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Children's Perception of learning with Educational Games Using iPod Touches

Yasemin Allsop

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Abstract

The use of computer games on mobile devices in schools for learning is still relatively new and is constantly evolving. The successful integration of this emerging technology into education requires a longitudinal study into how they are being perceived by learners and teachers. Finding out what works well with children in the terms of technology and pedagogy will be beneficial for both educators and technology developers as well providing an insight into how children learn. This paper is focused on student' perceptions of learning with games using iPod Touches. Both qualitative and quantitative approaches were employed including; surveys, interviews, observations and analysis of the children' work. The research involved different steps; finding literature, practical research in a primary classroom, analysing the data as an outcome of the practical research to understand the students' attitude towards learning with games using iPod touches. The overall student' perception of learning with games using iPod touches was a positive one. Many described their experience as 'fun', 'cool' and 'interactive'. It was evident in this study that iPod Touches had an impact on students' learning experience by making learning more interesting and fun, but it is difficult to measure if this had any effect on their actual learning.

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Chapter 1: Introduction

1.1 Background

In today's technologically advancing world, computer games have become a daily part of children's and young adults' lives. Many children spend hours playing their favourite games rather than reading (Oblinger, 2004). Researchers and educators started to see the power of this new medium and exploring ways of how to use computer games to support learning within the schools became a focus. Some suggested that games have a motivational power which can be used for facilitating learning (Squire, 2003), where others indicated that the use of appropriate games can improve thinking (Aliya, 2002) and enhance learning (Malone, 1981). How can technology achieve such an impact on learning? Many studies tried to answer this question focusing more on pedagogy; however, not many investigated the effectiveness of the gaming technology, or the content or the design of the game. Can we assume that children's game experience and learning they gain using a PC, console, or a portable device be the same? Earle (2002) suggests that there is a strong link between the design of the technology, and its impacts on teaching and learning. I agree with this and also suggest that students' interaction with the technology, which enables the learner to have a relationship with the medium, also affects the learning outcome. This interaction is not only shaped by students' characteristics but also closely linked to capabilities and design features of the medium. Although there are many references in research literature about technology, including computer based games having a varied impact on learning (Gee, 2003), not many studies have looked into the relationship between children's perceptions of different gaming technology and whether their viewpoint is influenced by gender, game content, the design features of the device, cost and / or their previous experiences with the medium.

1.2 The research Question

The recent integration of technology into the Schools curriculum has raised interest in the understanding of students' perception of technology (Léonie J. Rennie & Tina Jarvis, 1995). The implementation of new technology such as iPod Touches in education is relatively new and research into the attitudes of children towards this new device is limited and mainly focused on high school students. Exploring students' perceptions of learning, using technologies such as iPod Touches, may help educators to implement

new devices into education and also may support technology developers to design appropriate technology tools to use for academic purposes.

The main purpose of this study is to investigate children's perceptions of learning with educational games using iPod touches.   It aims to observe and understand the experiences of children to identify their viewpoint of learning using iPod touches.

1.3 Research Outline

This introduction is followed by a study of games based learning and the theories behind it. This also provides an overview of the tools for digital gaming which includes computers, game consoles and handheld devices. Chapter 3 presents a review of the literature linked to the research focus. Chapter 4 explains the research approach and methodology used for this study. The final chapter presents data and analysis of the findings in connection with literature and research background. This section also summarises the study, its limitations and suggested areas for further work.

Chapter 2: Educational Background

2.1 Electronic Story books to iPod Touches

Computer games have become very popular over the last two decades, especially amongst young adults and children, whose daily lives have offered them the opportunity to experience different media.   According to a survey study that was conducted by MORI, around four-fifths (79%) of children play video / computer games at least a few times a week either on their own or with friends, with 37% playing every day (Futurelab, 2009).   There are some reasons for this situation; firstly the marketing strategies that the Gaming Industry use, have been very successful at attracting children to play and promoting the pleasures of gaming. Industry figures show that the number of games consoles, in use in the UK, have increased from 13.5 million in 2008 to 22 million in 2009; and during 2010, 63 million console and PC games were sold domestically, which works out at more than one per person in the UK (UKIE 2010). Secondly the invention of personal computers followed by the use of portable devices for gaming has made this new experience more accessible. Portable devices which are also described as handheld devices in education moved from PDA's to cell phones and

MP3 players. Once used as an MP3 player, Apple's iPod Touch emerged into a pocket computer, with many capabilities that are used within classrooms for academic purposes, such as listening and creating podcasting, reading, playing games. Being inexpensive compared to classroom laptops and their portability, iPod Touches offer learning experiences independent of time and location. The use of new mobile technologies such as PDAs and iPods in education, makes learning much more attractive for students, which allows them to focus for longer periods (Banks, 2007). However, successful integration of iPod Touches into classrooms can only be achieved by adopting appropriate pedagogical principles. To understand these principles we need to look at how video and computer games became an instrument for education over the years.

2.2 Learning Through Games

When computer-based games were first developed, they were seen as a type of entertainment media and a distraction from undertaking homework, rather than being a learning and teaching tool with an educational value. Since the first game 'Space War', developed by Steve Russell (Graetz, 1981) and other text-based adventure games, the approach towards the purpose of these games has changed dramatically. During the 1990s, video and computer games became a part of the daily lives of children (Fromme, 2003) and their potential to become instruments of education increased. Educators who have experienced the use of technology to support teaching and learning believed that electronic tools such as game consoles, electronic toys and PCs offer play opportunities that are very important for promoting children's development in numerous areas including, mathematics, literacy and critical thinking (Bronson, 2003). Some researchers argue that limiting outcomes of games-based learning to curriculum goals, can overshadow other important skills that are developed by the learners. Gee (2004) talks about how people learn to play games and master skills by overcoming challenges that are part of the game according to their participation in 'semiotic domains' basically utilising 'made-up' words and images that are used to communicate when playing games. Furthermore, he explains that 'critical learning' occurs when the player experiments with different identities and overcomes the limitations of both their virtual and real life identities. Gee also argues that when people learn to play a new game, they basically learn a new language in the format of text or graphics which he describes as

'critical learning'. However, he doesn't explain if everybody will engage with the game at the same level, have the same experiences, and develop the same skills. Another issue that needs to be addressed is a player's motivation reason with the game. Most will be different and designing a game that meets all the players' needs is a challenge.

Furthermore there are questions related to how people's passion for commercial games can be captured and transferred to educational games. Many educators believe that the answer to this question lies in understanding the importance of motivation in teaching and learning. Motivation is seen as the key to improving learning and achieving learning outcomes (BECTA, 2008). Using activities that capture the children's interests reduces the risk of boredom and encourages children to take part actively. Lessons become more relevant to learners and their attitude towards the learning experience itself becomes more positive when learners are motivated. Thomas Malone (1980, p. 50) suggests that the main reason that people play games, is because they offer challenges, fantasy and curiosity, which can be seen as major ingredients for motivation. The development of computer games and their implementation into education has shown that children like computer games, but the effectiveness of the game to engage children with the learning activity depends on its design (Prensky (2001). Prensky describes the importance of the balance between the graphics-visual appeal of the game and controls-events of the game which he refers to as 'Eye candy' and 'game play'. Having a game that looks pretty alone is not enough to be relevant to learners without an interesting plot-line that offers engaging events and appropriate level controls. Well-planned educational multimedia games with clear objectives can engage students through fun, visual and interactive activities by combining pedagogy and entertainment (Laghos, 2008). However, the literature doesn't fully explain the factors that motivate players to play a game and the learning that is gained as an outcome of game-playing. It is especially very difficult to distinguish the effect of other mediums on the learning that can be gained by students.

How can practitioners justify that game-based learning is effective and has an impact on students learning? How can they evaluate the effectiveness of game-based learning so that they can show the impact on a students' progress? Connolly et al. (2008) presented

a framework to evaluate game-based learning. According to them there are seven aspects that should be analysed to evaluate the effectiveness of game-based learning. These are; learner performance, motivation, perceptions, attitudes, collaboration, preferences and a game-based learning environment. They talk about the importance of the perception of students towards game-based learning, their previous experience with the game and the level of the skills they developed as an outcome. Additionally they emphasize the value of understanding the feelings of not just the learners but also the teachers towards the subject and the use of games to learn that subject.

2.3 Learning Theories behind GBL

Studying students' perceptions of learning with games using iPod Touches involves an extensive understanding of games-based learning, mobile learning and the capabilities and affordances of the iPod Touch instrument. In this section, the games-based learning pedagogy will be explored and brief information about mobile learning will be presented. This will be followed by examining the affordances of the iPod Touch device.

Parallel to integrating games-based learning into education, the impacts on learning and investigating the theories that support games-based learning became a focus point for researchers. Whilst there are some existing learning theories which are integrated into the new games-based learning environment, some new models have developed. Well known theories such as constructivism, problem based learning, inquiry based learning and experiential learning provides a framework for understanding the principles of games-based learning in relation to teaching and learning.

Constructivism

Constructivism it is not just a single theory, it is a combination of many perspectives that are related to active-learning. Constructivist theory holds that people construct meaning through their interactions and experiences in social environments. According to Piaget (1970), children learn when they are actively involved in the process. Prensky (2000) agrees with the constructivist theory, but he also talks about additional relevant theories, suggesting that instruction can be evaluated along two dimensions, engagement and learning. He cited that games are effective tools for teaching and learning because they are learner-centered and motivate learners. Furthermore, he

explained; video games enable learners to be active participants and allow them to take actions and experience the results of their actions (Prensky, 2007). Gee (2004) also agrees with games-based learning supported with a constructivist theory. He explained, "You cannot play a game if you cannot learn it" (Gee, 2004, p. 6), emphasizing game designers need to create games that learners can learn by themselves to play which compels the learner to be an active participant in the learning activity not a passive observer.

Honebein (1996, p.11-12) describes seven pedagogic approaches to create constructivist learning environments; provide students with experience of the knowledge construction process; provide experience in and appreciation for multiple perspectives; maintain the authentic context for learning tasks; provide student-centered learning; encourage collaborative learning; encourage the use of multiple modes of representation; encourage self-awareness in the knowledge construction process. These principles are closely linked to the application of games-based learning. Games encourage learners to explore virtual, media-rich environments where they can create authentic situations for developing skills that can be used in real life situations. Learning environments based upon constructivist principles engage and motivate learners. There are many studies which suggest that technology, including videogames, can be used to engage and motivate students for academic purposes (Papert, 1993; Prensky, 2001; Gee, 2003; Jonassen, 2003; Shaffer, 2005). Although there isn't much evidence showing that games-based learning improves learning, the 'play' and 'fun' factor of games seem to engage learners with the learning which may also impact on learning.

Experiential learning

This perspective suggests that students learn better when they actively construct meaning by exploring and experiencing authentic contexts for themselves. Kii (2005) suggests that educational games offer a meaningful environment for problem-based learning. Games provide learners with an authentic task which engages them in problem solving. Games also provide experiential learning spaces, where learners examine and reflect on the situation using resources available in the service of complex problem-solving (Gee, 2003; Squire, 2003), especially games that offer multiple-solutions to

problems. However there is no evidence if the students take responsibility for their own learning, when they are applying their new knowledge into real life situations.

Problem - Based Learning

Problem based learning is a type of activity-based learning, where the student is given a problem to solve with the resources given, but the information on how to solve the problem is not provided (Boud & Feletti, 1991). Enabling students to be actively involved in the learning process, encouraging them to take responsibility for their own learning, teachers acting as a facilitator are the key elements of this approach. Computer games also can facilitate problem-based learning (de Freitas, 2006). Many video games provide problem solving environments, where players have to engage with the characters, story and the problem to complete the game; however, the skills they develop when playing games may not always be applicable to real-life problems. Designing games to develop specific skills may also not always be feasible. One other issue is that problem-based learning is usually group-based; however, computer games are generally played alone.

Collaborative Learning

Collaborative learning focuses on the importance of students working together, sharing ideas and learning from each other. According to Vygotsky (1978) learning occurs firstly at a social level then at an individual level. When children play multi-player games they take part in collaborative activities where they can exchange ideas, develop communication skills and appreciate each others perceptions. Online gaming communities also can be seen as a collaborative learning environment where players can learn and share information related to games with other players such as; game rules, processes, instructions. Nevertheless not having a specific goal and concrete tutor support may not be appealing for every learner. There are also some other potential issues; some students may prefer to work alone rather than collaboratively and differences in time zones may be problematic for work schedules and communication across the continents. Therefore educational multi-player games need to be well designed to foster collaborative learning opportunities (McGerenere, 1996).

2.4 Moving Towards Mobile Learning

Whilst computers are widely used for gaming purposes, the use of portable devices for game playing is becoming more popular than ever. The development of new portable gaming devices and sophisticated mobile phones have hastened this process rapidly. It is very difficult to give a description of mobile learning, considering many researchers have been focusing on the attributes of handled devices and missing on the relationship to learning that is perceived by the learners. Mobile learning merely can't be just about learning using portable devices. It is apparent that learning is done by using portable devices but does this explain the context of the mobile learning and its underlying principles.

Winters (2007) talks about four different perspectives on mobile learning;

- Technocentric

- Relationship to e-learning

- Augmenting formal education

- Learner-centred

 In the technocentric perspective, learning is seen as learning using a portable device such as mobile phone and iPod Touch. In the second perspective, mobile learning is seen as an extension of e-learning. Augmenting is defined as adding something to face to face communication. A learner-centred approach suggests that the focus should be on the mobility of the learner and device itself. Thus, what is mobile learning?

Quinn (2000) described it as the learning that takes place by using mobile devices. O'Malley et al. (2003) defined it as; "Any sort of learning that happens when the learner is not at a fixed, predetermined location, or learning that happens when the learner takes advantage of learning opportunities offered by mobile technologies". This description places the learner at the centre of mobile learning and suggests that learning happens when the learner interacts with the mobile technology. It is evident that mobile learning consist of; learner, mobile technology and the interaction between these two.

