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The application of gaming techniques for self assessment in learning: Online Quizzes.

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ABSTRACT

With the advancement of web services and web 2.0 technologies such as AJAX (Asynchronous JavaScript and XML) and Adobe Flash, the aim of this project was to utilise some form of web 2.0 technologies to produce an interactive self-assessment tool which would be fun to use and enhance learning compared to a basic multiple choice quiz.

In order to achieve this, extensive research was conducted in the fields of online learning, self-assessment in education, online quizzes, video games in education, and video games techniques that could be applied to the interactive quiz. As a result, certain guidelines were identified for designing the interactive quiz which would make the process fun and educational. The experiments were designed and developed from scratch and was put online for participants to have easy access. 24 participants were used in the project.

In order to determine the effectiveness of the interactive quiz and to obtain qualitative feedback, two versions of each experiment were tested. Participants were randomly put into two groups and were asked to read a text on a predefined subject. Group 1 was asked to answer ten questions using the interactive quiz, and a further ten questions using a basic multiple choice quiz, whereas Group 2 was asked to answer the same set of questions using a basic multiple choice quiz and the interactive quiz for the second set of questions. Participants were asked to complete a feedback form after the experiment. The average performance scores of interactive quiz and the multiple choice quiz between both groups were compared and analysed to determine whether participants performed better on the interactive quiz and the qualitative data was used to identify which application enhanced learning.

It was concluded from the analysis that T-Test results showed no statistical difference in average performance comparison between the interactive quiz and the multiple choice quiz, although the time difference in completing the experiments were significantly higher in the interactive quiz. The qualitative feedback results suggested that the multiple choice quiz was more effective in enhancing learning, therefore based on the analysis and the obtained feedback results the interactive quiz was only effective in making the process more enjoyable without enhancing learning.

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INTRODUCTION

The services offered by the Internet are increasing and with the technological advancements in computer speed, access to the World Wide Web enables many opportunities in online education. Access to all these technologies is now at a very affordable price (Cetron *et al*., 2003 as cited in Lindsay *et al.,* 2009) hence more users can benefit from these services. Due to these technological advancements there have been extensive researches in the fields of e-learning and the affects of online quizzes in students' learning and overall summative performance. These studies in general concentrate in traditional learning methods being employed in an e-learning environment. In this project, by using some of these technologies offered by World Wide Web, we will try to design and develop an interactive self-assessment tool which could be used by users to test their knowledge and improve their learning, and have fun at the same time.

We will look into the fields of online learning, self-assessment, online quizzes and video games in education. We will look at how these fields are being incorporated into education and their effectiveness in helping learners understand the materials being studied. In order to produce an effective self-assessment tool we will look at video games in education and find out which techniques we can borrow to make our online application fun, addictive, and educational. As a result of our research we will design and develop an interactive online self-assessment tool for users to test and comment on the functionality, enjoyability and effectiveness in improving their learning compared to a basic multiple choice quiz.

AIMS

The aim of this project is to research into the field of self-assessment in education, online learning, online quizzes and video games in education, and to design and develop a fun, interactive self-assessment tool for users to assess their knowledge and whether this would enhance learning compared to a basic online multiple choice quiz. By using a fun self-assessment tool we can influence students to interact more often with the subject and help them understand the content better. As Vollmer (2010) reports that students tend to produce better performance if they are having fun while learning**.** In order to determine the effectiveness of proposed self-assessment tool, the results will be compared against a basic multiple choice quiz.

OBJECTIVES

- To determine the benefits of self-assessment in education, online learning, online quizzes and video games in education.
- To identify video gaming techniques to be used in our interactive self-assessment tool.
- To implement the identified video gaming techniques and to design an interactive online self-assessment tool.
- To design and develop a basic online multiple choice quiz.
- To develop the designed interactive self-assessment tool in a short period of time.
- To identify a web hosting solution for the developed applications.
- To determine an effective topic and questions to be used in the experiments.
- To run the tests
- To gather and produce results for analysis.
- Determine whether interactive self-assessment tool is fun and enhances user learning compared to a basic online multiple choice quiz.

SCOPE AND DEFINITION

The idea of using video games in education has been utilised in many forms, from interactive maths applications to interactive language training. It is still an area that could be improved and the full potential of video games could be used in education. This project incorporates two different concepts, e-learning and the application of video gaming techniques in a simple interactive self-assessment tool which will be delivered online. This principle idea makes this study unique compared to other e-learning studies, and within the studies of video games in education.

The participants will not be asked to use the applications in a controlled room, but rather in their own time and at a place they feel comfortable, which should also make this study more authentic. Within the available time, a thorough, extensive research and experimentation will not be feasible. As a result of this we will adopt a qualitative and quantitative approach to the project with 20-30 participants. Due to the nature of this study, it will be very difficult to assess the validity of the developed application as a learning tool and whether it improves users learning in a short period of time.

The purpose of this study is to observe user feedback and produce qualitative, detailed results and if successful, it will demonstrate that applying video gaming techniques to a self-assessment tool; it is possible to improve user learning and make the process fun. However, a detailed quantitative/statistical approach with significant number of participants who is enrolled on an academic course is required to produce valid results for the effectiveness of the application as a learning tool. We will develop two applications, first one being an interactive quiz and the second one will be a basic online quiz. Both applications will be developed from scratch using Adobe Flash CS3 authoring tool. This should allow us to produce the desired applications in a short period of time, and we will be able to customize the applications as required by the aims and objectives of this study.

