videos were too easy while others were useless or too complicated
i) Used the book for questions on variables and expressions
k) MyPace could improve by making all of the other maths topics available and not just algebra.</td></tr>
<tr><td>Algebra Test Result</td><td colspan="2">89%</td></tr>
<tr><td>Previous Test Results</td><td>Natural numbers 91%
Integers 78%
Fractions 95%
Decimals 84%
Sets 100%

End of Term 1 97%</td><td>Average
90.83%</td></tr>
<tr><td colspan="3">Previous Average Results vs Algebra Result
90% vs 89%

-1%
  </td></tr>
<tr><td>Days Absent from class during research
0/18</td><td>Pre survey taken?
Yes</td><td>Post survey taken?
Yes</td><td>Total number of content viewed
35</td><td>Number of content rated
25</td></tr>
</table>

No. 18	Boyle19
	a) The best part would have to be the rating of things I have viewed d) The things **I enjoy the most about MyPace is that you can reflect on your work** **h) My current opinion of learning through technology is that it is really good and it really helps to learn** j) Yes, because now we **need to take responsibility for our own learning** n) Yes, **I found reflecting helped improve my independent learning skills** because I could see my progress by looking back at the journal
	b) I disliked the way that you had to search things. I would like it better if it was sorted out into folders and you could choose which parts of the algebra you wanted to learn about e) The thing I **dislike the most about MyPace is that it's quite hard to find exactly what you are looking for** g) I am becoming **less enthusiastic about learning using MyPace because it is not as good as the book.** m) No, because even though I understand most parts some were very hard to understand.
Algebra Test Result	68%
Previous Test Results	Natural numbers 80% Integers 53% Fractions 53% Decimals 54% Sets 79% End of Term 1 72% Average **65.16%**
Previous Average Results **vs** Algebra Result **65% vs 68%** **+3%** 	

Days Absent from class during research	Pre survey taken?	Post survey taken?	Total number of content viewed	Number of content rated
2/18	Yes	Yes	47	40

Researcher Comments:

Comments will go here

No. 19	Boyle20
	a) I enjoyed the way you could play games and I could take down the notes that I thought I would need. I viewed a few videos about algebra first to understand it **c) I would recommend this to others** d) After my first week of using MyPace the thing that I enjoy the most is learning algebra and looking up videos to help me understand new topics that I do not understand **f) I really like MyPace because it helps me understand things that I do not understand** g) I think **I am becoming more enthusiastic about using the MyPace PLS** h) My current opinion of learning through technology is brilliant because **it is a great learning experience and I think that I would definitely use it after if I am stuck on something** that our class has already gone through k) No, I do not think there needs to be any improvements about how we are using MyPace **l) I have also been working using my book and if I don't understand something I use MyPace to watch a video etc.** n) I do find that reflecting on my learning helped me to improve my independent learning skills **o) I think this was a good experience and I would recommend this to others**
	b) The **only thing that I disliked was that you could not talk to others**, but now I think that its better that way m) **I would not like to learn this way** because I think that it is too confusing but **I think that I benefited from this**
Algebra Test Result	66%
Previous Test Results	Natural numbers 86% Integers 35% Fractions 60% Decimals 54% Sets 88% End of Term 1 47% Average **61.66%**
Previous Average Results **vs** Algebra Result **62% vs 66%**  **+4%**	

Days Absent from class during research	Pre survey taken?	Post survey taken?	Total number of content viewed	Number of content rated
1/18	Yes	Yes	59	56