Despite the fact that there is no clear commonly agreed definition of Mobile Learning, set framework or concrete pedagogy, there are many studies which suggest that when used with web 2.0 technologies and games, mobile learning offers exciting learning opportunities to students.   In a comprehensive study Attewell (2004), suggests that mobile learning may have a positive contribution in various areas. Her study findings indicated that mobile learning helped learners to improve both their literacy and numeracy skills.   She also reports that mobile learning helped learners to focus on learning for longer and helped them to raise their self-esteem and self-confidence.   In another study, Pollara and Broussard (2011) produced an extensive review of 18 studies that investigated students' perception of mobile learning.   Their research showed that students found mobile learning motivational and enjoyable.

The question is 'How?'   How does mobile learning achieve such an impact?   One suggested explanation for this is; mobile learning allows students to learn anywhere and at anytime which encourages students to learn in both their home and school environments. This can be very useful for closing the gap between school and home learning. The vast amount of content available for mobile devices is also another factor. Today students can access train time-tables, music videos, curriculum games and much more information by just downloading data onto their devices.   Mobile learning promotes collaborative working but also provides opportunities for personalized learning too. Mobile learning additionally offers a blended learning environment from face-to-face to using cameras and MP3 players. When there is a class of students with diverse needs that require different learning styles, this can be a very useful tool for educators.

Shuler (2009) outlined five opportunities that mobile learning offers; encourages 'anywhere', 'anytime' learning; provides opportunities for under-served children (meaning; reaching children from developing countries and disadvantaged communities); improve 21st century social interactions, adapt into many learning environments and provide personalized learning experiences. In her report 'Pockets of Potential' she also talks about the key challenges in mobile learning. These are; negative aspects of mobile learning such as distraction or health issues; cultural norms and attitudes where parents and teachers may not see the potential of mobile learning; no mobile theory of learning to support the design of new applications for learning;

differentiated access and technology where there are so many devices available it is hard to decide which one will facilitate the learning and finally limiting physical attributes such as poor design.

2.5 An overview of the affordances of iPod Touch

Today computer games can be played on portable, handheld devices, personal computers and specialized games consoles. Computer games can also be played online on the Internet. Despite many mediums being available for gaming purposes, only a few have been used for educational purposes. This section will provide an overview for the affordances of the iPod Touch device. Becoming familiar with the capabilities of the iPod Touch is useful, when investigating the relationship between the perceptions of the students and the affordances of the iPod Touch device.

Evolved from Apple's MP3 player, the iPod Touch is a rectangular shaped, thin, handheld device with a WiFi platform. It has widescreen glass, multi-touch display. It is like a handheld computer that plays audio and displays video. It has a combination of many features such as; touch-screen, computing power, Internet connectivity, high-resolution screen, large memory. The touch-screen allows learners to physically manipulate data or objects. The affordances of iPod Touches are:

Portability: The iPod Touch is a small pocket sized device, which makes it easy to carry around either in or out of the classroom. It fits easily into a hand, which makes it easy to move according to your eyes.

Internet: The iPod Touch has a WiFi platform which enables Internet access. Students can browse resources either online or in the App Store. It also allows you to access You Tube, Facebook and other social network sites directly using specific apps.

Cost: The iPod Touch is a lot cheaper than laptops and computers so it is more affordable.

Text Editing: There is a notepad in the iPod Touch which is useful for text editing and note taking. You can also use it like a diary as it keeps a record of what and when you used the device.

Multimedia: The iPod Touch has a built in speaker and microphone for recording memos and playback. The new model also has a camera which also records video clips. It allows you to access iTunes for downloading music. You can also upload songs from your CDs or computer.

Content Creation: Using an iPod Touch, children can create multimedia projects. They can also download apps which enable them to design their own games even for the iPod Touch.

Sharing: Students can share and transfer data using the Internet.

Touch interface: The touch screen allows you to interact with the content without an interface. You can move objects by touching and dragging them.

Access to Content: There is a wide range of content available in the Apps Store both for educational and leisure purposes. Some apps are free to download.

Built-in Applications: It comes with the following applications pre-set by the factory; Clock, calculator, weather, map, notes, safari.

It is apparent that the iPod Touch combines many great functions and capabilities; however, having these features doesn't suggest that they will be pre-conceived by students or have an impact on their learning. The affordances are there to be perceived, but this is more likely to be determined by the interactions between the learner and iPod Touch. The following chapter will present more information on students views of the impacts of technological affordances in terms of their learning, through exploring studies focused on students perception of technology including iPod Touches.

Chapter 3: Literature Review

The purpose of a literature review in this study is to understand what perception means, how it could be measured and the previous studies that presented children's perceptions of learning with technology including mobile learning, games-based learning and new technologies such as iPod touches.

3.1 Perception

The word perception originates from the Latin word percepio and it means "the process of attaining awareness or understanding of the environment by organizing and interpreting sensory information" (Pomerantz, 2003). There are many theories about the process of perception. According to Gregory (1972 / 2000), perceptions depend upon the expectations and previous knowledge of the individual, not directly on the stimulus. In his constructivist theory of perception, which is also called the "top down" theory, he explains that perception is a constructive process and that prior knowledge is a vital element of an individual's perception of the world. He suggests that our brain makes a guess based upon both what we see and our past experiences.

Gibson (1979) argues with constructivist theory in his "bottom up" theory and he suggests that perception relies directly upon the information available in the stimulus, not on prior knowledge or experiences. He also talked about the term 'affordance' which he describes as the possibilities that the environment offers to the perceiver. Basically it is the relationship between the physical properties of the object and the characteristics of the user that facilitates an interaction between the user and the object. He suggests that the environment is perceived through affordances and that the same environment is perceived by different organisms differently, which may produce different affordances, some positive and some negative. In the technology based environment, 'affordances' have been used as the investigating opportunities that technology provides for students. When educational affordances are determined in learning environments, it refers to the relationship between the educational tool and the characteristic of the learner that enables the interaction between the two.

Brougere (1999) explains that in the culture of learning, learners' perceptions are affected by many factors such as culture, gender and social background. Additionally previous learning experiences and familiarity with the content of the learning can be also added to this list. Does students characteristics such as; previous experiences of using technology, likes or dislikes, gender, interests have an impact on their perception of learning with technology including iPod Touches? Do they perceive the affordances of the iPod Touches for learning, independent from their beliefs and experiences? The first part of the following section will review the studies about student' perception of

technology and the second part will focus on the studies in students' perception towards learning with iPod Touches.

3.2 Studies into Student' Perception towards technology

Early studies of students' perceptions of technology had been limited to college students' experiences.   McMahn et al. (1999) examined high school students' perceptions of computers.   Parr (1999) explored students' perceptions of learning contexts that used learning technologies.   Shell et al. (2005) studied high school students' perception on learning using computers.   Some studies focused on the relationship between the students' and their teachers' perception and suggested that students' attitudes to learning is closely linked to their teachers' attitude to teaching (Trigwell, Prosser & Waterhouse, 1999).   Raat and de Vries (1986) developed a Pupils' Attitude towards Technology Scale (PATTT) and investigated the attitudes of middle school students towards technology which would be helpful for developing course material.   They found that females were less interested in technology and it was less important for them than it was for male students.   They suggested that students' attitude towards technology was affected by four factors:

- Interest in technology
- Gender differences
- Diversity of technology
- Importance of technology

Recently there has been a considerable amount of research within the area of student' interest in new technology such as online learning and learning using mobile technology.   O'Malley and McCraw (1999) studied students' perceptions of online learning. They suggested that the perceived effectiveness of educational technology is based not just on the perceived characteristics of the technology but at the same time the background and characteristics of the students.

Jones and Hinkle (2005) conducted a study to find out about students perceptions of using handheld computers for mathematics instructions.   Data was collected from classroom observations, mathematics test scores, teacher interviews, teacher lesson plans and an attitude survey.   The students' perceptions were measured by using an

attitude survey before and after the study and class observation checklist. The study reported that the students attitudes towards technology was a positive one and that the majority of the students agreed that handheld computers made learning mathematics instructions 'easier', 'fun', 'interesting' and 'exciting'.

Mifsud (2005) investigated students' perceptions when using handheld devices to learn. The research was conducted in a primary school in Norway for a period of four weeks and the data was collected from observational data, interviews with the students and teachers and the students work. Research findings were placed under two categories; fun and personal and private. Mifsud reported that 89% of the students described the use of the handheld devices as 'fun'. She explored this term in the students' interviews to understand the students' preferences. The students reported that writing with a PDA was more fun than using writing books. Mifsud suggests that one reason for their preference for using a handheld device for writing could be the students' familiarity with the device and whether or not they felt comfortable using it. Another reason could be the flexibility aspect of the handheld device. The study also reported that students used their PDA to learn both at home and in school. Another important result that Mifsud noted was that the handheld devices and their contents were seen as personal and private by the students. They decorated their device how they liked and did not share it with other students.

In a comprehensive recent study Pollara and Broussard (2011) identified and reviewed the current research practices, to understand students' perception of mobile learning. They investigated 18 studies that studied attitudes towards mobile learning, focusing on the type of technology used, the activity the technology was used to support, learning tasks, perceptions, and any outcomes measured. Their review of mobile devices included; PDAs, mobile phones and MP3 players. Their explanation for selecting these devices was, 'they can be owned and used by students for learning purposes'. They also suggested that the 'personalization' element of the device can be motivational which may have a positive impact on the learning outcome. 13 studies out of the 18 they selected, centred on only the students' attitude towards learning with mobile technology, 1 on the students achievements and 4 on both attitude and achievement. They found that overall, students perceptions of mobile learning was positive. They reported that

students found learning with mobile technology enjoyable and easy to use. The students also commented on the portability of the devices. The students described their learning experience using mobile devices as 'convenient' and 'flexible'.

Since the 1980s much research has been undertaken to understand the value of games in education. One area of research is known as Game-Based Learning (GBL). Some educators and researchers suggest that games can enhance learning, and by engaging learners, games can create an inclusive learning environment (Malone, 1981; Garris, Ahlers, & Driskell, 2002). Papert (1993) argues that although most of the games are hard and complex, they still engaged learners in a way that school can't. He also elucidates that software games can provide children with fast-paced, powerful and rewarding learning experiences, which can be identified by children, as the opposite of traditional learning, that was seen as being slow and boring. He criticized the schools for treating children as passive learners, rather than adapting a learner-centred approach, where knowledge about numbers and grammar are valued more than knowledge about learning. Recent researches show that games-based learning has a motivational power which enthuses the learners (McFarlene et al, 2002; Oblinger, 2004), however we cannot assume that every student likes playing games or learns through playing games. Instead of dismissing other mediums that traditional schooling uses such as drama and role-play, adopting a blended learning style, where traditional schooling and games-based learning, are used together according to the needs of the learners may be a more effective solution. Hays (2005) suggests that video games are beneficial for specific situations and work better when it is used together with instructional programs that offers feedback and support. He also advised that games should be used together with relevant pedagogies rather than as a stand alone medium.

The increased popularity of video and computer games among children and young adults, recent implementation of games-based learning in schools as teaching tools, has encouraged scholars to focus on children's perception of this new approach. Shreve (2005) suggests that when designed well, games can be an important teaching tool. Many researchers have agreed that video and computer games can have a deep rooted impact on how we learn (Shaffer et al., 2004), but they will not provide clear short-cut solutions for tackling the barriers to learning. Gee (2003) emphasized that children

have very high expectations for games in terms of the quality of graphics, engaging narrative and the challenge that is offered. Gee talks about the application of computer games into education and described them as an edugame (2005) and lists features that should be built into good computer and video games such as; a continuous course of action, goal-oriented narratives, engaging actions and immersive plotlines (Gee, 2005).

There is no direct evidence that digital games improve students' learning, but it is explained in Becta's 'Computer Games in Education Report', that by providing challenging activities appropriate to a pupil's levels and needs, games can engage children with problem solving, critical thinking and decision making (Becta, 2001, p. 10). The 'Literature Review' in the 'Games and Learning' report by Futurelab (John Kirriemuir and McFarlane, 2004) also supports and extends this statement by suggesting that teachers and parents recognize the value of games play and its impacts on developing skills such as strategic thinking, planning, communication, application of numbers, negotiating skills, group decision-making and data-handling. This report suggests that learners prefer to work on fast paced, active and exploratory tasks, rather than traditional school-based learning, however, there is no evidence that gaming can develop applicable general skills. For example a very high skilled game player, may be able to plan their actions and solve problems in the game, but this doesn't mean that they can apply these skills to plan their actions in real life situations and solve real life problems. Similar evidence was found in a study of educational games. In one study Squire (2002) found that students were good at solving algebra problems when playing algebra video/computer games, but they did not have an awareness of how to apply this critical thinking skill to real-life situations. However, some researchers disagree with this statement and suggest that digital games give children the opportunity to extend their learning by exploring new worlds through providing fantasy worlds (McVey, 1997). By exploring new worlds the children deal with different situations which help them to develop their problem solving skills and improve their thinking (Aliya, 2002).