LITERATURE REVIEW

Self-Assessment

Self assessment is important and it is used in education by students to assess their own piece of work or performance which makes them independent learners and increase their motivation. “Self assessment also help students develop the ability to examine and think critically about their learning, help students to determine what criteria should be used in judging their work and apply these objectively to their own work in order to facilitate their continuing learning, and be undertaking as a part of the assessment requirements of a course or as an exercise within the course’s requirements” (Peer and Self Assessment, n.d.).

Boud (1995:13) investigates the importance of self assessment in higher education and states that “self assessment is coming to be regarded as an accepted and significant part of course because it relates to one of the central goals of a university education: enabling students to become effective and responsible learners who can continue their education without intervention of teachers or courses”. Self-assessment is important and it can improve learners’ skills in the professional environment. Sluijsmans *et al* (1998) discuss the skills and qualities needed from students and how professional organizations require students to reflect on their own behaviour. It is also stated that many current assessment practices in higher education has still not answered this requirement, and self-assessment is proposed as one of the assessment forms which can be used to tackles this problem.

A survey was carried out amongst college graduates in Australia and the results showed that problem solving and self-assessment were identified as the two skills graduates needed. Participants stated that they were not trained enough to develop those two skills (Midgley & Petty, 1983). The importance of self-assessment is mentioned again as Loacker (2003-2004) states “my own experience, as well as that of my Alverno colleagues, strengthened by our formal research, has verified for us that self assessment enhances learning and extends the responsibility students assume for their own education if they take self assessment seriously and work to develop it with increasingly

sophisticated understanding" (Alverno College Faculty, 1994; Loacker, 2000; Mentkowski & Associates, 2000, as cited by Loacker, 2003-2004).

Alverno College student who is about to graduate describes self-assessment and says: "I think I kind of figured out what the goal is behind this whole self assessment thing that I have spent three and a half years on. The whole goal is to become a self-directed learner, to become responsible for your own education because we are not always going to have the opportunity to be here and to be guided by a teacher and to lean on a teacher "(Alverno College Faculty, 1994, p.78).

In the area of language training, Oscarsson (1989, as cited in Coombe & Canning, 2002) describes six points into why self assessment can be effective. He makes his first point by stating that self-assessment enhances learning. It allows learners to evaluate their knowledge which results in benefits to the learning process. In his second point he points out that it gives students and teachers a raised level of awareness of perceived levels of abilities. Taking basic self-assessment methods and enabling students to question what they are learning encourages them to look at the course materials in a more perceptive way. In his third point it is stated that for students it is highly goal oriented thus it motivates students to take self-assessment tasks. Fourth, by enabling students to undertake self-assessment methodologies the range of assessment techniques are expanded in the classroom. This result in the learner broadens his/her knowledge through the use of self-assessment methods. In his fifth point, he stresses that by practising self-assessment, learners participate in their own evaluation. And in the last point he states that by successfully engaging student in self-assessment throughout the course, students will also benefit from it after completing their studies.

McDonald & Boud (2003) conducted a study to find out whether self-assessment practices improve the quality of the students' work. The study was carried out on high school students and by training students through self-assessment, whether it would have an impact on the students' external examination performance. A group of 256 participants had received formal training in self-assessment for three terms of an academic year. A control group was also selected which did not receive any self-assessment training. The results show that the group that received self-assessment

training had produced better performance than the group which didn't receive such training.

Quizzes in Education

Effective feedback is very important in maximizing students' learning and performance. Teachers need to produce plenty of valuable feedback to achieve this (Hattie 1987). Producing effective feedback is not enough on its own. This has to be done using variety of assessments (Seale *et al.,* 2000). Quizzes can be used in education as a self assessment tool and also can be used as an incentive for students to understand the course material and keep up with the concepts offered. Using online quizzes we can give instantaneous feedback on the spot (Dobsan 2008).

Quizzes can also be used by students as a tool to gain valuable feedback on the concepts thought and whether they understand the materials provided, and it can keep the students motivated between exams (Cooper *et al*, 2007: 214, 220). Using online quizzes, we can improve the process of giving formative feedback to students and it can be more beneficial to teachers. Online quizzes that is used by students to test their understanding on the key areas being thought, will also allow teachers to increase the number of students who participate in such exercises in efficient manner (Cooper *et al*, 2007).

Ebbinghaus (Llyod 2009) has experimented with the reasons why humans forget the things they've had learned and the findings show that most people forget what they had learned over time if the material is not reviewed again. Ebbinghaus called this "overlearning". He showed that continued practice of the material learned would lead to better performance in remembering. This process resulted in the discovery of the "forgetting curve". Ebbinghaus states that the amount of time elapsed after learning had completed has negative effect on the learning as we tend to forget what we had learned soon after stopped learning, and then the rate of forgetting slows.

Hulbert (n.d.) states that this is one of the reasons why teachers usually repeat materials, or re-teach it in a different form to help and make it easy for their students to remember the materials. Online quizzes suit this purpose perfectly, students can assess their

knowledge, review the areas they haven't had a firm understanding, and most of all, they will be able to improve their performance in the summative exam scores by remembering what they've had learned. See Dobson (2008) for effects of quiz on student's summative exam performance.

With online quizzes students can access them at a time most convenient to them, whether at home, in the library or in the class. All that will be required is an internet connection, and a basic computer. But users are not restricted to their computers when accessing the internet, as BBC (2008) reported "some 7.3m people accessed the net via their mobile phones, during the second and third quarters of 2008. This is an increase of 25% compared to a growth of just 3% for the PC-based net audience - now more than 35m". With the release of the latest mobile phone handset from Google named Nexus One (2010) and with the latest update to the operating system named Android Froyo (2010) users can view the web in its full power in high resolution, including full Adobe Flash (Adobe, n.d.) support within the browser. This can enable students to have an easy access to the online quizzes even when they're on the move unless a complex technology is used for the development of the online quizzes.