No. 20	Boyle21				
	a) **I loved playing their games because I learn and have fun**. I also like watching their videos because **it helps me to learn a lot and their not boring**. I love the idea of your very own avatar **c) At the end everybody should make their own video and their explaining how to do algebra** d) I found the videos more interesting each day, same with the games their so much fun. I enjoy finding and learning algebra on the computers. **MyPace is really helping and interesting. I'm learning more and more each day** e) **I am having lots of fun while learning**. MyPace it's really helpful and fun k) I think MyPace is helping a bit, mostly the videos. I don't like reading about algebra o) **I really prefer learning from a teacher its easy but not as fun as computers** but if I had the choice I would pick the teacher				
	b) There are some videos that are extremely long like 20mins and after 10mins of the same video you get bored. **There are some videos that are way too advanced and I have no idea what they are talking about.** e) I'm learning a lot about algebra but it is not easy, **it's quite hard but I am trying my best.** h) **I love using the computer but MyPace is getting boring.** I love the idea of using a computer i) **I'm afraid to be behind everybody and won't do well on my test because** I'm still not used to independent learning j) I learn better, when a teacher, teachs me. **It's harder to learn on your own.** Algebra is getting harder l) The chapter is really big and I'm afraid to be behind everybody **m) I wouldn't like to learn on my own in the future because I found it fun but extremely hard.** n) Personally **I didn't find reflecting on my learning skills helpful**				
Algebra Test Result	53%				
Previous Test Results	Natural numbers 85% Integers 62% Fractions 71% Decimals 78% Sets 76% End of Term 1 51%		Average **70.5%**		
Previous Average Results **vs** Algebra Result **71% vs 53%** **-18%** 					
Days Absent from class during research 4/18	Pre survey taken? Yes	Post survey taken? Yes	Total number of content viewed 80	Number of content rated 79	

No. 21	Boyle22
	a) I enjoyed the videos because they showed me how to work the problems and talked through it. The **quizzes are very helpful and are easy to understand and help me to do better.** **c) I thought that the notations were hard when I started but became easier watching the videos** d) **I am using the book more and finding it slightly easier** with the questions and examples
	b) Some of the web pages were useless but everything else was helpful e) Trying to find good videos **g) Less because I have settled into using it** h) **Yes because it is getting harder with algebra** and the videos I am looking at are not much help **j) Yes I think it is harder and they aren't helping me** **m) No because I prefer for someone to teach me and give me help** n) I am unsure I didn't use it a lot
Algebra Test Result	64%
Previous Test Results	Natural numbers 91% Integers 74% Fractions 79% Decimals 80% Sets 96% End of Term 1 67% Average **81.17%**
Previous Average Results **vs** Algebra Result **81% vs 64%** **-17%** 	

Days Absent from class during research	Pre survey taken?	Post survey taken?	Total number of content viewed	Number of content rated
0/18	Yes	Yes	66	54

Researcher Comments:

No. 22	Boyle23
	Introduction: **I think that it is a great way to see how far we can push ourselves** to get what we want to get in maths it is important to know how to do it not just write the answer down. a) I enjoyed the way **MyPace is cool in the way that it helps us learn it teaches us how to do it by ourselves** b) I did not dislike the MyPace system c) One comment I would like to make would be to show more games so we can learn more d) I found the system useful because **if I got stuck I could just look at it and it would give me an indication on how to work at it** g) **Yes I am becoming more enthusiastic because I am learning more for myself** and doing a lot of exercises in my book h) My current opinion is that it is a good way of learning by yourself i) I would like to reflect that it is getting much more easier to use **j) I am because I used to depend on my teacher and now I do not depend on anyone, I can do it myself.** **l)** Yes **I have been going on MyPace and learning more** m) I would like to learn this way because I would be able to see what I need help on and what I am good at **o) Yes that I think I got a lot out of MyPace and that I would like to do it again**
	n) No
Algebra Test Result	73%
Previous Test Results	Natural numbers 44% Integers 46% Fractions 51% Decimals 81% Sets 83% End of Term 1 38% Average **57.17%**
Previous Average Results **vs** Algebra Result **57% vs 73%** **+16%** 	

Days Absent from class during research	Pre survey taken?	Post survey taken?	Total number of content viewed	Number of content rated
3/18	Yes	Yes	37	32

Researcher Comments:

No. 23	Boyle24
	a) The games help you revise what you have learned and learn more f) It would be good to have more games **because children learn through activity most of the time** g) **I am becoming more enthusiastic** because when you search a topic you get loads of options and the videos give you loads of information. h) I still enjoy MyPace but **sometimes I prefer using the book** to do questions. **The MyPace games are also very good because it helps you learn through having fun** i) No, MyPace is working very well and is very helpful for independent learning j) **I find it easier to learn now because all the content has pictures that help me remember** information l) The videos are very good at explaining information **m) I would like to learn like this in the future because it means you can enjoy maths while learning and you are able to help friends if they need help** n) Reflecting on what I learned helped because it reminded me of what I had learned in class o) The **MyPace is very good and would help loads of students learn**
	b) Some of the videos were not very informative they just gave you a sum and an answer without calculations
Algebra Test Result	72%
Previous Test Results	Natural numbers 92% Integers 83% Fractions 91% Decimals 66% Sets 93% End of Term 1 76% Average **83.5%**
Previous Average Results **vs** Algebra Result **84% vs 72%** **-12%** 	

Days Absent from class during research	Pre survey taken?	Post survey taken?	Total number of content viewed	Number of content rated
0/18	Yes	Yes	60	37

Researcher Comments:

No. 24	Boyle26
	a) I like using the MyPace website because you can pick any video you think looks good and **if you don't understand you can look at a different one. I also like it because you can learn at your own pace** **c) I had a very successful day on MyPace. I found one video that went through mixed variables and I was very happy with it** d) I like MyPace because you get to pick what video you think will be useful and **you are not rushed so you can go at your own pace.** g) **I am becoming more enthusiastic about learning using MyPace** because before I could never really find any good videos so I was working out of my book but now I can find loads of good videos **h) I like using technology to learn because everyone learns differently and with technology you can use the book sometimes and choose what videos you think will help you** **j) Yes I am thinking differently about my learning because working out of the book by myself makes me think twice about the question I am about to ask because I can find it out for myself** o) I enjoyed using MyPace because **it will help me in college when there is no teacher to tell you what to do**
	b) I didn't like the way there was a lot of games and not many videos to help you play the games e) I don't like the way **when you are working out of the book and you get stuck on a question you can never find help.** k) I think we could take notes on what we learn on MyPace because **if your looking at loads of videos the information will go out of your head** and not to play so many games m) I would not like to learn like this in the future because **I found it a lot harder in my test today than I usually do in the past tests I have done**
Algebra Test Result	53%
Previous Test Results	Natural numbers 69% Integers 56% Fractions 79% Decimals 48% Sets 81% End of Term 1 51% Average **64%**
Previous Average Results **vs** Algebra Result **64% vs 53%** **-11%** 	

Days Absent from class during research	Pre survey taken?	Post survey taken?	Total number of content viewed	Number of content rated
0/18	Yes	Yes	15	7

No. 25	Boyle27
	m) I wouldn't like to learn like this in the future because it's easier when our teacher explains it to us n) Yes because it's like revising on what you did but giving your own opinion
	
Algebra Test Result	44%
Previous Test Results	Natural numbers 75% Integers 54% Fractions 57% Decimals 42% Sets 72% End of Term 1 35% Average **55.84%**
Previous Average Results **vs** Algebra Result **56% vs 44%** **-12%** 	

Days Absent from class during research	Pre survey taken?	Post survey taken?	Total number of content viewed	Number of content rated
8/18	Yes	Yes	29	20

Researcher Comments:

No. 26	Boyle28
	a) The first time I used MyPace I enjoyed how if you couldn't find any good video or games on algebra that **you could see what other people in your class viewed or rated and click on some of them** c) I think I should look at more content and take more notes d) The thing **I enjoyed most and found most useful was the rating**. If I couldn't find any good videos I could see what others liked and disliked and it saved me a lot of time **f) Speed up my work a bit because test is in a week or so and I still have a lot of notes to take down and learn.** j) I am beginning to think differently about my learning and how I learn because **I have learned you don't always need a teacher to show you how to do stuff and teachers won't be there for you all your life so I have to learn how to figure stuff out by myself.** l) I think I should go over everything I have done in the algebra chapter before my test m) **I think learning like this is a good way to learn because in college we won't have teachers to help us**, but I don't really like learning like this because it's a bit confusing sometimes.
	b) The thing that I disliked most about my first use of MyPace was that there was so many **different videos and all of them telling you how to do algebra different ways** g) **I am becoming less enthusiastic about learning using MyPace** because I have looked at a good few videos and **I am becoming a bit bored** with using it. h) I don't really like learning through technology because there is **too many videos telling me all different ways to learn algebra**. It has not changed since using MyPace k) I think MyPace is a good system but I just think it's hard to find helpful video to what you are actually looking at n) I don't think reflecting on my learning helped me to improve my independent learning skills because **I didn't read back over the reflections and didn't really see the point of my reflections**
Algebra Test Result	83%
Previous Test Results	Natural numbers 93% Integers 70% Fractions 92% Decimals 95% Sets 91% End of Term 1 78% Average **86.5%**
Previous Average Results **vs** Algebra Result **87% vs 83%** **-4%** 	

Days Absent from class during research	Pre survey taken?	Post survey taken?	Total number of content viewed	Number of content rated
1/18	Yes	Yes	56	9
Researcher Comments:				

No. 27	**Boyle29**
	a) The games are good g) More enthusiastic about MyPace i) Not really, I used my book at home j) Yes, it's a lot harder now m) Yes, I thought it was good because you learn from your mistakes. It wasn't easy but it was ok
	b) I don't like the videos because I don't understand them c) I don't understand the basics of algebra and don't know how to teach myself. I am afraid I might not get a good grade in algebra l) I'm not going to get a good grade because I'm not trying hard enough n) No, not really
Algebra Test Result	59%
Previous Test Results	Natural numbers 73% Integers 33% Fractions 45% Decimals 29% Sets 79% End of Term 1 32% Average **48.5%**
Previous Average Results **vs** Algebra Result **49% vs 59%** **+10%** 	

Days Absent from class during research	Pre survey taken?	Post survey taken?	Total number of content viewed	Number of content rated
0/18	Yes	Yes	76	53
Researcher Comments:				

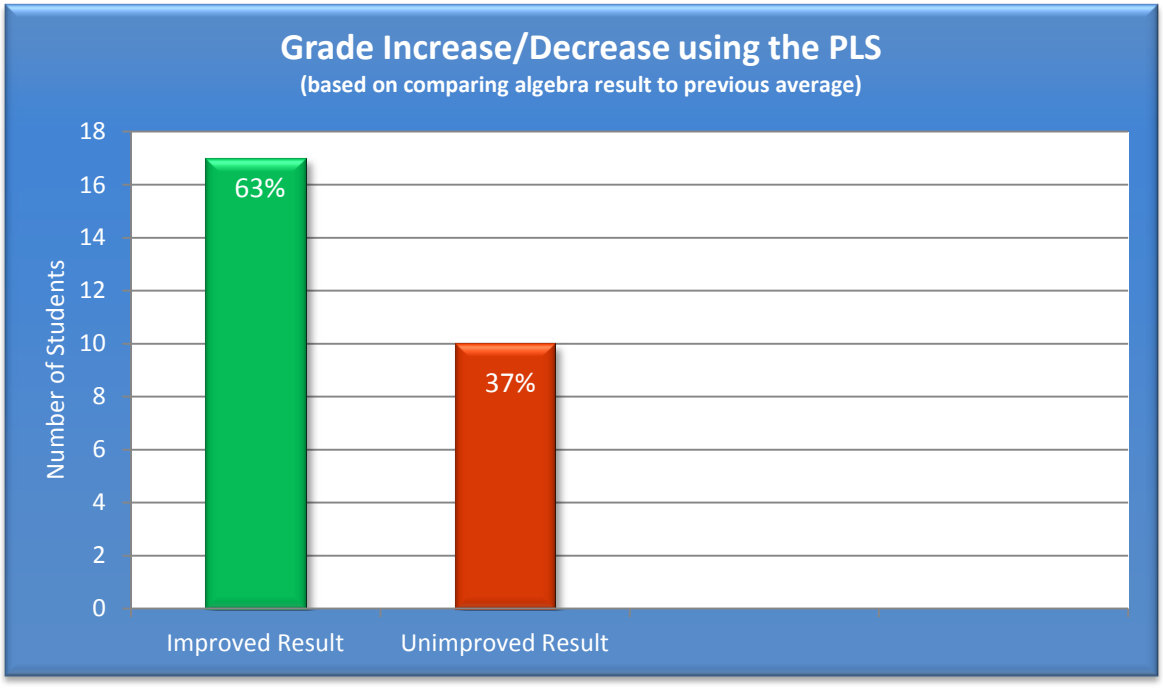
Note: Boyle01 & Boyle25 did not want their results used in the research