The majority of the computer games that are used in classrooms are specifically designed for educational purposes and usually the gaming is done on computers – not

many consoles or portable devices are used as the medium. Some researchers argue that 'pure games' which are designed and produced for fun, not for educational needs are more effective than games designed for education, as they are more successful in engaging learners and introducing them to a new world (Trotter, 2004) as they offer fantasy, challenge and new experiences. Seymour Papert (1998) also argues that adapting the games according to curriculum requirements, can also take the fun element out of games. Can leisure games be used for educational purposes, or what is the best way of creating more effective learning games? There are a few examples of using pure games for academic purposes within the classroom setting. Research on the use of the Civilization III games in classrooms presents evidence that learners have engaged with history, they obtained agriculture, architectural knowledge, as well as learning about history, all whilst having fun (Shreve, 2005), but it also confused some students because they did not understand why they were playing this game as they had not considered the educational purpose of the game. In Civilization III, players create and lead a civilization from 4000 BC to date. Students can win the game in political, military, cultural and economic arenas. They run a country: they need to consider how to use resources, prepare a strategic plan to manage economies, establish relations with other civilizations. Because it is an open-ended game, learning outcomes of the game depend on the aims of the player. Some players may focus on historical activities, whereas some only show interest in military actions. In a way it gives players the flexibility to put their ideas and fantasy into practice. Gee (2005) suggests that commercial off-the-shelf (COTS) games such as Civilization III allow students to create personal identities, such as becoming a world leader. In research into using Civilization III, Squire (2005) explained the learning gained by students whilst playing the game. The game was used three times a week for a six week period in high school classrooms as part of their history lessons. Squire (2005) reported that students played the game in their own personal ways and their engagement level with the game varied. One reason for this was that some students found the game very complex, which had an impact on the level of their engagement with the game. It has also been found that commercial games are not always seen as being motivational by learners when used to support formal learning in education environments (Squire, 2005). Furthermore he argued that students who do well in school particularly found it difficult to play the game. He found that the game was more appealing to students who had problems with traditional schooling. One issue

with using pure games in education is that the link between the learning goal and games is not always clear, so it is very difficult to understand and identify the learning that occurs during game playing. Because the connection between the outcome and game playing is not clear, educators face challenges in assessing specific learning goals.

It has been suggested that the reason children like learning using computer games is because of its motivational effect. In a research 'Motivation and computer game based learning' Whitton (2007) studied, how motivational computer games are and students' perceptions of games and computer gaming. In-depth interviews and a larger-scale survey were used to investigate 200 students' motivations to play games and learn with games. The result of this study suggests that students' perception of game-based learning was positive; however there is no evidence of computer games-based learning to be motivational. One important result to come out of this study is that students will be motivated to use a game if they perceive it as being the most effective way of learning. I think this creates more questions. What makes the students perceive a game as being the most effective way of learning? What are the factors? Is it about the game itself or students' characteristics and expectations? This needs to be investigated in depth.

Another study in this area I want to refer to was carried out by Futurelab (2010). The impact of console games is discussed in a report (Groff et al. 2010) which presents a study conducted in Scotland. As part of this study, 150 students, 48 teachers and 19 school leaders from 19 schools were interviewed. Of these, one nursery, ten primary and eight secondary schools were included. Various game consoles such as the Nintendo Wii and Nintendo DS were used for playing games such as Guitar Hero, Kororinpa and Samba de Amigo. Semi-structured interviews were used to find out about the students' own perceptions of game-based education. The students' perspective on learning through console game-based learning was that learning was fun and overall the perspective was reported as being positive. According to this report, the students' perceptions of console game-based learning were as follows:

Physical activity: One of the common responses that students gave was being physically active while learning.

Increased interactivity: Students liked the fact that their actions received an immediate response according to their ability and performance during game playing.

Increased challenge: The students reported that the challenge of the game was engaging if it was at a suitable level to their ability i.e. It wasn't too easy or frustratingly difficult.

Visual: Many students explained that the visual features of the game made learning more fun and engaging in comparison to other instructional methods. They also found learning with games easier.

Greater collaboration: Many students commented that they enjoyed working as a team, helping their peers when they had difficulties and receiving help from other students when they needed it.

Student driven: Students saw themselves actively taking part in creating learning where the teachers act as a guide and the students just get on with the activity.

Connections: Students reported that having all their class work built around the game was a really fun way of learning. Basically the game connected learning in other subjects.

The students' perceived learning outcomes were content, teamwork, co-operation and collaboration, concentration and focus, creativity and imagination, co-ordination, organization, confidence and basic life skills. The students' enjoyment was not only linked to the game play but also the curricular topic they were studying. The majority of the students articulated their experience as 'learning is fun' as they learned but also had fun at the same time. Another important point made by students was that they felt that they were 'learning without realising', as they explained they did not feel that they were doing educational work. Some students preferred to work alone whereas some found working with others more helpful. After several weeks some students felt bored, the researchers thought that the reason for this was mainly because the activities remained the same. Increased collaboration, focus, creativity and communication were the other impacts that were perceived by students. Some students reported that they felt that their learning was distracted by the games.

In a recent study Alexiou-Ray and Wright (2011) investigated whether daily access to handheld computers affected elementary school students' attitudes and perceptions

towards technology. Students used the devices as part of their regular educational routine for a period of nine weeks. Mixed method methodology, a combination of qualitative and quantitative research approach was used for data collection and analysis. Students were asked to complete an attitudes and perception survey before and after the study. Student interviews, class observations and focus group discussions were also used for data collection. The students were exposed to handheld computers every day regularly for nine weeks. Their findings showed that students had a positive experience with handheld devices; most students enjoyed using computers and agreed that computers are important. One important result was that students indicated that they preferred to use handheld computers for learning rather than traditional instructional methods such as handwriting a story. Students also indicated improvements in their learning and a preference for using a handheld device instead of a desktop computer or laptops. Their explanation for this was because of the freedom and mobility of the device, they could complete their work anywhere and at anytime. Their negative comments were more about technical issues.

3.3 Studies into Student' Perception towards learning with iPod Touches

The use of iPod touches in classrooms is new and research in this area is limited and focused more on its technological capabilities (Clyde, 2005) or examples of early usage of iPods for podcasting lessons (Pownell, 2006; Nishimura, & Kato, 2006). Many authors indicate that one of the most important benefits of implementing iPods into education is allowing students to learn when and where they want to (King & Gura, 2007), in other words supporting them to become mobile learners. In a study amongst university students McCombs and Liu (2006) wanted to find out the advantages of learning with an iPod Touch. They asked the university students who took part in an iPod course to list the main advantages of using an iPod for educational purposes. One of the main advantages that students reported was being able to compensate for something they missed. So if they had missed a lesson, they could just use the lecture recorded on an iPod to replace the missing one. They also commented on the ease of access to lessons, the portable features of an iPod allowing their use anywhere, improving their learning and making learning become more fun. In general students expressed a very positive attitude towards the use of iPods in education, however, there

was not much information about the impacts on learning, how it makes learning better and what makes students interpret their learning experience as fun.

Early studies of learning using iPod Touches was more focused on creating and listening to podcasts for language studies. This may be linked more to the affordances of the device itself, as previous models of the iPod device did not have the features of the newest iPod Touch such as; touch screen and a camera.   In the study 'the iPod project: A mobile mini lab', Sathe and Waltje (2008) investigated the use of an iPod for language learning. The students were asked to use iPod Touches on various projects such as; interviewing native speakers, keeping an oral diary for a week etc. They were then asked to post their work to either a Blackboard class site or email it to their instructor to share with the whole class. The study result reports that by learning using the iPod device, students were provided with extra opportunities for them to be more actively engaged and independent in their learning. The majority of the students were reported to enjoy learning with iPods, only around 6% cited their learning experience using an iPod Touch as not being enjoyable. When it comes to their achievement, more than half of the students commented on the iPod device having a positive impact on learning a new language. 90% of the students appreciated the portability of the device and described using iPods rather than going to the Lab as 'convenient'. 67% of the students found learning with an iPod motivational and around 80% cited that they would use an iPod regularly. One important result was the students' unwillingness to spend much time on learning how to use the device. Can we assume that there is a relationship between the ease of operating the device and students perceived learning or their attitude towards technology?   In this study students were actively involved in learning through recording and listening activities.   If they were learning a new language using a game on a new model of iPod such as iPod Touch, would their perception be the same?   This brings up a question which needs to be investigated further. Can affordances of the technology devices impact on how it is perceived?

One of the affordances of the iPod Touch device is being able to download educational games and apps (applications) for specific subjects from the apps store.   This encouraged educators to trial the device to teach specific curriculum subjects such as mathematics. They wanted to see whether learning using an iPod Touch would engage students better than traditional learning and teaching methods and also improve their

learning.   In a report of 'The iPod Trial Program' Heggart (2010) explores the use of iPod touches in McCarthy Catholic College, in News South Wales, Australia. The program was run as part of the whole schools numeracy improvement plan.   Their reason for using iPod Touches was; to improve teachers' organisation and record keeping skills and increase the students' engagement and basic skills in mathematics. Year 7 students and mathematics teachers were included in the study. He wanted to find out whether Year 7 students would feel as if they were learning mathematics more effectively when using iPod touches. Interviews, field notes and evaluative surveys for the teachers and students were used for data collection. The study result suggested that the vast majority of the children enjoyed using iPod Touches and learned a lot by using them. When they were asked to identify what they enjoyed about the iPod Touches, 92% reported playing games as a reason for their enjoyment.   Analysis of the motivational effect of iPod Touches showed that 81% of the students agreed that using iPod Touches increased their motivation in learning. Heggart suggests that this tells us of the necessity for employing different tools and methods to motivate all the learners. The students described their experience of learning mathematics using iPod Touches as 'fun'. Heggart agrees that finding learning fun doesn't mean it will improve learning but he indicates that students' enjoyment is closely linked to their engagement and motivation.

The 'iPod Touch Research Project' (2008) for the Department of Education and Early Childhood Development of State for the Government of Victoria, in Australia also presents a similar study amongst primary school students using a newer version of the device, iPod touch. The aim of 'iPod Touch Research' was to investigate the students' attitudes to learning with handheld technology. They also explored the impacts on teacher pedagogy, curriculum and assessment, and the challenges of implementing this new technology. The research included three primary schools that had different input levels of the students; a small regional school, a large school and a school where the majority of the children spoke English as their Second Language. The research team used student and teacher online surveys, interviews with teachers, observations, students' work, reflective blogs and teacher curriculum samples as a research methodology.   The students described their learning experience with iPod touches as exciting, motivating and awesome. They surveyed 62 students of which 47% were

female and 53% were male to find out their use and attitude towards technology at home and at school. Their findings showed that mostly students used desktop computers at home and although other technology such as mobile phones, games consoles and digital cameras were also widely used, it was not to the same extent as the desktop computer. 43% of the students used a computer daily and 53% used one at least once a week.

One of the interesting findings was the decrease in internet research at home during the iPod Touch project. 70% of the children did not access blogs and chats from home but after the project a third of the students accessed them from home. 87% of the students reported that they used technology at school and that it made learning fun. 63% stated that they learned better with technology. When it comes to the use of iPod touches 68% of the students reported that they used the iPod Touch weekly. The students generally found the iPod Touch easy to use, although almost 50% of them found it hard to use it at the beginning, but easier with experience, however, a small percentage of the students found it hard to use the keyboard function.

When the students were asked whether technology helped them with their learning, 100% reported that using computers supported their learning. This was followed by iPod Touch (96%), laptops and interactive whiteboards (73%) and Nintendo Wii (66%). However when the outcome from the schools were compared, in one school the iPod Touch was seen as a very useful tool by over two thirds of the students for learning, whilst in another school only 32% of the students reported that the iPod Touch helped their learning. These differences were similar for other technology that was used for learning. For example in one school the impact of whiteboards and Wii console on learning were rated highly (64% and 36% respectively) and in another the contribution of Whiteboards and Wii console were both rated 11%, indicating they were not seen as being important. One of the reasons for the differences in rating can be linked to how often the students were allowed to experience these technologies and whether this experience was a positive one. The majority of the students in all three schools also indicated that they preferred to use the iPod Touch for 'personal' tasks such as emails and viewing podcasts, however for tasks that required typing they preferred to use computers. The students also reported on the portability and visual features of the iPod

Touch. They commented that because of the dimensions of the device it is easy to carry them around and its visual features allowed them to look and learn.

The researchers listed students' views on iPod Touch functionality in different categories and placed their comments under specific headings; positive/good things, feelings, thinking about thinking, new ideas and bad things.

Positive good things: Children reported specific functions and features of iPod Touches as positive things, they focused on the technological capabilities of the device and how this made learning easier and fun for them. They described the iPod Touch as a small portable device which can be taken anywhere. They also talked about iPod Touch providing instant and fast access to learning.

Feelings: The students reported mixed feelings about their experiences of using iPod Touches in a classroom environment. Some students described their experience as 'cool and fun' and found learning with iPod Touches motivating. However some students had expressed negative feelings such as boredom and frustration when they had to wait for a page to load.

Thinking about Thinking: The students understanding of learning with iPod Touches becomes clear with their description. They suggested that if they used iPod touches more they will learn more. They also think that you can learn anything using this device.

New Ideas: In this section children talked about their ideas for making better use of iPod Touches. Having an integrated internet capability on the iPod Touch, sharing ideas, involving parents in learning by taking the device to home were suggested by the students.

Bad Things: The students talked about the technical difficulties they experienced whilst they were using iPod Touches. Lack of flash player, not using them long enough to master the skills required, connection and battery problems were reported as being negative things by the students.

Researchers stated that they have received many positive responses from students to the iPod Touches. Being able to play many different games, ability to access the Internet, portability which allows the student to carry the iPod around whilst they are using them, are some of them. One important point that was reported by the students was the

functionality for multitasking. Some students explained this as using various functions of iPod Touch at the same time. For example they can play a game and listen to some music at the same time. The opportunity for multitasking may also be linked to students' engagement with learning but this need to be explored further.

When students were asked about any new ideas that they may have, they came up with some technical suggestions that will add more functions to iPod touch or will improve current ones. Using an old model of iPod touch which didn't have a camera, students suggested that having a camera would be useful for many activities. They also expressed difficulty of writing on a touch screen and suggested a slide out keyboard or a touch pen as a solution. Some students also complained about not having copy and paste function. This is quite interesting as it shows us that children's' expectations from handheld devices is very similar to the functions of computers.

When it comes to analysing the impact of the use of iPod touches on learning, although the schools reported some improvements in reading, writing and numeracy skills, it is difficult to establish a direct link between the use of an iPod touch in lessons and an increase in skills levels as students receive many other incentives to support their learning.