Effects of quizzes on student's performance have been an interesting question and several studies have been carried out to find out whether quizzes enhance student's performance when used as an additional tool in academic courses. A study shows that incorporating online quizzes enable students to see how the concepts they are learning in lectures applied in the real world, and students indicated that the assignments and quizzes were helpful in understanding the material (Cooper, Tyson and Sandheinrich 2007: 214, 220).

Another study shows that the use of online assessment methods on average produced better results in the final mark compared to those students who had taken the more traditional approach, and it is stated that there are two affects of the online quizzes on students, "it allows learners to test their knowledge, and understand the course unit materials" (Stanfield, McLellan, Connolly 2003:181, 185). As Dobson (2008: 297) concludes that incorporating technology in the form of online quizzes can enhance summative exam performance and the results from these quizzes can be a valid predictor of one's exam performance.

In a different study “the members of both focus groups firmly believed that the quiz was a valuable learning tool that helped them to gain a better understanding of the area of disclosure" (Maxwell, Pastellas, n.d.). An interesting study which illustrates the effectiveness of taking daily essay quizzes on student's writing skills. The results conclude that “daily essay quizzes would show better retention of information, clarity of ideas, and critical thinking when asked to write about an unfamiliar article in their discipline than would students who did not engage in daily graded writing. These findings suggest that students who wrote daily essay quizzes went beyond simply learning the course material to develop reading and thinking skills that generalized to a new assignment outside the realm of their class” (Green, Murdoch, 2000:21).

An example study which uses the combination of quizzes and technology to enhance student performance, the study discusses the effectiveness of technology in language teaching, especially the use of online quizzes. The results of the study show that “quizzes, especially when used interactively, can be of great value to motivate students in the study of a foreign language”. It is also stated that “the use of technology for language teaching and learning is much more effective, motivating and challenging than the use of the traditional classroom tools: pen, paper and chalkboard” (Mello, 1997).

By looking at these studies we can conclude that most students benefit from quizzes whether it's online or offline when used as an additional tool in their course. Again, indicated by “An Action Research project studying a group of final year undergraduates indicates that quizzes accompanied by brief discussions can be more valuable. Students on a one semester Technical Editing course were given a short quiz every three weeks. Most of the students felt that these activities helped them to understand concepts, or even to apply them” (Hulbert, n.d.).

Online learning

The advent of affordable computers and Internet access has introduced new ways for students to study. As a result of this "the Internet or the World Wide Web (www) is being used as a major teaching resource in the United Kingdom" (Kuraishy, Bokhari, 2009:2). Online learning is being utilized by many of the higher education institution, academic and professional organizations. "According to CCA consulting, nearly 50% of higher education institutions currently engage in some type of online learning. Academic and professional organizations agree that using web-based learning environments can offer sound pedagogical benefits" (Blackboard, 2000:1)

E-learning has been widely researched and many academic papers have been written, and the acceptance of these academic papers by major journals can be seen as an indicative of the serious view of the research in the discipline (Dick, 2009). E-learning incorporates many elements from the current Internet technologies. There are debates whether e-learning is necessary and whether it actually enhances student learning. Many studies have been conducted to find out whether academic courses delivered online are more effective than traditional classes. One of the concerns of academics is that not all courses are suitable for online (Dick, 2009). Some of the concerns include setting up and maintaining such an online distance education, providing enough incentives for students to take part in the online aspects of the course and coping with the number of students that will be taking part in online distance learning. It is essential that these points must be addressed prior to offering such an online distance course. It is in fact very important to organize and plan effectively as this phase of the distance online learning for a particular programme can decide whether it will be a success or a failure (Lindsay *et al*., 2009).

According to a survey conducted by the National for Education Statistics, the results predicted that number of people enrolling in colleges will grow 16% over the next 10 years (Jones, 2003). As result of this and the increasing number of people enrolling in colleges, many institutions recognise that there will be more students than what the institutions can accommodate in the future (Oblinger *et al.*, 2001). Technology is one of the areas affecting distance education. As computer speed is increasing and the cost is decreasing, network connections are also increasing in speed, and also decreasing in

cost and access to all these technologies is now at a very affordable price. (Cetron *et al.*, 2003 as cited in Lindsay *et al*., 2009).

The cheaper technology and its services are being used by more people by nationalities, age-groups and by people at different economic levels (Murray, 2003 as cited in Lindsay *et al*., 2009). With the widespread of technology into every house, every business it is essential for graduates to have technology fluency, and graduates cannot afford to be without computer competence (Oblinger & Kidwell, 2000). Universities are also starting to acknowledge the use of technology as an outcome skill, encouraging students to take online courses (Young, 2002).

Universities and colleges are constantly coming up with new ways of offering education in order to address the student needs (Witta, 2009). Witta (2009) talks about 'seat times' and states that "the amount of time spent in a classroom (commonly called seat time) has been a standard for judging the value of a class for years. Schools have established policies that if a student is absent for a specified number of classes, the student cannot pass the class—regardless of knowledge". But within the recent years there has been a huge interest in the use of online classes to overcome some of the education's problems such as increasing student learning, providing flexible teaching formats, making classes available for varied number of students (e.g. old, working) and to improve the problems encountered due to the shortage of teachers needs (Witta, 2009)**.**

The author states that with online learning the 'seat time' is not known hence it is difficult assessing students. If a student was accessing an online lesson for an hour, it is not possible for the instructor to know whether that student is actually sitting front of the computer, or just left the computer on. For online delivered classes seat time cannot be the decisive factor. As a result of this Witta (2009) asks the question of "if online methods are used, are learning outcomes equivalent?". As opposed to this Carnevale (2001) proposed assessing the outcomes rather than the way materials are delivered or time in study. The National Council for Accreditation of Teacher Education (Performance, not seat time, 2000) has moved from assessing the seat time to assessment of performance. As a result of this, development of Web-based classes were encouraged (Witta, 2009).