Overview of Participants Results Tables

Number	Male/Female	Participant Number	Average Result %	Algebra result %	% + or -	
1.	Male	Boyle 2	85	84	- 1	
2.	Male	Boyle 3	65	54	-11	
3.	Male	Boyle 4	32	36	+4	
4.	Male	Boyle 5	89	89	0	
5.	Male	Boyle 6	69	59	-10	
6.	Male	Boyle 7	73	69	-4	
7.	Male	Boyle 8	28	29	+1	
8.	Male	Boyle 9	91	91	0	
9.	Male	Boyle 10	69	69	0	
10.	Male	Boyle 11	79	63	-16	
11.	Male	Boyle 12	85	82	-3	
12.	Male	Boyle 13	58	52	-6	
13.	Male	Boyle 14	55	31	-24	
14.	Male	Boyle 15	90	85	-5	
15.	Male	Boyle 16	86	69	-17	
16.	Male	Boyle 17	55	54	-1	
17.	Male	Boyle 18	90	89	-1	
18.	Female	Boyle 19	65	68	+3	
19.	Female	Boyle 20	62	66	+4	
20.	Female	Boyle 21	71	53	-18	

21.	Female	Boyle 22	81	64	-17	
22.	Female	Boyle 23	57	73	+16	
23.	Female	Boyle 24	84	72	-12	
24.	Female	Boyle 26	64	53	-11	
25.	Female	Boyle 27	56	44	-12	
26.	Female	Boyle 28	87	83	-4	
27.	Female	Boyle 29	49	59	+10	

Based on the -10% allowance, 10/27 or 37% did not improve their result after learning algebra using the MyPace system. However 17/27 or 63% did improve.



Appendix 18

Future learning using a PLS

Number	Male/Female	Participant Number	Yes/No
1.	Male	Boyle 2	Yes
2.	Male	Boyle 3	Yes
3.	Male	Boyle 4	Yes
4.	Male	Boyle 5	Yes
5.	Male	Boyle 6	Yes
6.	Male	Boyle 7	Yes
7.	Male	Boyle 8	Yes
8.	Male	Boyle 9	Yes
9.	Male	Boyle 10	Yes
10.	Male	Boyle 11	No
11.	Male	Boyle 12	No
12.	Male	Boyle 13	Yes
13.	Male	Boyle 14	No
14.	Male	Boyle 15	Yes
15.	Male	Boyle 16	Yes
16.	Male	Boyle 17	Yes
17.	Male	Boyle 18	Yes
18.	Male	Boyle 19	Yes
19.	Female	Boyle 20	No
20.	Female	Boyle 21	No
21.	Female	Boyle 22	No
22.	Female	Boyle 23	Yes
23.	Female	Boyle 24	Yes
24.	Female	Boyle 26	No
25.	Female	Boyle 27	Yes
26.	Female	Boyle 28	No
27.	Female	Boyle 29	Yes

This chart uses the data from the show of hands for ‘those that would like to learn like this again in the future’ during the discussion.

- Overall 20/27 or 74% of participants said they would like to learn like this in the future
- 16/18 or 89% of males said they would like to learn like this in the future.
- 4/9 or 44% of females said they would like to learn like this in the future