3.4 Summary
The review of the literature to investigate students' perception of technology presented mixed results. The majority of the studies reported student' experience of learning with technology as a positive one (Jones&Hinkle, 2005; Mifsud, 2005; Whitton, 2007; Futurelab, 2010). A few reported that learning with technology was easier than using traditional methods such as books or listening to a teacher (Jones&Hinkle, 2005). Some studies suggested that learning with technology improved student' learning (Alexiou-Ray&Wright, 2011), others found no evidence of this (Whitton, 2007). Learning was perceived as fun, interesting and exciting (Jones & Hinkle, 2005; Mifsud,2005; Futurelab, 2010). Mobile technology was highly rated for giving students the flexibility to learn anywhere anytime (Mifsud, 2005; Alexiou-Ray&Wright, 2011).

The study of literature in use of iPod and iPod Touches in education produced similar outcomes. Students perceived learning with iPod and iPod Touch devices was reported

as fun and their experience as a positive one (McCombs & Liu, 2006; Sathe & Valtje, 2008; Heggart, 2010; iPod Touch Project, 2008). The design features of the iPod Touch device such as size, portability, touch screen and apps were highly rated by students and learning itself was seen as convenient and exciting.

The literature also revealed the complexity of measuring ones perception. If the perception is affected by so many external factors such as; individuals' characteristics and background information, their likes and dislikes, age, gender, how could we measure students' perception of learning with technology? The investigations included in this literature suggest that a mixed methodology approach is required to measure students' perceptions. Examples of the use of surveys, in-depth interviews, observations and children's' work for data collection is widely evident in these studies.

Chapter 4: Methodology

This chapter explains the research methods and approach that was adopted for this study. It presents information about how the sample was chosen, the data collected, analysis procedures carried out. It also covers the ethical issues that had to be considered.

4.1 Research Approach

Although a qualitative method was adopted for the preliminary data, this study employs both quantitative and qualitative approaches including; a student survey, semi-structured interviews, observational data and a review of the children's concept map document. The qualitative research method was used to understand the social context around the children's perceptions of learning with games on iPod Touches. As recommended by Cohen (2000) the aim is to explore children's experiences and actions, their interpretations of emotions not external statements. The quantitative method was used in the form of a survey to collect background data about the participants' experience of using technology.

The research involved different steps; finding literature, practical research in a primary classroom, analysing the data as an outcome of the practical research to understand the students' attitude towards learning with games on iPod touches.

I looked at the meaning of perception, how it could be measured and the studies that aimed to understand the attitudes of children towards learning with various technologies. This study did not aim to analyse students achievement or any specific learning outcome, neither have a hypotheses to prove or work on. Various maths games were used on iPod touches using the topic of multiplication and division. Some of the games were downloaded from the Apps store and some were played on the Internet. It was not the purpose of this research to investigate the content and effectiveness of these games on learning, rather this study was interested in the children's perception of the use of iPod touches as an instrument for learning in the classroom.

4.2 Data Collection

Rennie, L. J., & Jarvis, T. (1995) suggests the use of three instruments for measuring and describing children's perceptions about technology; questionnaires, interviews and children's writings/drawings. Furthermore they explain that "different methods provide different information and are suitable for different age levels of students." Given the research focus, I adopted a multi method qualitative and quantitative research approach including interviews, observation, children's concept map and an online survey. This enabled me to present detailed data about children's perspectives of learning with educational games using iPod touches within classrooms.

The findings of this study were based on observing children playing games using iPod Touches, analysis of the children's concept map of their discussions, group interviews and a survey completed by the children about the use of technology prior to this study.

The data collection was administered at four levels. Firstly at the beginning of the study before allowing children to use the iPod Touches, an online survey was completed by the children about the use of technology to understand their experiences with iPod touches and other technologies. Secondly the questions 'What do you expect to learn from using an iPod touch that you can't from other technology?' and 'What are the ways of learning multiplication and division calculations?' were asked, and a children's concept map of their discussions to answer these questions were written down on a A4 sheet by them. Analysis of the data from this document was based on identifying words that indicated their perceptions and expectations from learning with iPod Touches.

Observations

Unstructured observations were conducted where children's use of iPod Touches were monitored and their reactions to activities, their interactions with the games and their peers, discussions, vocabulary they used were written down randomly. Observation is a powerful method for gaining insight into specific situations. It is useful as it gives the researcher the opportunity to gather 'live' data from 'live' social situations (Cohen et al, 2000). Observations in this study enabled me to find out the views of the participants, which they may not have freely expressed in interviews and allowed me to access their more personal knowledge.

I also carried out non-participant observations of children playing games on iPod touches to extend my understanding of the research topic. This allowed me to discover behaviours and interactions that naturally occurred during game playing using iPod touches but also enabled me to investigate any specific vocabulary that was used by participants which might be useful when interpreting the data. Because I was the only observer I was aware of the risk of bias so I decided which observations were valid and included data entries according to this selection. I repeated my observations every morning which enabled me to gain a deeper understanding of children's perceptions of learning with games using iPod touches. I compared the data I collected during my observations to what the children said in the interviews and their written explanations to enhance the validity of my analysis.

Semi Structured Interviews

Due to the limited time scale involved, one-to-one interviews were not sought, in this research as a data collection method. Three semi-structured group interviews were undertaken with the students in groups of seven to allow them to respond and talk about their own perceptions of educational games on iPod Touches and explain their viewpoints. The interview schedule was based on set of questions that were relevant to this study and its aims. This schedule included essential questions, extra questions; throw away questions and probing questions (Berg, 2001). A semi-structured approach was chosen to ensure a certain level of comprehensiveness across the cases. However

the questions were not too structured so that participants' individual explanations could be investigated. The reason for using interviews instead of a questionnaire was that; questionnaires have limited power to investigate the context fully (Yin, 2003). Semi-structured interviews allow the researcher to expand the context of investigating according to research topic. Interviews were used as the principal method of collecting the data that had a direct link to the objectives of this research (Cohen et al. 2007). However I remained attentive to ethical issues that may occur when conducting interviews which are; informed consent, confidentiality and the consequences of the interviews. By adopting a 'nonscheduled standardised interview' which consisted of less formal and open-ended protocols, I was able to change the order or phrasing of the questions for different participants and situations (Ackerman 2004).

In order to find out more information about children's experience with educational games on iPod touches in depth interviews were used. Some children talked more than others, some did not say much. I asked prompting questions based upon students statements which helped me to clarify their ideas.
I used a voice recorder to record the interviews and transcribed it directly afterwards. I also took some notes of children's responses that I thought had significant importance for the research project.

Reflecting on the project so far, although this is a small scale research project, it is important to use more than one method to gather data to support my research findings. The reason for use of observations was to explore children's views on learning with games using iPod Touches to support the data from interviews which made the data more reliable. The questions that were used in the interviews were designed to explore the children's viewpoints on the benefits and challenges that game based learning using iPod Touches offered in the classroom. The interviews lasted for 30 minutes and were recorded using a sound recorder. The data collected was analysed using the constant comparative method (Glaser and Strauss, 1967) to conceptualize the overall data and establish the link to the research focus.

4.3 Sample Selection

A considerably larger than the average primary school in London was selected for this study for convenience reasons. The school serves an ethnically diverse

community. 21 pupils from a Year 5 class (ages 9-10, 14 male and 7 female) took part in the project. The children had higher mathematical skills than expected for their age levels. They were from four different classes and did not have much inter-communication with the children who were not from the same class as them outside of the mathematics classes. They sat in mixed gender and ability groups not necessarily with children from their own class. I selected these children as I teach mathematics to them every morning, which allowed me to implement multiplication and division mathematics games on iPod touches into their regular daily numeracy lesson. This was the first time that they had used mathematics games on iPod Touches in the classroom.

Berg (2001) suggests that purposive sampling focuses on certain types of individuals with certain attributes. The sampling I used was suitable for the needs of this study however it does not aim to represent the wider population and it is acknowledged that the possibility of generalising from the findings is therefore negligible (Cohen et al, 2000).

The 2nd generation iPod Touch with 8GB memory was used for this case study. The device did not have an integrated camera. The school had a trolley of 20 iPod Touches with connection to the Internet through Apple Airport. After introducing the children to the iPod Touches, the children were allowed to use them regularly, every morning for 6 weeks for 20 minutes. I modelled how to use the iPod Touch, accessing the apps store, connecting the Internet and other functions such as using the calculator and using the keypad.

4.4 Data Analysis

A content analysis approach was used to explore the children's behaviour when investigating their use of games on iPod touches for learning. According to Ole Holsti (1969) content analysis is a technique for making inferences by objectively and systematically identifying specified characteristics of messages. Weber (1990, p. 9) suggests that content analysis is a research method which uses a set of procedures to make valid inferences. Content analysis can involve any kind of analysis where communication content such as speech, written text, interviews, images etc. is

categorized. By using content analysis as a method; I was able to draw out words and behaviours linked to students' perception from their interactions that took place during classroom observations and also group interviews.

I started my data analysis by looking at the data collected from an online survey, interviews, observations and written explanations separately. I then continued by categorising and coding the raw data from my notes and transcriptions. By linking the codes to one another I was able to establish a pattern for the whole data which was linked back to the research focus. It was difficult to obtain coding from the theories and case studies that are included in this research. Coding was mainly acquired from the conventional content analysis of the observational data, interviews and children's concept maps. In other words a traditional approach was adopted to analyze the findings from the data, drawing on Strauss's (1987) "coding from the data" method where data were analyzed as they were collected. As I continued to analyze the data, any word, text or behaviour that represents student' perception was identified and written down. When I looked at the observational data I placed children's behaviours and comments under five categories that can be described as their perceptions of learning with games using iPod touches. I explored what was more significant based upon my understanding of the topic. In order to interpret the data I reorganised it focusing on children's individual experiences of playing games using iPod touches. The findings were than arranged according to themes and categories of children's responses, attitudes and emotions. I used quotes from the interviews with students and anecdotes from their interactions to give an insight to student's perceptions.

A comparison of the results from the three sources yielded reliable evidence of the particulars of the student' perception of learning with iPod touches. By using triangulation research methodology I aimed to produce reliable results which would then improve the validity of the research. According to Cohen, Manion et al (2007, p. 141), A triangulation in social sciences attempt to explore "the richness and complexity of human behaviour by studying it from more than one standpoint", and in the opinion of this author, "the more methods contrast with each other, the greater the researchers confidence". I compared the findings of this study to other studies that presented

information on children's perceptions of learning using iPod touches which has been mentioned in the literature section of this study. Finally I have written a conclusion to explain what the research findings in detail and presented limitations to this study.

4.5 Ethics

In qualitative research, informed consent needs to be sought and may be withdrawn at any time, and it is also important to include direct talk regarding the continued willingness to participate (Cassell, 1982). I had a generic permission letter that was prepared by the school office regarding using children's photos, videos and work on school websites or publications. This letter also included a line which states that educators can study their work to improve standards in school. All the children's parents signed these letters at the beginning of the year. I also reminded children that could withdraw from the activity anytime they liked. In case this happened we put in place extra adults who would work with these children on different activities.

Working with such young children as part of this study, understanding the ethical principals for conducting this research was extremely important. I followed the BERA guidelines (2004) for this purpose. According to Bibby (1997) it is important that researchers consider different moral arguments as part of their training and reflect on what is acceptable behaviour before commencing their research. It is extremely difficult to determine the main moral principles which should guide researchers to deal with ethical issues which can arise when attempting to interpret individual realities. Ethical codes can only operate as a guide. The best solution is for researchers to regularly reflect on their work to develop their understanding of the ethical concerns associated with their research (Burgess, 1989).

Cohen et al (2000) argues that informed content constitutes the foundation of ethical approach in research which places some responsibility on the participant if anything goes wrong during research procedure. I explained the purpose of the study to the participants so that they were aware of the aims of the research project. I also informed them that their participation is voluntary and that they may withdraw from the study any time. I also gave them information about the research procedure so that they knew what to expect in the study.

Chapter 5: Evaluation

The implementation of iPod touches in mathematics lessons for learning multiplication and division facts has been described by students as 'exciting' and 'cool'. I spent a considerable amount of time researching mathematics games to find ones that would be suitable for the topic studied. I also invested time getting to know the features and technical capabilities of the device to ensure that I was not just competent in using them but fully able to assist and answer any questions from the pupils about the equipment.

5.1 Online Survey

An online technology survey was conducted at the beginning of the project to find out more about the children's experience of using various technology devices, their preferences and also their attitude towards the use of technology for learning. The students were also asked to complete a short post-project survey to investigate the impact of the iPod Touch Project on their beliefs and attitude towards technology. Table 1 presents the data from three questions which formed part of the technology survey and focuses on which technologies the participants had at home and their purpose of usage. A copy of the survey pro-forma can be seen in Appendix A.

A total of 21 students (33% female, 67% male) were surveyed to determine their prior experiences of using iPod touches and other technologies. When asked which technology they have at home, 29.67% cited that they have either a computer or laptop, 23.08% of the students reported that they have a game console, 17.58% have mobile phones, whereas only one child (1.10%) had an iPod Touch at home. All of the children had at least one or more technologies at home. The results also show that only one child selected the video recorder option. One reason for this may be that the other participants may have a video recorder as part of their mobile phone or other devices rather than having one as a separate device and because of this did not consider declaring possession of one.

Variable		f	%
Gender	Male	14	66.67
	Female	7	33.33
Do you have any of the following technology at home?	Desktop computer	17	18.68
	Laptop computer	10	10.99
	Game console (Nintendo Wii etc)	21	23.08
	MP3 player	10	11.99
	Mobile phone	16	17.58
	Digital camera	15	16.48
	Video recorder	1	1.10
	iPod Touch	1	1.10
In the last week, what did you use technology for at home?	Homework	18	20.22
	Playing games	21	23.60
	Take/create photo or film	2	2.25
	Find information online	9	10.11
	Email	5	5.62
	Chat with friends	8	8.99
	Social network	2	2.25
	Listen to music or look at videos	12	13.48
	Download music/videos	2	2.25
	Upload music/videos	1	1.12
	Use blogs/wikis	3	3.37
	Text	6	6.74
Have you used an iPod Touch before?	Yes	1	4.76
	No	20	95.24

Table 1: Students Backgrounds

All of the students reported that they used technology for playing games, followed by 20.22% using it for homework purposes. A schools homework policy may have an influence on this data. Schools provide children with homework that can be completed and submitted using the schools Virtual Learning Environment (VLE), this may encourage children to complete their homework at home using technology. They also reported using technology for finding information online, email, listening to music, and

watching videos, chat with friends and text messaging. Only one participant (4.76) reported that they had have experience of using an iPod Touch.