A questionnaire was carried out to find out whether online learning tools such as WebCT websites contributed to student's learning. And the results show that:

Students are interested in having course web sites that complement the courses in which they are enrolled. An analysis of the questionnaire completed by around 400 students who participated in courses that had WebCT-based web sites found that 57% of the students believed that WebCT web sites should be built for all Technion courses. In general, it may be said that the students were satisfied with the WebCT system. Fifty-five percent of them thought that using the system contributed 'a lot to a great extent' to learning.

(Frank, Barzilai, 2004:39).

In his analysis Brusilovsky (1999) talks about the benefits of web-based education. The author states that “Benefits of Web-based education are clear: classroom independence and platform independence. Web courseware installed and supported in one place can be used by thousands of learners all over the world that are equipped with any kind of Internet-connected computer”.

A study was conducted in summer 2000 to find out student achievement based on the mode of study. A researcher was assigned to master’s level research classes for the duration of 8 weeks (Witta, 2009). Although the seat time was equivalent to the 15 week class which was thought the spring before, but the 8 weeks of summer classes were longer in individual sessions**.** The students were given 10 homework assignments and a final research proposal project. The amount of work that needed to be done in 8 weeks was overwhelming, this raised concerns on the quality of learning. In addition a Web-based version of the same class was offered during the next year. Course materials were available in the form of online PowerPoint presentations, and students had their own private discussions areas. The web class was also conducted in 8 week time period and also had the same amount of homework and a final research proposal project. Nine out of the ten homework assignments for the web class were group assignment rather than individual. Although the final examination was not the same, but the content covered was.

Results: (Witta, 2009).

Figure 1

Table 1. Descriptive statistics for the midterm and final examinations by class

Class Condition	Mean	Standard Deviation	Sample Size
Midterm			
15-week	79.74	7.82	23
8-week Summer	80.50	8.67	28
8-week Summer	76.00	10.00	31
8-week online	79.22	17.61	18
Final			
15-week	84.27	11.14	22
8-week Summer	85.54	7.71	26
8-week Summer	86.81	9.02	31
8-week online	90.53	10.01	17

Witta states that “in conclusion, although the constraints (i.e., varying semesters, graduate classes) required to conduct this study limits the ability to generalize to other situations, the findings suggest there are no differences in outcomes based on class length or format. Further research into the attentiveness aspect of participation in online classes is suggested”.

In a different study (Dick, 2009) students were offered both modes of study, online and offline. They had the option to change it to the offline mode if desired. But in fact, more students asked if they could join the online class. The course was run on WebCT and by the use of e-mail. Students were very satisfied with the class and the learning experience, and as a group they found it enjoyable, would recommend it to others and would take another such class. Analysis of department evaluations indicated that 30% students agreed that they’ve learned more in the online classes, and they’ve stated that it was more challenging and intellectual. Analysis of evaluation also showed that around 5% of the students felt they haven’t learned as much as they could in the online classes, that it was less challenging and less difficult.

There are more classes being offered online Tucker (2001, as cited by Witta, 2009), but there is no firm evidence to show that online classes are superior to traditional classes, the results are mixed. An example would be Brown and Liedholm (2002) reported students taking the traditional classes perform significantly better than those students who take online classes. In contrast Shachar & Neumann (2003) found that students

taking online classes performed better than face-to-face students, and Gagne and Shepherd (2001, as cited by Witta, 2009) found no differences in the performances of online and offline students.

But opposed to some of these studies which show that there are no significant differences between the online and offline mode of studies, there are many benefits introduced by e-learning. One of the major advantages of undertaking an e-learning course is the flexibility it offers. Students can study without compromising from their responsibilities such as family commitments and full-time job (Penn State | Online, n.d.). This allows students to select the best online course suited to their schedule and that is flexible enough not to distract them from their responsibilities and commitments (Paulson, 2002).

With the traditional classes, students will need to schedule their other responsibilities to fit around their class schedule which is sometimes a problem for students and it could be a reason for them not to take a traditional class. Other benefits include greater motivation to work, it enables students to learn greater and understand the course materials, for some students the quality of the education is higher, it enables better access and communication with the staff, allows students to communicate more often and more effective with each other and it offers more active discussions and some students also prefer the instant access to self assessment tools and the immediate feedback from them (Dick, 2009).

There are also disadvantages reported by students in previous studies in online learning as Dick (date) states:

> *"A high level of frustration and dissatisfaction, lower levels of satisfaction, technical and logistical problems, lack of interaction with the professor, difficulty in developing student friendships, more likely to stop "attending" and fall behind, lack of feedback and confusion about what was required, overwhelming amounts of reading from e-mail and online discussion, less interesting, and students less likely to ask questions."*
>
> (Dick, 2009: p.42)

Online learning is still being researched and as we can see from many different studies conducted, the results are mixed. The next logical step would be to find out the reasons behind having mixed results. Technology can be used as a tool for enhancing traditional on-campus study rather than taking it over completely (e.g. online distance learning). Prior research also has indicated that online education is not suitable for everyone, it might be an excellent option for one student, but not for the other (Dick, Case & Burns, 2002).