Question 3: How often do you use the following technologies at home?				
	Daily %	Weekly %	Rarely %	Never %
Desktop computer	67	10	10	14
Laptop computer	42	5	11	42
Game console (Nintendo Wii, play station 2/3, Xbox, Nintendo DS, PSP)	86	14	0	0
MP3 Player	53	0	0	47
Mobile Phone	65	5	0	30
Digital Camera	0	40	40	20
Video recorder	0	0	20	80
iPod Touch	5	0	0	95

Table 2: Technology used at home

The technology most regularly used at home by students was game consoles, 86% using on a daily basis. Use of desktop computers (67%) and laptops (42%) were also popular, indicating many students have both of them. Mobile phones and MP3 were widely used by the students daily. Other technologies were not used to the same extent.

The most favourite game console was the PlayStation 3 with move, followed by the Nintendo Wii and then the Xbox Kinect. Students reasons for selecting the Play Station 3 were more about being able to control the game by moving and having access to an online shared place where they can play games with their friends and relatives. The Nintendo Wii was seen as fun and interactive by five participants. The Nintendo DS was reported as being the fourth favourite console for its portability. Their reasons for selecting their favourite game consoles were more related to the technological features and affordances of the device. The vast majority reported that being able to control the game with their own body movements and interactivity as their main reasons for preferring it. Having access to online games was also a popular reason. This was followed by having an opportunity to play online. Portability and size were common reasons reported by students who selected handheld devices as their favourite games console.

Question 5: What is your favourite game console? Why?
1. Nintendo Wii. Because it lets you do sports. You can move around a lot.
2. Nintendo DS. It is easy to pack up and carry.
3. PSP. Because it is small and you can carry it where ever you want.
4. My favourite game console is Xbox Kinect, because you are the controller.
5. Play Station with move. Because it is like real, you can control it by moving and you can access everything online.
6. PS3, because I can talk online with my family and play games.
7. Nintendo DS because it is portable and I can play in 3D as well as in just normal style.
8. My favourite game console has to be the Wii because it feels so real, like you are driving the car.
9. Nintendo Wii, because it has nice games like singing sport. You can do exercise.
10. Xbox because is your body that moves it is like you control it
11. PS3 because i can go on the internet I can play with my friends
12. Xbox 360 because you don't always have to buy games and it has kinect you can move
13. Play station move i like it as you have no wires you can move about as well
14. Play station 3 because you can speak to other people and it has lots of memory.
15. PS3 because you could play 3D if you have a 3D TV.
16. Wii because it is fun and interactive
17. PS3 because the network connection is free not like xbox 360. it has move too, so you can move around.
18. Nintendo wii because you can move, helps you do exercise and interactive and fun
19. My favourite games console is the DSi because it is so small and doesn't hurt your eyes.
20. Xbox kinect because you are the controller
21. Xbox kinect because you can move around and you are the controller

Table 3: Students comments on game console preferences

Before the project commenced the children were given ten statements to rate. In terms of technology the vast majority (90%) of the students agreed that technology makes learning fun. 67% reported that they learn better using technology. 81% expected that an iPod Touch would make learning more fun, only 10% expected learning to be easier and 19% indicating learning with iPod Touch would help them learn better. Just over half them said that they didn't need any training to use an iPod Touch, which may indicate their confidence level in using new technology. 19% of the children thought that an iPod Touch would have disadvantages whereas none of the students reported otherwise.

Question 7: Do you agree with these statements? (Pre Survey)			
	Agree %	**Don't know %**	**Don't agree %**
Technology makes learning fun	**90**	**10**	**0**
I learn better when I use technology	**67**	**33**	**0**
I am excited to have an opportunity to use iPod Touch	**95**	**5**	**0**
iPod Touch will make learning more fun	**81**	**19**	**0**
iPod touch will make learning maths more interesting	**62**	**38**	**0**
iPod Touch will make learning maths easier	**10**	**71**	**19**
iPod Touch will help me learn better	**19**	**62**	**19**
I think we can use iPod Touch to learn other subjects	**52**	**48**	**0**
I need special training to use iPod Touch	**14**	**33**	**52**
I don't think there are any disadvantages of iPod Touch	**0**	**81**	**19**

Table 4: Students pre survey statements

After the project the students were given the same ten statements to rate again. All of the students agreed that technology makes learning fun and 76% thought that they learnt better with technology compare to 67% in the pre survey. 100% reported using an iPod Touch as being fun and made their maths learning more interesting. 71% said that using an iPod Touch made learning maths easier and helped them learn better whereas 29% didn't know if this was the case for them. Just over half of the participants indicated that they didn't having any difficulty with using an iPod Touch and 67% agreed that there are disadvantages to using an iPod Touch compared with 19% who expected iPod Touches to have disadvantages.

Do you agree with these statements? (Post Survey)			
	Agree %	**Don't know %**	**Don't agree %**
Technology makes learning fun	100	0	0
I learn better when I use technology	76	24	0
I feel good about having an opportunity to use iPod Touch	95	5	0
It was fun to use iPod Touch	100	0	0
iPod touch made learning maths more interesting	100	0	0
iPod Touch made learning maths easier	71	29	0
iPod Touch helped me learn better	71	29	0
We can use iPod Touch to learn other subjects	71	29	0
After the introduction session I didn't have any difficulty with using iPod Touch	52	19	29
I didn't find any disadvantages of using iPod Touch	24	10	67

Table 5: Students post survey statements

5.2 Children's written explanations of their prior discussion; concept maps

At the beginning of the study, and prior to the introduction of the iPod Touches, the children were sat in three groups and discussed their answers to the question 'What do you expect to learn from using an iPod touch that you can't from other technology'. They were given a sheet of paper on which they used one side to record what they thought were the ways for learning multiplication and division and the other side of the paper was used for writing down their expectations of learning using an iPod touch.

Using a Nintendo DS and playing games on the Internet were the most common ways to learn division and multiplication reported by all three groups. The iPod Touch was stated by one group as a way of learning multiplication and division. Table 6 shows the list of ways of learning multiplication and division that the children proposed.   An original concept map of the children's discussion can be viewed in Appendices B, C and D.

It is quite interesting to see primary school children listing so many tools that they thought would help them learn to multiplication and division. They had a mixed group of methods such as; technology devices, mental maths, displays, playing traditional

games (around the world) etc. All three groups included some form of technology in their list.

Group 1	Group 2	Group 3
Displays	Nintendo DS	Around the world
Jigsaws	Writing it down	Computer
Counters	Calculator	Calculator
Dice	Mental	Maths club
Maths videos	Nintendo Wii	iPod
Quizzes	Grid method	Internet
Favourite thing		Nintendo DS (Brain training game)
Maths books		
Ipad touches		Maths games
Physical games		In your head
Learning CD		Puzzle
Maths Cards		T.V.
Posters based on maths		Teachers
Maths Games		Play Station 3
Colour by numbers		Computer
Charts based on maths		
Maths websites		
Technology		
Board games		
Socialising		

Table 6: Students comments on ways of learning multiplication and division

Another question that the children were asked prior to introducing the iPod touch was 'What do you expect to learn from using an iPod touch that you can't from other technology?' They used one side of the A4 sheet to record their answer to this question. The students reported that they expected that learning using an iPod touch to be 'fun' and 'something different'. Their list included more of the technological features of iPod touches. This was quite interesting as the majority of the children neither possessed an iPod Touch nor had used one prior to this study. When they were asked how they knew that an iPod Touch would have these features. A few of them reported that they had seen one in either a friends or relatives house. Some stated that they heard about them from a T.V. advert and some stated that they had read about them on the Internet.

Table 7 shows the list of what they expected to learn from using an iPod touch. The student's original work can be seen in Appendices E, F and G.

Group 1	Group 2	Group 3
Faster than computers	Play games for learning	It is quicker
Internet connections	Electric calculator	It is easier to use
Built in calculator	Internet	It is interactive
New	Games for learning	It helps you more
We can concentrate	A fun way to learning	It is fun
More learning games	Same learning amount	
Some thing different than lesson	Touch screen	
Children like technology		

Table 7: Students comments on their expectations of learning with iPod touches

5.3 Semi-structured group interviews

Eight pre set questions were used during interviews. Throw out questions and prompts were used to help children toe expand their answers. The interviews were recorded using a sound recorder and transcribed afterwards. Further responses to these questions can be viewed in Appendices H, I, J.

Q1. Do you still think that learning with games using iPod touches are different to learning using computers, Nintendo DS and other technology? & Q2. How are they different?

Many students reported that learning using iPod touches is different to learning with other technology devices. They were asked to expand their response to how are they different than other technology. The most common comments included; 'iPod touch have a touch screen', 'allows you to move things by hand', 'it is small', 'you can hold it in your hand so it is more comfortable to learn', 'you can download many games so you don't get bored'. They also cited that using games on PCs for learning is not fun any more, because they have been doing it for a long time whereas iPod touches are new. When they were asked if they would get bored by iPod touches after a while as they did with PCs, the majority answered 'no'. Their explanation for their answer was that with an iPod touch they could download a new game for free everyday and they could learn on the bus, or at home. One student commented;

"Computers are heavy. You can't just put one in your bag, can you?   But you could carry an iPod Touch wherever you go.   Even on holiday, you could use it for chatting with friends or listening to music."

A few students suggested that once they ran out of free games they might start getting bored which was opposed by other children as they argued that there will always be new games available.

The students also commented on the game content that was available for different devices. They said that there were many educational games such as numeracy games, literacy games available to download onto iPod Touches, but there were not many educational games to use with other game consoles. When they were asked to expand what they meant by educational, their responses were more about subject specific games. Some of their comments were:

"Well, you can play brain gym on DS but, thats all really.

I have a game that teaches you French, it is for my DS, it is cool.

They haven't got games that teach you stuff like maths on Play Station.

Brain Gym teaches you a a lots of things, it teaches you maths too."

Q3. What do you mean by interactive?

During the pre-project discussion a majority of the children reported that they expected learning with games on iPod touches to be interactive. They were asked what they meant by the word 'interactive'. Their responses were more about how they learn and including some physical movements such as; learning by doing, being active, being in control, completing activities by touching, learning on the move, talking with iPod Touch. When they were asked to expand their answers, one of them said;

" It talks to you when you get it wrong or right. It says well done or try again, doesn't hear what you say though, would be nice if it did'.

Some students did not agree on, learning with iPod touches being interactive. Some students described interactivity as doing it actually with your body and gave examples

from Nintendo Wii and Play Station Move. Some students thought interactive means being like real. One student commented;

"When you play tennis on Wii, you actually do move your arm like real game, same when you play bowling, like you actually playing." She stood up and moved her arm to demonstrate how she played tennis and bowling on Wii.

Q4. Have you played using a Play Station 3, Nintendo DS or other games console? How is it different from using an iPod Touch? Which one do you prefer?

The students talked about disadvantages of using a controller in other devices when you can control an iPod touch with a finger. The lack of an internal screen with a Play Station 3, having two screens on a Nintendo DS which they found confusing to focus on both at the same time. The cost of games when you can get free on iPod touch was also reported by students. They also commented on not being able to find their favourite games on iPod touches.

"Well, you can download many maths games and stories on iPod touches but not my favourite game" one of them commented.

When asked to expand he said his favourite game is Call of Duty Black Ops and he can't play it on iPod Touch. Some students argued with this saying there are games like Call of Duty Black Ops available, but some suggested that they weren't actual games; they were either guides or cheat codes showing that they had already checked to see if the iPod Touch offers games other than educational ones. A few reported issues with the screen size, saying they can't see very well. A few had issues with the games itself, complaining the game didn't have clear instructions to tell them how to play. 11 out of 21 children suggested that it would be better if you could control iPod Touch with your body and voice. One student said;

"I saw it in a film ye, you go in and say hello to your computer, it recognises you and magic, on".

Q5. Did you enjoy learning using an iPod Touch?

The vast majority stated that they did enjoy learning using iPod Touches. Though there were a few students who thought that it was ok to learn using iPod touches but they

preferred to use their computer to play games. When asked why, they said computers have bigger screens which makes it easy to see the game. One talked about the fun element of learning with iPod Touch;

"Sometimes you can have fun and learn like, you learn from things that help you to do and learn like iPod Touch. So you learn by doing and enjoying. On a paper, you waste paper, not so good for the environment."

Many children agreed that it was fun to learn with iPod Touches and they enjoyed their experience.

Q6. What is the one thing that you liked about learning using iPod Touches?

When they were asked to say one thing that they liked about learning with iPod touches, the answers included; fun, easy to use, lots of games, it is fast, you learn more, teach you a lot, easy to hold. Then they were asked to explain what they meant by learning more and teach you more. One student explained this

"When we were playing games like times tables game, it is learning ok, but it is like a game too. We like games ok. So we play more, so we learn more."

Some students suggested that the longer they play the game the more they learn. One noticeable thing in this comment was the students' use of 'we' instead of 'they'. They appeared to know what each other liked or thought. The reason I asked for one thing was, I wanted to see what they thought was the most important aspect of learning with games using iPod Touches.

Q7. Did using an iPod Touch make you more interested in maths?

The Majority of them said that learning with games using the iPod Touch made learning maths more interesting suggesting they didn't think it was like a lesson. One comment was interesting;

"Basically I felt like at home, just playing, wasn't like we were in school." Another one said, *"You let us talk. That was nice".*

This kind of brings a question; was it the iPod Touch or the classroom environment that facilitated making learning maths more interesting? There isn't a clear cut answer to this

question. When I asked the children, if they were allowed to talk more in lessons and not have an iPod Touch would they still find learning interesting? One asked *"What are we going to talk about?"* another student added to this "*You can't really talk about maths a lot, can you, you just do it"*. Again this tells us about how they see learning maths, 'just doing it'. Students' attitudes and expectations of learning in the context of different curriculum subjects may also have an impact on their views about learning with technology. Therefore it would be interesting to investigate their perceptions of learning with technology in different curriculum subjects.

Q8. Did you think that you learnt more using an iPod Touch? Why or why not?

Students had mixed answers to this question. Some said that they learned more using an iPod Touch. Some suggested that they already knew a lot and that the games on iPod Touches were too easy for them, so they didn't learn much. When asked to explain why they didn't think that they learned more using iPod Touches some students comments were;

"iPod Touch doesn't really teach you, doesn't tell you things, you just answer questions, you can't ask a question when you stuck, it tells you if you get it wrong."

During the group 1 interviews some students argued that there wasn't any learning actually happening. They suggested that they had just practiced what they had already known. Their discussions included comments such as;

" I am not sure I learned something new, I already knew my times tables."

"Yeah, but, if you already know your multiplication, it is not really learning, is it?"

" I don't think getting better is learning. When you learn , you learn something that you didn't know"

" It doesn't tell you how to do things anyway, you just play games"

There were children within the group that did not agree with these comments. They suggested that when you improve your knowledge of something that you already know, you actually learn to do it better, or quicker, or answer more difficult questions. Their comments included;

'Well, it is kind of learning, it is like you practise and you get better, I think it is like learning."

" I don't agree with you, because sometimes you can learn something you know, you learn to do better, for example, you know your times tables, but when you practice you remember them, and you do it faster."

This tells us that student' perception of the meaning of learning varies. Some thought that learning was 'learning something new', others suggested 'you can learn by learning to do better'.

5.4 Observations

During the project the students were observed when using iPod Touches every morning for 20 minutes for a period of six weeks. The observational data was analysed and the emotions /comments/ behaviour that were significant identified. Then this data was organised and put in five themes that represents information about the children's' attitude towards learning with iPod touches such as; I like (Positive aspects), Not so good (negative things), feelings, I think (suggestions) and learning. Table 8 shows the categories identified using the observational data. This data was expanded by the children's' direct quotes and findings from the interviews to gain an insight as to how the children perceived learning with games using iPod touches.

The students first reaction to the iPod Touch device was a positive one and received comments such as 'awesome', 'cool', 'oh, so exciting'. After the children had been shown how to use the iPod touches and some of the features such as access to the apps store, connecting to the internet, typing etc., they were allowed to explore the device itself for around 30 minutes. During this time none of the students asked for help or made any requests. However they moved around the classroom to show things that they had found or seen using the iPod Touches to their friends.

The majority of the students were focused on the given tasks during iPod Touch sessions and played maths games as had been agreed. However there were two children that were often found to be ignoring the tasks and were playing other games that had been previously installed on the iPod Touches such as Fifa 10 and Hangman. They were asked why they had stopped playing maths games, they said they were bored.

When they were reminded that it is a maths lesson and that they need to play maths games, their answer was *"where is the fun, if you can't do what you like?"*

One other interesting observation was the way students talked about the affordances and features of iPod Touches. Excerpt 1 and Excerpt 2 presents information about this.

Excerpt 1

One participant leaves his seat and sits next to another student. He tells him to look at his game and asks him if he wants to play with him. He says he can't see anything. The first boy suggests it is the lighting in the class, so they both move away from the window side of the class. The first boy tells the other one that at least they can carry the iPod Touch easily and move wherever they like.

Excerpt 2

A student looks cross as he shouts "I didn't select that answer, o man, stupid machine". The child next to him asks what happened. He tells him that every time he touches the answer, the machine gets it wrong; he says it is something to with the touch screen. The other child suggests that maybe it is broken and suggests for him to come and show it to me. I try it, it works fine. So I tell him to use his small finger and touch gently only on the answer. He tries; sometimes it works, for him but sometimes it doesn't. The other boy suggests that the screen is too sensitive.

The students enjoyed using a small device that they could move around with. They also liked having free games available. Some of them thought that the touch screen was too sensitive.

I like (Positive aspects)	Not so good (Negative things)	Feelings	I think (Suggestions)	Learning
Fast	Video won't play	Fun	Use it for history (Looking at Tudors apps)	Learning by doing
Touch screen	It is slow	Cool		Active
Small	Didn't type that	New	Video player	Interactive
Fits into hand	Too small	Different	Bigger screen	Enjoying
High definition	Can't see	Focus	Need a pen like	Fun
Free games	I didn't touch there	Enjoying	DS	Working with a partner
Lots of games		Annoyed	Separate keypad	
No mouse	I can't hear it	Cross (Another student looking at his screen)	Slide out keyboard	Working alone
Move around	Not like real			I decide (student centered)
No cables		Distracted (Reading book not playing maths game)		
Just drag it				
Show me (Sharing)		Bored(doing something else)		
Cheap				
Visual				

Table 8: Findings from the observational data and the interviews

5.5 Students perceptions of learning with games using iPod Touches

The overall student perspective on learning with games using iPod touches was a positive one. Many students reported their experience of learning maths with games using iPod touches as 'fun', 'cool' and 'interactive'. They described learning multiplication and division using an iPod device as 'learning by doing' and 'enjoying'. The vast majority of the students reported that the iPod Touch helped them learn better and made learning more interesting. They wanted to try out different maths games using iPod touches but additionally all the participants expressed an interest in extending the use of iPod touches into other lessons. The students' feedback included not only their learning experience but also their evaluation of the technological features and capabilities of the iPod touch device in comparison to other devices that they used for learning purposes both at school and also outside of school.

5.5.1 Students Perception of using iPod Touch

Many positive comments were received from the children that were more about the affordances of the iPod Touch device and their evaluation of the technology itself. The touch-screen feature of the iPod Touch which allows students to physically manipulate

data and objects was extremely popular. Also visual aspects and content available in the apps store received many positive feedbacks.

Touch-screen / Physical Contact

Using a touch screen which allows them to control games without any other button or external tool was described as 'exciting' by the students. They compared this feature to other handheld devices such as the Nintendo DS where you need to use a small pen or control buttons on the device to play games. There were many statements made by students regarding the touch screen feature of an iPod touch and how this impacted on their perception of learning such as; *"You can touch the screen", "you don't need a mouse or pen","you can touch and move things by hand", "it is like you can touch your learning", "you can have your learning in your bare hands", "you can interact by your learning by touching".* They thought that the touch screen feature of the iPod touch made it easier to use.

The size of the device was also a focus area for the children. Some commented on the advantages of having a portable device such as; easy to carry, no cables etc. Some cited the disadvantages of using such a small device such as; difficult to see.   There were comments about the ease of holding an iPod Touch in their hand where they could bring it nearer or hold it further away as they needed.

Visual

Some students commented on the visual features of the games. The majority of the students reported that the graphics and sounds of the games made their learning fun and interesting. They also expressed views on the screen size of the iPod touch device, they thought it was bigger than the Nintendo DS and the quality was like 'high definition'. They also commented on the fun aspect of learning with games. They reported that they learnt better using the games on the iPod Touches.

Content

One of the commonly reported positive attributes of learning with games using iPod touches was the variety of the content. They commented on how this makes learning less boring and more engaging, as one of them said "when you got bored with one game, you can always download and play with another one". Being able find so many

educational games in many subject areas was another positive response that was received from the students. They compared this to games on other devices such as the Nintendo DS and Play Station 3. The majority of them commented on how limited the choice is for the other game devices when it comes to educational games and how expensive the cost is.

"It is boring to learn with a Nintendo DS, because it just has brain gym, that's all. And the game is so expensive, my parents don't want to buy, it gets boring to play with the same game" a student expressed his view of cost and limitations of Nintendo DS game console.

5.5.2 Perceived learning

Although this study did not aim to measure any actual learning gained when playing games using iPod Touches, it is invaluable to understand what children thought of their learning experience. Their comments were organised and placed under 6 modes of perceived learning; interactive learning, being in control, collaboration, learning without realising, motivation, failure and issues.

Interactive Learning

Students reported that when they played maths games, they liked being able to see their score on the screen instead of waiting for me to mark their work. They also commented on how this allowed them to move onto the next activity without waiting for others to complete their work which they thought made lessons boring. One of them said 'It is like having your own teacher in a box' which shows that children value having a one-to-one interaction when learning in the classroom.

"You can have more fun when you have things that helps you to learn like iPod touch, so you learn by doing and enjoy it too. When you use a paper, it is boring and not good for the environment too" reported a student describing their learning experience as 'fun', 'enjoyable' and 'active'.

Being in control

Many students commented about deciding on the task and level of the activity they were going to undertake. They reported that this helped them to choose a task that was appropriate for their level. By having control over this they selected activities that

weren't too easy for them which they described as boring or too difficult which prevented them from playing the game. *"I can play what I like, I can choose the level too, it is kind of teaching myself really,"* a student referencing independent learning opportunity.

Collaboration

Although all the students were given an iPod touch individually, some of them chose to use one with a partner. Their reason for this was that they have more fun when they work with a friend. Some of them sat together and used an iPod touch individually, but played the same game where they compared their results or had a discussion on the activity. A few children decided to work on their own.

Learning without realizing

The children's comments suggest that they thought that they were learning but without realizing it. They reported that when they played game, which is a multiplication facts game, they felt the aim was to help Squeebles which is a small red creature to save its friends from a nasty monster, but actually they were doing maths but they didn't think it was like a maths lesson. Some commented on feeling like being at home. The student expressed their amusement at the number of games they can actually download from the Apps store not only in Maths but in other curriculum areas.

Motivation

Another commonly cited aspect of learning by the students was motivation. They commented that when they played maths games for 20 minutes every morning, it felt like 2 minutes for them. Many of them wanted to play for a longer period. Some commented on the link between the games and learning, they said they like games, so they play more, they learn more.

Failure

A majority of the students reported that they utilized the unlimited try opportunity when learning with games using iPod touches. When you don't get good score you just do it again, you can do it a hundred times if you like was a common response received from the students. By completing the same activity many times, students reported that they

learned to correct their mistakes and improve their scores as an outcome. They stated that they felt better as a result of their enhanced scores.

Issues

Many students commented that by having so many game choices, they could be distractive from learning. They reported that sometimes they play with a game for only a few seconds before moving on to a new one without fully completing a task. Some of them also admitted playing history or literacy games instead of the maths games that had been selected in a specific area; i.e. multiplication and division.

Some children had problems with the screen size. They cited that looking at a small screen for so long, tired their eyes and made them sleepy, as a result of this they couldn't focus on the activity for any longer.

There were a few students who reported technical issues such as; slow connection, battery running out too quickly, long time to download a game. A few students expressed their frustration at having difficulty with typing using the on screen keypad. They reported that when they selected an answer to a question or typed the answer using the keypad, the device did not respond either correctly or quickly enough. This affected their scores at the end of the game which they found very frustrating.

Chapter 6: Conclusion

6.1 Findings and Discussion

The findings of this study indicated that the students perceptions of learning mathematics with games using iPod Touches was a positive one. This conclusion can be evidently confirmed by the data presented. The results of the post-survey show that the participants felt good about having an opportunity to use iPod Touches and reported that using an iPod Touch was fun. They also disclosed that they learnt better when using an iPod Touch (71%). Furthermore they agreed that using an iPod Touch made learning mathematics more interesting (100%) and easier to learn (71%). The survey also

revealed that the students were confident in their technological skills as they noted they didn't need any special training to use iPod Touches.

The survey results also showed that the participants had experience of using various technologies and enjoyed learning with technology. Although they agree that using an iPod Touch made their learning more fun and interesting, there were a number of students (29%) who didn't know if using an iPod Touch helped them to learn better. This may tell us that the iPod Touch may not be the most appropriate tool for teaching all students and therefore educators need to employ different methods and tools for teaching and learning to meet needs of all students.

Although students' perceptions of using the iPod Touches was more about the affordances of the device, this can also be used for understanding their learning experience. Their comments about their perceptions of learning such as; the visual features of the games, content, learning by doing, being in control, collaborative working, learning without realising, motivation and failure provides us with an insight into how they think and learn. Their feedback shows that students enjoyed being in control for example, deciding which activity to complete and at which level. This might create concerns for some educators as to allow children to do whatever they like and can make it hard to set a learning goal for the activity and assess learning. Students also reported that they liked having an opportunity to complete the same task many times until they were happy with their scores. When their score was low, this was not seen as a failure, simply as 'low score'. This is very important for two reasons; firstly it encouraged students to try and do better which will impact on their confidence level, secondly it gave them the ownership of their learning. They didn't act because they received feedback from a teacher to do better, they decided for themselves, which score was enough for their expectations and which actions to take when they got low score; re-try or move onto a new task.

This study shows the importance of understanding children's idea of learning. Some of the students suggested playing maths games on ipod Touches was a learning activity and they learned to do better, however some described it as just practising what they already knew. They thought that learning happens when someone tells you, or teaches

you how to do new things. This shows that students' previous knowledge of the subject and their understanding of what learning means affects their perception of learning with technology. When there are so many factors to consider, new approaches needed to measure children's attitude towards learning using technology.

There were some similarities and differences between the findings of this study and previous ones as discussed in the literature review, however, it is very hard to compare the outcomes as the age, gender and the background of the participants were not necessarily the same. Previous studies reported student' experiences of learning with iPod Touch as a positive one (Jones&Hinkle, 2005; Mifsud, 2005; Whitton, 2007), the findings of this study also supports this statement. Some studies suggested that learning with technology improved student' learning (Alexiou-Ray&Wright, 2011). It was not the purpose of this study to measure learning gained by playing games using an iPod Touch, rather this investigation wanted to find out simply children' perceptions. When used together with well designed learning activities the iPod touch offers many opportunities to increase interactivity and students engagement with the learning. The findings present that learning with games using iPod Touches had an impact on children's learning by making it more interesting and fun but it is difficult to measure if this had any effect on the students' actual learning.