Video Games in Education

The use of effective technology and its implementation is one of the key building blocks for improving and restructuring education (Scheffler & Logan, 1999). Learning in itself should be a self-motivating and rewarding activity (Kolesnik, 1970 as cited in Amory *et al*., 1999). With the advancement of technology, within the last decade video games have improved and became one of the main entertainment forms. The number of educational video games that is accessible on the internet and computer is increasing (Adultlearn, n.d.). The advancement of technology enabled developers to create complex simulation based games with high production values, sound and graphics (Squire, 2003). Video games put players inside virtual worlds created with high quality graphics, engaging narrative, sound and video (Amory *et al.*, 1999).

Video games come in many different genres; this includes shooters, strategy, arcade, sports, simulation, puzzles, adventure, RPG (role playing game), flight simulators and micro management. But what actually defines a video game? Kirriemuir (2002) defines a video game as:

> *"Playable using a television set. The game software is accessed via a games console, to which input devices such as joysticks or controllers are attached; or playable using a television set, with the game being accessible or downloadable through a satellite or digital subscription-based system; or playable on a PC or Macintosh; or housed inside a cabinet with a built-in screen and input device such as a joystick. These are typically found in arcades; or found on small, portable games machines, of which the most well-known is the Game Boy; or*

increasingly found in consumer electronic devices, such as mobile phones and handheld PCs."

(Kirriemuir, 2002)

In their analysis Greenidge and Daire (n.d.) discuss the potential application of video games in counselor education programs. The authors discuss "the ability to immerse students in high-risk situations and with high-risk populations provides another benefit in using gaming in counselling preparation programs" as one of the benefits of using games as educational tools. Kirriemuir (2002) asks the question of "Why do people play video games?" and states that there is vast number of people playing video games, and yet this area has received relatively small attention from the research sector. In few of the studies conducted in regards to the proposed question, researchers found interesting results. According to Mitchell (1985, as cited in Squire, 2002) a study revealed that families used an Atari 2600 games system spend more time together using the system as a shared play activity.

Kirriemuir (2002) describes computer games as a medium that engages players for long periods of times, and gamers usually re-play certain games many times over. He gives an example using the popular Pokémon franchise which is being played by millions of people, mainly children. In order to play Pokémon, whether on a handheld console or on a T.V. set, players need to deal with huge amounts of information. They need to know the characteristics of the monsters (Pokémon's) and the outcomes of each battle based on the Pokémon involved in that battle. He then asks the question of "how people deal with that sort of information during play, and how we can replicate the process in education and learning".

Malone (1981a) identified three elements that contribute to the fun in games and why people play games; these are fantasy, curiosity and challenge. According to Quinn (1994) for games to be effective as educational tools, they need to incorporate fun elements with effective instructional design and system design that will include key elements to motivate players to learn using interactive components. Also described by Lepper and Cordova (1992) learning is more effective when it is fun. Malone (1981: 333-369) outlines several guidelines for producing fun education applications. He argues that in order to produce enjoyable education applications it should have clear

goals that users find meaningful, multiple approach to proposed problem and feedback on their progress, flexible enough to adjust the difficulty to user's skill, randomness in terms of surprising the user and an emotionally appealing theme that is related to game skill.

Bowman (1982) came up with similar set of guidelines as Malone which he developed by analysis of Pac-Man players. The main idea Bowman proposes is that the power of video games comes from their ability to place players in "flow states". Based on the video game Pac-Man, "flow state" is a system where players' skills and challenges are gradually balanced, the player clearly knows the goals, players' receive instantaneous and explicit feedback from the game, and "relevant stimuli can be differentiated from irrelevant stimuli. Together, this combination contributes to the formation of a flow experience" (Bowman, 1982 p. 15). Pac-Man players are in total control of their action, actively seeking their own goals, and always challenged to achieve the best result, and instantaneous, clear feedback is given on their achievements and performance (Squire, 2003).

Bowman compares video game players who are engaged in state flow, with students in traditional class environments. Bowman explains that the traditional classes led by a teacher give little control over their learning, they are not interactively engaged with the material, only passive learners and only learn the material chosen by the teacher, they don't have control over the pace of the course, and the feedback gained from teachers are normative, shallow and imprecise. Bowman also suggests that educators could improve learning by following in the direction of video games by giving clear goals, challenging students, allowing for collaboration, using criterion based assignment and allowing students to have more control on the learning process.

SimCity is an urban and city planning simulation, and a micromanagement video game developed by Maxis. As Squire (2002) states that most people would think that SimCity is often being used in geography or urban planning classes. In fact Maxis saw the potential of their game being utilised in the classroom hence they've published a set of resources for teachers on its website, publicising that it can be used by teachers for education purposes in the class room (Squire, 2002). Kolson (1996 as cited in Squire,

2002) points out that “SimCity potentially teaches the player that mayors are omnipotent and that politics, ethnicity, and race play no role in urban planning”.

In a study a six-year old noted that when playing SimCity, as soon as his city had electricity people began moving into his city as they wanted to have lights in order to see in the dark (Squire, 2002). The author states that “this example illuminates how the process of interpreting game play, of drawing analogies between symbolic representations in the game and their real-life analogy is one of active interpretation, and suggests that students might benefit from systematic explanations or presentations of information”.

BBC (2002) reported on a research which found that computer games have important education value and it can become a part of the school syllabus. The study concludes that different genres had different benefits on students. Genres such as simulation and adventure games such as SimCity and RollerCoaster Tycoon, in which players create their own societies or build their own theme parks, helped develop children’s tactical and strategic thinking and planning skills. In addition, parents and teachers also agreed that their children’s mathematics and literature skills have improved.

In a different study conducted by Teem (Teachers Evaluating Educational Multimedia) students preferred playing video games in groups or pairs. The director of Teem, Professor Angela McFarlane (BBC, 2002) states that "adventure, quest and simulation type games have a lot of benefit - they're quite complex and create a context in which children can develop important skills." She also stressed that "we're not advocating arcade, shot-the-baddie type games”.

Depending on the genre video games can have unique influences on the player. For example reported by Surette (2007) “Those who played the first-person shooter Unreal Tournament (the paper did not say which version of Unreal Tournament was played) experienced greater improvements to visual acuity and peripheral vision than subjects who had played Tetris”. Similarly in a different research reported by BBC (2009) “26 adolescents were asked to play Tetris for 30 minutes a day over a three-month period. Their brain power was then compared with a similar group who hadn't been playing the game. The theory is that Tetris thickens the cerebral cortex - part of the brain that plays

a key role in memory, attention, perceptual awareness, thought, language and consciousness." Dr Haier who led the project states that "what we found was a change in the brain after playing Tetris... The thickness of the cerebral cortex actually increased, by less than half a millimetre". These studies show that as well as having educational benefits, players can also gain mental and physical benefits from playing video games from certain genres.

Video Games in Training

Video games are not only being utilised by the entertainment industry (Kirriemuir, 2002). Businesses are also using video games to train their staff, and help develop their fiscal, economic and trading skills. The US military has been using video games in their training programs. Wired (2003) reports that a specially developed video game "Full Spectrum Warrior... squad leaders learn how to command nine soldiers in complex, confusing urban-warfare scenarios". The article states that the army has used big, sophisticated simulators for years but using video games is far more cost effective than setting up high-tech hardware which costs millions and it is not feasible to be widely available, even for the army.

In a different story Wilson (2008) reports that a video game player saved two lives after playing America's Army, which is an army simulation game. The player never had any form of medical training; he only went through the medic certification in the video game. In the article it is stated that the player "pulled two injured passengers from the truck, assessed their wounds, and properly prioritized/administered treatment (direct pressure and elevation) to one of the accident's more brutal injuries, a mutilated hand. In short, he did things just as he should have in a circumstance that could have ended even worse. And yes, Galvanek thanks his training in a video game for his performance under pressure". This could be seen as an example of knowledge and skill gained by playing video games and applied in real life.

The other area where video games are used as training tools is for training aircraft pilots, also drivers of other vehicles (Kirriemuir, 2002). Video games are usually used in the form of simulation in the early stages of the training. This allows the trainee to be

familiarised with the user-interface, cockpit or any other physical control mechanisms. One example would be the use of Microsoft Flight Simulator (Williams, 2006) as an aid for pilots and students. Some of the features include but not limited to: enables students to take flights in different weather conditions, handling emergency situations such as engine, system and instrument failures and do flight analysis. All of these are available on a personal computer without the requirements of expensive hardware.

The Future of Educational Video Games

With the advancement of technology next-generation educational games (The Education Arcade, online, formerly known as Games-to-Teach Project) to support learning has been developed at Microsoft Research. The first conceptual education games were developed to support math, science, and engineering at the advanced high school and introductory undergraduate levels. Some of the latest games as of June 2010 include: "Augmented Reality Games (2008)", "Caduceus (2008)", "Labyrinth (2007)" and "Revolution (2008)".

For the *Augmented Reality Games* "early research has shown that this mode of learning is successful in engaging university and secondary school students in large scale environmental engineering studies, and providing an authentic mode of scientific investigation". *Caduceus* is "an online puzzle-adventure game for tweens. *Caduceus* exposes young players (ages 8 to 12) to the concepts of altruism and compassion, while also testing their skills of logic, reason and creativity". *Revolution* is a 3D multiplayer game which "combines the best elements of live classroom role-playing exercises and period drama films to provide a new kind of teaching resource for understanding American history". *Labyrinth* "is an on-line puzzle adventure game, designed to promote math and literacy learning, and is targeted at middle-school students".

All these games utilise some form of new technology whether it's 3D graphics, multi-player elements or using GPS and augmented reality to enhance education applications. To be next-generation, education games developed at The Education Arcade must continue using latest technology, and experiment with new ideas. As Squire (2002) states "such games will demand a broad, industry-wide investment if they are to

succeed. Long-term, this kind of project requires creative game designers who understand the tools and capabilities of the medium, educators who can help ensure an effective product and visionary thinkers who can design a suite of games that will appeal to a broad market".

METHODOLOGY

This section will outline the selected methods used in this project, and the rationale behind employing these methods, which can be divided into 11 stages.

STAGE 1 – DETERMINING THE VALIDITY OF SELF-ASSESSMENT IN EDUCATION

After the completion of the literature review associated with the project, the validity of self-assessment in education had to be determined. This was done by analysing previous research and studies conducted in this area and the affects of self-assessment on student's performance and student's learning.

STAGE 2 – DETERMINING THE VALIDITY OF QUIZZES, ONLINE LEARNING AND VIDEO GAMES IN EDUCATION

Once the validity of self-assessment was determined, the next step was to research into the fields of self-assessment, quizzes, online learning and video games in education in order to assimilate whether we can apply video gaming techniques into a basic multiple choice quiz which could be delivered online for the purpose of self-assessment.