One important finding was, that from the beginning of the project, the children didn't expect the technology to be perfect and they reported in the pre-survey that there would be some disadvantages when using iPod Touches. Interestingly in the post-survey a high number of students reported experiencing disadvantages when using iPod Touches. This indicates that the students are capable of evaluating the use of technology for learning. This is an invaluable point for technology designers, as involving students in the design process of future technologies would be very beneficial for them to pre-evaluate their products.

Another important result of this study was the diversity of the students list of ways to learn multiplication and division. Their list included both technological and traditional approaches such as Nintendo DS and traditional board games. This shows that the students had experience of learning with different tools and approaches. However, it is

hard to identify if this is the reflection of their needs for different learning styles or their attitude towards learning with technology.

It is noticeable that there is some kind of relation between children' perceptions and the mass media. Students reported to know a lot about what to expect from iPod Touches in terms of its affordances. Their explanation for this was what they heard or saw in the media. This brings up another question, how much effect mass media has on our perceptions, especially on children?

6.2 Further work

The integration of technology in education is still relatively new, varied and constantly evolving. It is claimed that successful integration will enhance learning. It is extremely difficult to justify this statement, however, one important point that both educators and technology developers are agreed on, is that the successful integration of technology into education, requires continuous evaluation of the learning technologies and pedagogies used in education. Understanding the interaction between the technology, student and teacher is the crucial part of this evaluation process. Studying students' perception of learning with technology would be beneficial for both educators and technology designers. From the educators perspective, it would support them to develop and use different learning programmes that will motivate learners and make learning more interesting. On the other hand technology designers and developers would benefit from examining what works well with students in terms of learning with technology. Findings from evaluating student's perception of negative and positive aspects of the technology, impacts on their achievements and their attitude towards learning with technology itself, can be used for the making of future technologies.

This was a small scale study within the context of learning mathematics with games using iPod Touches. The educational context of this study was learning maths and participants were from the same age group, there was no parental involvement in this study. Therefore it wasn't possible to explore the relationship between age, curriculum subject, parents and perceptions of the students. Future studies should include more participants and perhaps proceed as a longitudinal study to determine the impacts on student learning and attitudes. Additionally, allowing the students to take the iPod Touches or other handheld devices home would ensure their full utilization and might produce more detailed results for student' perception and achievement, as well as

provide better insight on the implementation of the devices. The outcome of these studies should also be used as a design evaluation to inform technology developers. Therefore building a more concrete relationship between educators, researchers, students and technology developers is required.

Appendix A: Sample Survey

Technology Survey

* 1. Gender

○ Male

○ Female

2. Do you have any of the following technology at home?

☐ Desktop computer

☐ Laptop computer

☐ Game console (Nintendo wii, play station 2/3, Xbox, Nintendo DS, PSP)

☐ MP3 Player

☐ Mobile Phone

☐ Digital Camera

☐ Video recorder

☐ iPod Touch

3. How often do you use the following technologies at home?

	Daily	Weekly	Rarely	Never
Desktop computer	○	○	○	○
Laptop computer	○	○	○	○
Game console (Nintendo wii, play station 2/3, Xbox, Nintendo DS, PSP)	○	○	○	○
MP3 Player	○	○	○	○
Mobile Phone	○	○	○	○
Digital Camera	○	○	○	○
Video recorder	○	○	○	○
iPod Touch	○	○	○	○

4. In the last week, what did you use technology for at home?

☐ Homework

☐ Playing games

☐ Take/create photo or film

☐ Find information online

☐ Email

☐ Chat with friends

☐ Social network

☐ Listen to music or look at videos

☐ Download music/videos

☐ Upload music/videos

☐ Use blogs/wikis

☐ Text

5. What is your favourite game console? Why?

6. Did you use iPod Touch before?

○ Yes

○ No

7. Do you agree with these statements?

	Agree	Don't know	Don't agree
Technology makes learning fun	○	○	○
I learn better when I use technology	○	○	○
I am excited to have an opportunity to use iPod Touch	○	○	○
iPod Touch will make learning more fun	○	○	○
iPod touch will make learning maths more interesting	○	○	○
iPod Touch will make learning maths easier	○	○	○
iPod Touch will help me learn better	○	○	○
I think we can use iPod Touch to learn other subjects	○	○	○
I need special training to use iPod Touch	○	○	○
I don't think there are any disadvantages of iPod Touch	○	○	○

Appendix B: Group 1 Concept map A

Ways of learning multiplication and division
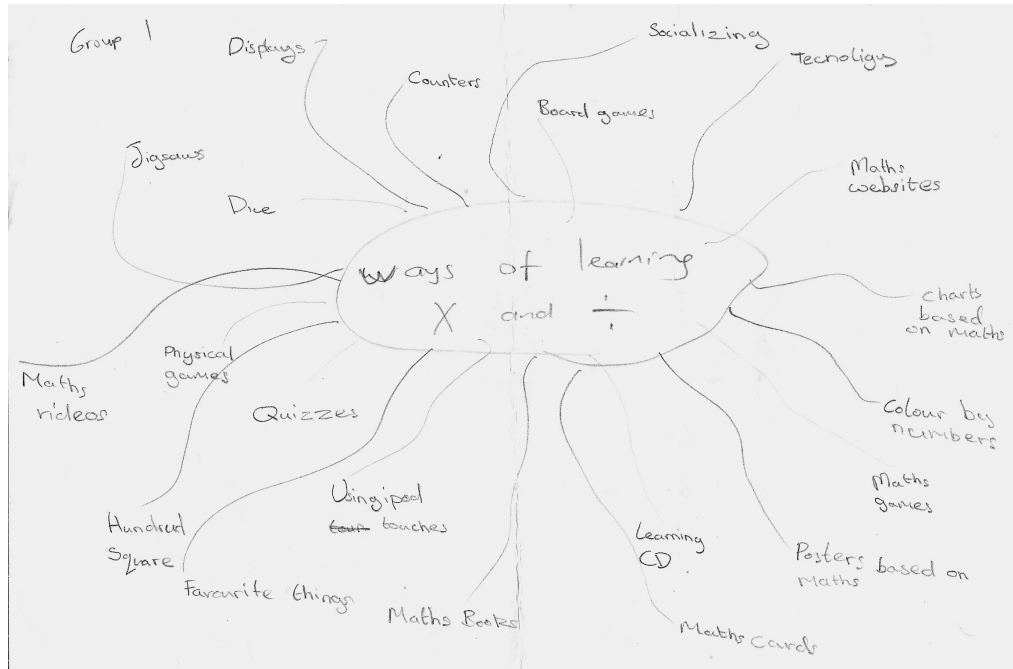
Appendix C: Group 2 Concept map A
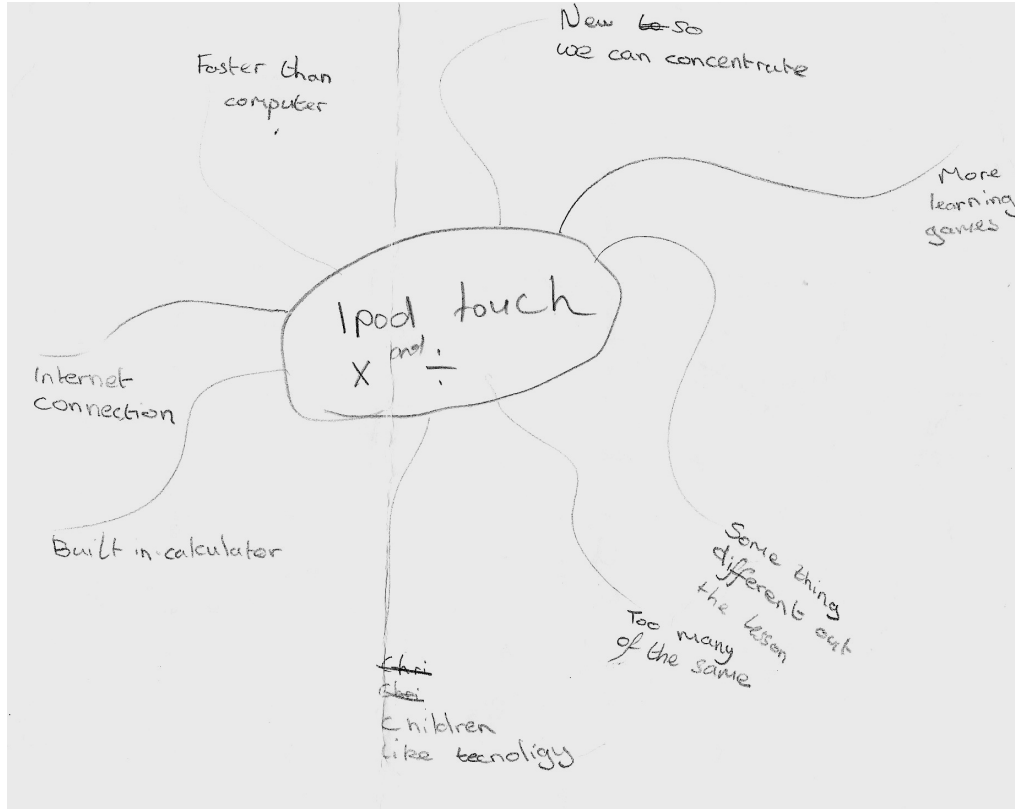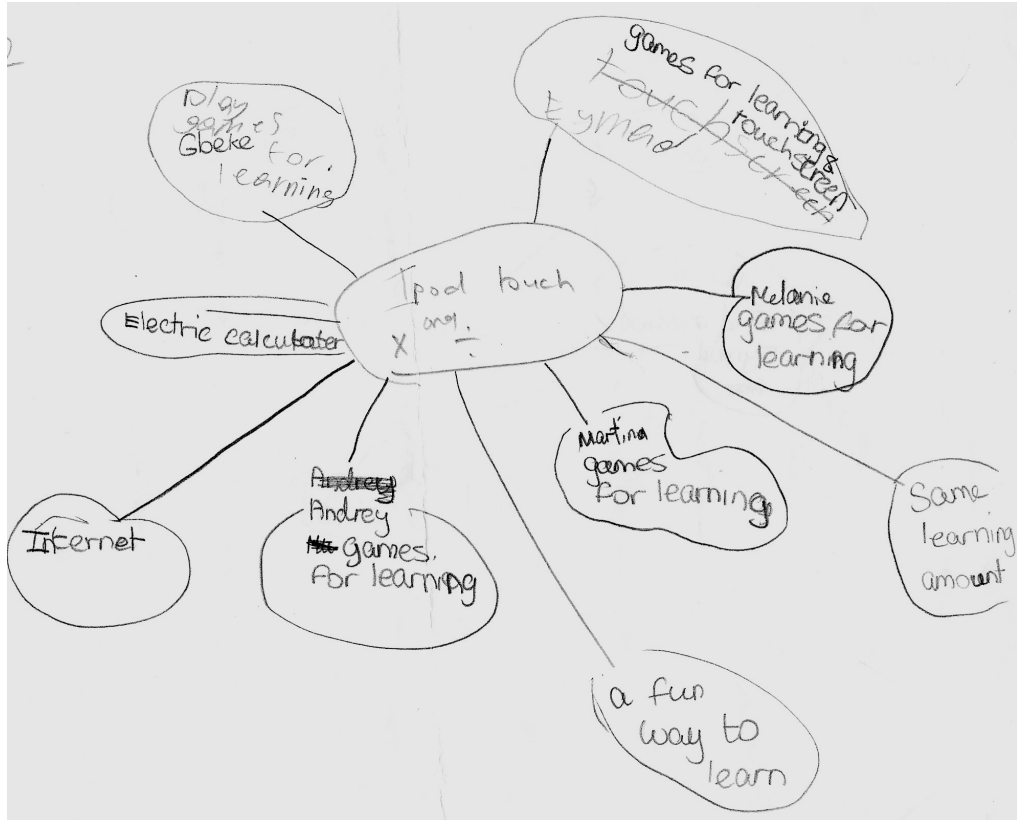
Ways of learning multiplication and division

Group 2

DS &
Writing it Down
Gbeke

Calculator
Martin
Wii

Mentol
Andrew

Wii &
Grid method
Eymad

ways of learning
X and ÷

Melanie
DS, Efficient
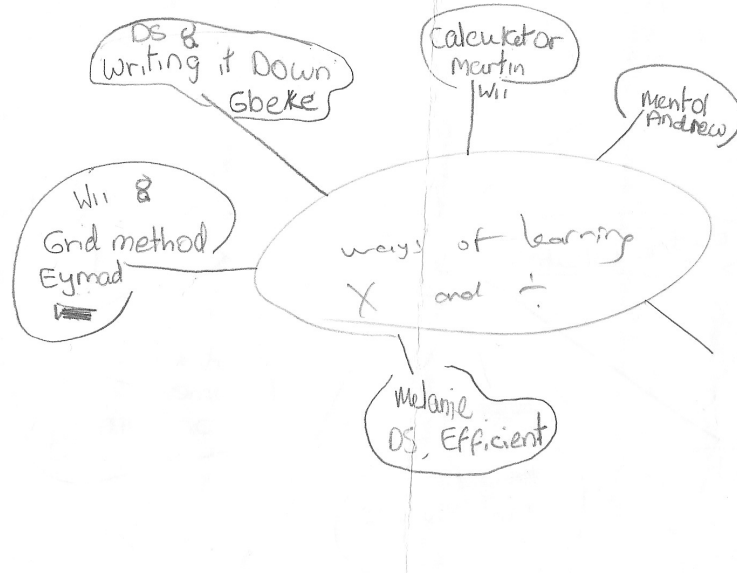
Appendix D: Group 3 Concept map A