STAGE 3 – IDENTIFYING SET OF GUIDELINES AND GAMING TECHNIQUES FOR THE DEVELOPMENT OF THE INTERACTIVE SELF-ASSESSMENT TOOL

The next step was to identify set of guidelines and gaming techniques that could be implemented for developing an interactive quiz which would be fun, challenging and will enhance user learning. This section was one of the most important parts of the project, as it would affect the outcome of this research. Maximum dedication and thought was given for this section. In order to produce an interactive quiz that would be fun, challenging and enhance learning, the guidelines set by Malone (1982:333-3690) and Bowman (1982) were utilised. Due to the nature of this study, limited time was a major factor for some of the decisions taken when designing the interactive quiz.

STAGE 4 – SELECTING MODE OF DELIVERY

The content had to be delivered online, and as a result of this there were many options available. When taking into consideration of the fact that there was limited time and finance, the options were narrowed down to three appropriate solutions: designing and developing the multiple choice quiz and the interactive quiz from scratch, and also a website from scratch for the experiments utilising a local development environment and uploading it on to the City University's web server, hiring a professional development team for developing and designing the experiments based on the guidelines identified, or using WebCT / CitySpace content management system which was provided by City University. The amount of technical skill required for the development of the interactive quiz and the basic multiple choice quiz, setting up the experiments, and the freedom of having full control over the files and the way the experiments would be carried out was the factors taken into consideration when selecting mode of delivery.

First option was to hire a professional developer to develop the required applications based on the guidelines identified and a basic website to host it. This was a viable option but the cost of hiring a professional development team, and the cost of hosting it was not feasible, and it was the first one to be rejected.

Although, using WebCT was a feasible idea at first, it was clear that full control over the experiment would not be possible. It was also required of me to spend some time learning the features of the WebCT for designing the sections for the experiments and gaining permission from the WebCt staff. Using WebCT, participants were required to sign-in in order to take part in the experiments, as there was a possibility for some of the non City University students refusing to take part due to that requirement. There was one advantage of using WebCT, the tools for designing the multiple choice quiz and the feedback survey was readily available, as well as City University students being familiar with the interface.

Developing the experiments from scratch and uploading it to the City University's web server was the most feasible method based on the nature of this project, skills and time required. A list of software was identified for the development of the applications, and the website. There were many options available to select from but based on personal

knowledge and previous experience, it was decided on Adobe Flash CS3 for the design and development of the multiple choice quiz and the interactive quiz. Adobe Flash “is a multimedia platform used to add animation, video, and interactivity to Web pages. Flash is frequently used for advertisements and games" (Wikipedia). Adobe Dreamweaver CS3 which is a web development application (Wikipedia) was selected for the development of the website and Adobe Photoshop CS3 which is a graphics editing program (Wikipedia) was selected for the production of the graphics. It was also important to create a local development environment for the project before uploading it on to the City University’s web server as this would dramatically increase the development time. There were few options to choose from but from previous experience, and ease of use WAMP was selected, which is “an acronym formed from the initials of the operating system Microsoft Windows and the principal components of the package: Apache, Mysql and PHP” (Wikipedia). WAMP is open source which means it is freely available to use.

The rationale behind choosing Adobe Creative Suite was that all three software allows cross software compatibility, which means a graphic developed in Photoshop CS3 could be easily imported into Flash CS3, and Adobe Flash applications can be easily imported into Dreamweaver. This would increase development time rather than constantly thinking about compatibility issues between different software. Once the development tools were identified, the next step was to select set of tools for storing the results of the experiments online. City University’s web server offered support for PHP and Mysql which was perfectly suitable for storing the results of the experiments. Initially, the idea was to create the feedback survey from scratch. This would have increased the duration of the development time. In order to reduce the development time, it was possible to find a free survey service online (www.esurveyspro.com) which allowed me to create surveys, and offered multiple ways of access to those surveys.

The intended development process was to develop the graphics in Adobe Photoshop CS3 and then import it into Adobe Flash CS3. Both applications (multiple choice quiz and the interactive quiz) would be developed and tested in Adobe Flash CS3. A basic website would be developed in Adobe Dreamweaver CS3, and the Flash files would be imported into Dreamweaver.

Once the core features of the applications were developed, the database for storing the results would be created using Mysql database (available with WAMP) and the developed applications would be tested on a local development environment using WAMP before being uploaded to the City University's web server. At the end of each experiment participants would be provided with a link for accessing the surveys created at esurveyspro.com, therefore Adobe Creative Suite 3, WAMP, PHP & Mysql and esurveyspro.com were ideal resources based on the nature of this project, the selected mode of delivery and the available time.

STAGE 5 – IDENTIFYING TARGET AUDIENCE

Since the aim of this project was to design an interactive application for self-assessment which would make the process fun, and enhance learning, the target audience chosen for the experiments were users currently enrolled in education or non students with academic qualification. This would ensure that they would have the experience of being formally assessed in a given subject and would be familiar with the process of answering questions thorough recognition and/or recall. In order for a user to be a valid participant, he or she had to posses one of the following characteristics:

- Enrolled as a student
- Working Professional with a minimum qualification of A Levels
- Unemployed with a minimum qualification of A Levels
- Be above the age of 18

The main target audience was the City University masters students as they fell in to the category of "student", as well as non-City University students and working professionals with academic qualification. Gathering participants from other academic institutions was not a problem due to the mode of delivery, which allowed anyone to participate with an internet connection.