Ways of learning multiplication and division
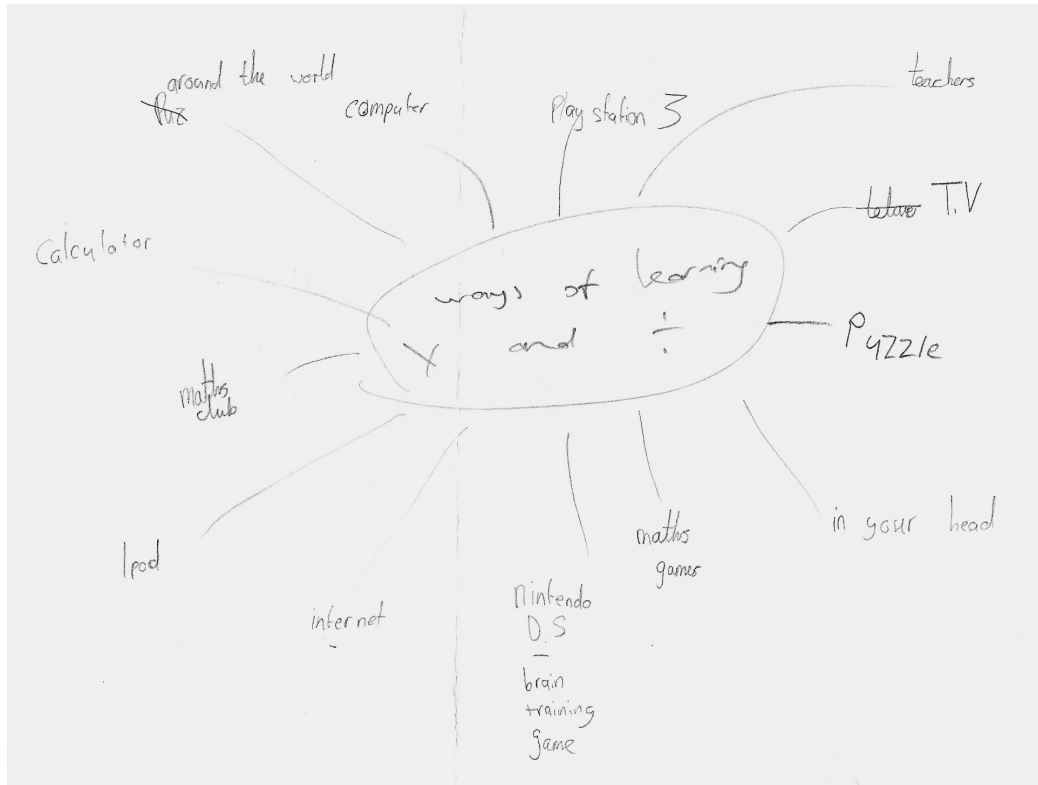
Appendix E: Group 1 Concept map B

Students' expectations of learning with iPod Touches

Concept map showing "Ipod touch X ÷" in the centre with branches to: Faster than computer; New so we can concentrate; More learning games; Internet connection; Built in calculator; Something different out the lesson; Too many of the same; Children like tecnoligy

Appendix F: Group 2 Concept map B

Expectations of learning with iPod Touches

Appendix G: Group 3 Concept map B

Expectations of learning with iPod Touches
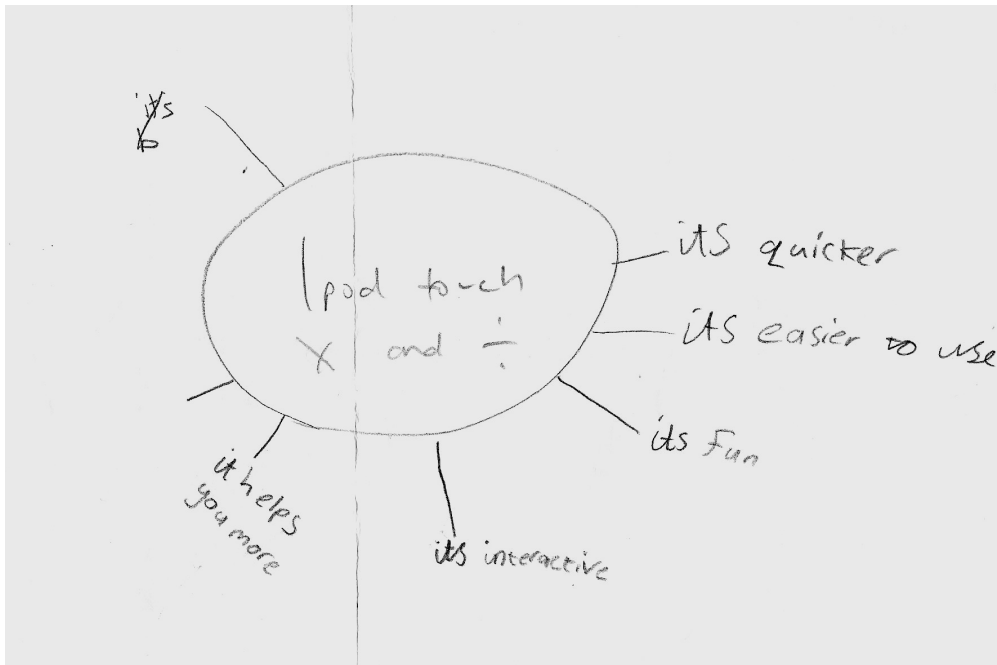
Appendix H: Group 1 interview comments

Q1- Do you still think that learning with games using iPod touches are different to learning using computers, Nintendo DS and other technology?

- Yes. Computers are not portable
- With iPod Touch you can learn even when you are on the bus or train
- DS is bigger
- you can fit in your bag but not really in your pocket
- you could carry iPod Touch in your pocket
- iPod touch have a touch screen

Q2- How are they different?

- With iPod Touch yeah, you got games, you can play games with DS too but you need to buy them. They are not free
- You can download them to your iPod Touch too, can't you?
- You can play games with computers too, but you need to buy games.
- You could download from the Internet
- My mum doesn't let me download it, she says they got viruses and stuff
- It is a new , so it is interesting, with computer I get bored because I got it for 3 years
- You can have a break (From using PC) if you get bored
- Yeah but if you use it everyday it is not that fun anymore

Q3-What do you mean by interactive?

- I think it means easier to play
- Playing by touching
- Means you actually do something
- Like you are active
- Doing
- I think... it is like being active and doing things

Q4- Have you played using a Play Station 3, Nintendo DS or other games console? How is it different from using an iPod Touch? Which one do you prefer?

- It is smaller
- you can fit in your bag
- easy to carry
- you can take it with you when you go on holiday
- you can get free games
- no cables, you don't need a plug
- it is like high definition
- lets you do many things like you can listen music... play games.. use the google
- DS is nice too, but games are very expensive, my mum won't buy anymore
- It (DS) doesn't really have maths games or books to read
- Yeah but it (DS) has cool games
- fits in your pocket

Q5- Did you enjoy learning using an iPod Touch?

- Yes
- it was fun
- can we use it to do something else
- like reading book
- searching the Internet
- it was cool
- can we take it home

Q6- What is the one thing that you liked about learning using iPod Touches?
- Fun
- easy to use
- small
- it is interactive, it is like real
- you can touch things
- you can hold it in your hand

Q7-Did using an iPod Touch make you more interested in maths?
- Yes, I think when you like doing something, you do it longer
- yes but because it wasn't like a lesson was it?
- Not sure.. it wasn't really like real maths, just playing games

Q8- Did you think that you learnt more using an iPod Touch? Why or why not?
- I am not sure I learned something new, I already knew my times tables
- Yeah, but, if you already know your multiplication, it is not really learning, is it?I don't think getting better is learning. When you learn , you learn something that you didn't know
- It doesn't tell you how to do things anyway, you just play games
- Well, it is kind of learning, it is like you practise and you get better, I think it is like learning.
- I don't agree with you, because sometimes you can learn something you know, you learn to do better, for example, you know your times tables, but when you practice you remember them, and you do it faster.

Appendix I: Group 2 interview comments

Q1- Do you still think that learning with games using iPod touches are different to learning using computers, Nintendo DS and other technology?

- Well I think it is a bit bad for you, if the game has bad graphics it can hurt your eyes.
- It has more learning games
- It has maths games, books
- You don't have to sit next to it, you can take it with you
- No cables
- It is fun
- It is fast, it takes 20 seconds... Google opens..
- you can download many games so you don't get bored

Q2- How are they different?

- PC, you learn better, because it has more information
- Computers are faster
- iPod is more portable
- Well, you can play brain gym on DS but, thats all really
- Brain Gym teaches you a a lots of things, it teaches you maths too
- Smaller
- Computers are heavy. You can't just put one in your bag, can you? But you could carry an iPod Touch wherever you go. Even on holiday, you could use it for chatting with friends or listening to music
- Not many games for learning on DS

Q3-What do you mean by interactive?

- Something has technology in it
- It talks to you when you get it wrong or right. It says well done or try again, doesn't hear what you say though, would be nice if it did
- Learning by doing
- Being active
- Something that makes you be active
- Things makes you play
- Things makes you do

Q4- Have you played using a Play Station 3, Nintendo DS or other games console? How is it different from using an iPod Touch? Which one do you prefer?

- PS3 doesn't have much learning stuff
- PS3 is more for racing or fighting games
- DS- you can learn learn little bit, there is this thing called brain-trainer, they train your brain
- But it (brain-trainer) asks you the same questions again again, so you don't really learn much.
- I saw it in a film ye, you go in and say hello to your computer, it recognises you and magic, on
- Well, you can download many maths games and stories on iPod touches but not my favourite game, not really real games

Q5- **Did you enjoy learning using an iPod Touch?**

- Yeah, it was fun

- Can we use it again

- I liked it, I loved it

- Yes, but can we do more stuff, like what we like

- I liked it but couldn't see a thing, it is a bit small

- It was ok, but not so easy to play games, when i touch the screen it does completely different things, doesn't always work

Q6- **What is the one thing that you liked about learning using iPod Touches?**

- You can carry in your pocket

- Fits in your bag

- It is fast and small

- Cost less, because you get free games

- you can get different covers like your favourite football team

- you can carry with you

Q7-**Did using an iPod Touch make you more interested in maths?**

- Kind of, it was fun, so kind of interesting

- Yes because it made it easier

- It was more interesting because wasn't like a maths lesson

- Yes, because it is like you are learning, but you are actually playing

Q8- **Did you think that you learnt more using an iPod Touch? Why or why not?**

- Well, when we play longer, we learn more

- Yes, because it was easier

- I don't think I learned more, I already know my multiplication

- Yes, because he (pointing his friends) helped me, so when I got stuck, asked him

- Not sure, it tells you when you get it wrong, thats quiet good, but don't know if you learn more

- When we were playing games like times tables game, it is learning ok, but it is like a game too. We like games ok. So we play more, so we learn more

Appendix J: Group 3 interview comments

Q1- Do you still think that learning with games using iPod touches are different to learning using computers, Nintendo DS and other technology?

- Yes, because PC is much a lot bigger, won't fit in your pocket, so you need to sit next to it, if you sit long it hurts your back too
- It is fun to use different technology
- you can hold it in your hand so it is more comfortable to learn
- PC is better, because it has a mouse and keyboard, it is easier to use
- allows you to move things by hand

Q2- How are they different?

- iPod Touches, you can keep downloading games , so you don't get bored
- You can have use Internet with DS too
- They haven't got games that teach you stuff like maths on Play Station
- DS small too
- Most people like iPod Touches because you can touch and play
- You can learn with DS too, but games are a bit expensive
- I have a game that teaches you French, it is for my DS, it is cool

Q3-What do you mean by interactive?

- Sometimes you can have fun, you learn from things that helps you to do and learn, so you learn by doing and enjoying
- It means you do it
- Learning on the move
- Means like when you play, like you are active
- It means doing using technology, not on the paper, you waste paper, it is not so good for the environment
- Talking with iPod Touch
- When you play tennis on Wii, you actually do move your arm like real game, same when you play bowling, like you actually playing (She stood up and moved her arm to demonstrate how she played tennis and bowling on Wii.)

Q4- Have you played using a Play Station 3, Nintendo DS or other games console? How is it different from using an iPod Touch? Which one do you prefer?

- PS3 has some free games online, but just demos
- DS, you can download games but not free, games are too expensive, like 30-40 pounds
- iPod, you can get games cheap or free
- PS3, you need a controller, iPod Touch you just touch and drag, it is easy
- DS has controllers too, next to the start menu, it has a touch screen too, but you need a pen to touch
- It is boring with DS because, I play with the same game for a long time, my mum won't buy any more games

Q5- Did you enjoy learning using an iPod Touch?

- It was awesome
- It was cool, I am going to save money and buy one (5 out of 7 says they will too)

- I liked it when we had free time, sow e could play other things
- It was like learning by doing
- Yes I did, but I was a bit bored too, because doing the same thing every day
- Would be better if we had iPad, got bigger screen

Q6- What is the one thing that you liked about learning using iPod Touches?

- It is very light
- Small
- Lots of games
- Touch-screen
- High definition screen, graphics were cool
- You can do a lot
- It opens google quickly

Q7-Did using an iPod Touch make you more interested in maths?

- Well it was fun, so yes, it was interesting
- Yes, but afterwards it got a bit boring
- Yes, because we were allowed to talk
- You can't really talk about maths a lot, can you, you just do it
- What are we going to talk about?
- It was interesting because, we didn't have to write anything
- Basically I felt like at home, just playing, wasn't like we were in school." Another one said, "You let us talk. That was nice

Q8- Did you think that you learnt more using an iPod Touch? Why or why not?

- I don't think so, we learned multiplication and division before
- Yes, because it is more fun, so you want to learn
- I think I learned more because when I got it wrong, I did it again, until I get better
- Not really, It doesn't really tell you how to do stuff, so it doesn't teach you
- iPod Touch doesn't really teach you, doesn't tell you things, you just answer questions, you can't ask a question when you stuck, it tells you if you get it wrong

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