STAGE 6 – DESIGNING & DEVELOPING THE INTERACTIVE SELF-ASSESSMENT TOOL

Since this was the major part of the project it was important to follow and implement the guidelines set by Malone (1982:333-3690) and Bowman (1982). This part of the project also required creative thinking and game design skills, as well as technical and artistic skills. As a student who holds a bachelors degree in video game design, I felt comfortable following the guidelines in order to produce an effective, fun application. There were general key points that needed to be taken into consideration such as the duration of the experiment, usability of the developed application, time required for developing the designed application and implementing the experiments, while making sure enough time for participants to complete the experiments and with enough time left over to analyse the results and draw a conclusion. The application was developed from scratch hence keeping it simple was the most viable option while adhering to the guidelines.

Taking all these points into consideration, the following guidelines set by Malone (1982:333-3690) and Bowman (1982) were used in designing the interactive quiz:

Malone (1981: 333-369) argues that in order to produce enjoyable education applications it should have:

- Clear goals that users find meaningful.
- Multiple approach to proposed problem and give feedback on their progress.
- Flexible enough to adjust the difficulty to user's skill.
- Randomness in terms of surprising the user.

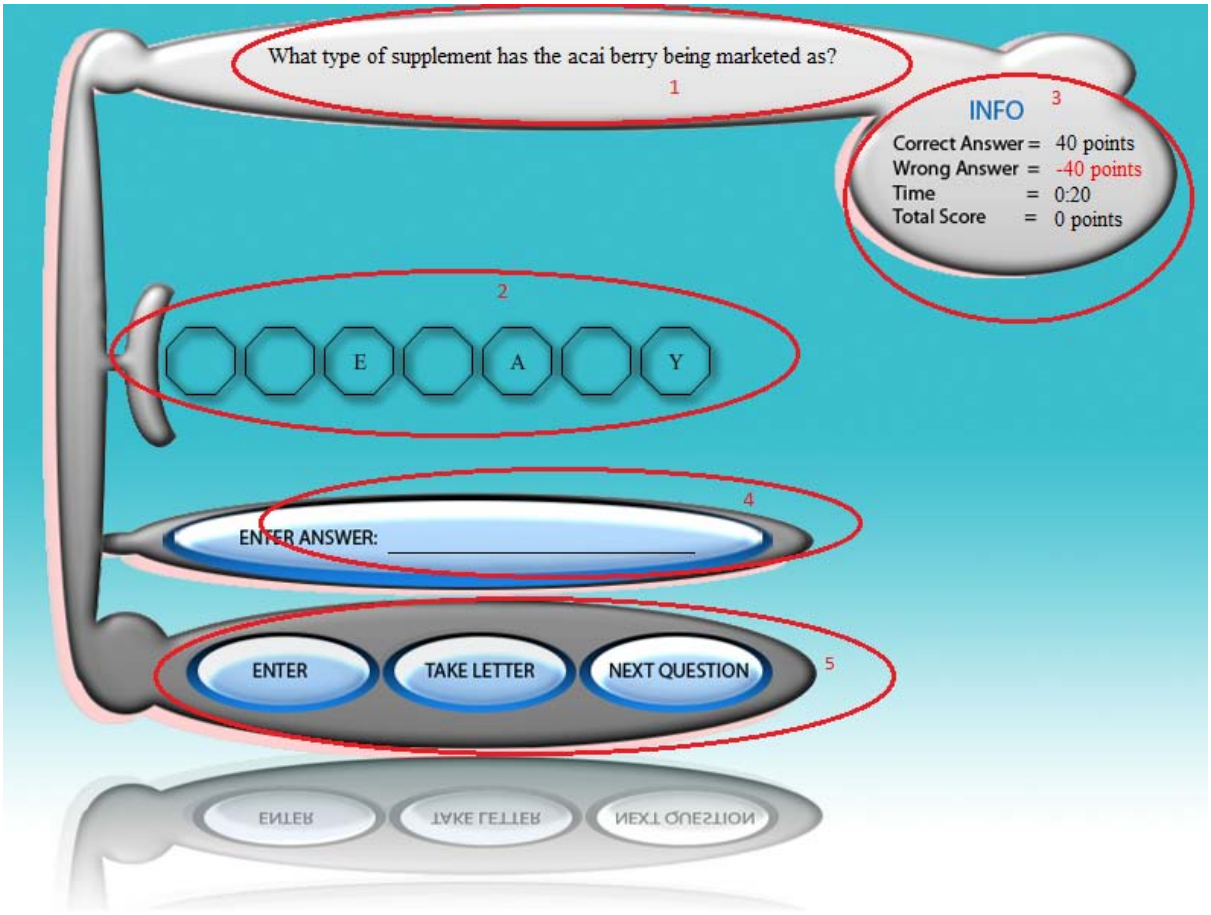
Bowman (1982) came up with a similar set of guidelines as Malone which he developed by analysis of Pac-Man players. The main idea Bowman proposes is that the power of video games comes from their ability to place players in "flow states". Bowman argues that:

- "Flow state" is a system where players' skills and challenges are gradually balanced.
- The player clearly knows the goals.

- Players' receive instantaneous and explicit feedback from the game.
- Relevant stimuli can be differentiated from irrelevant stimuli.

This is a screenshot of the developed application based on the guidelines set by Malone and Bowman. Also, key user interface design techniques explained by Fadeyev (2009) were taken into consideration. We will go through the guidelines set by each author and explain how it was incorporated into the design of the interactive quiz, as well as explaining the features of the application.

Screenshot 1: Interactive Quiz



1 - Active Question.

2 - Taken letters.

3 - Information on the current state of the game.

4 - Textbox for entering the correct answer.

5 - Buttons for interacting with the application.

Guidelines by Malone

First guideline set by Malone is a simple one, to give clear goals that users' find meaningful. The main goal of the interactive quiz was to enter the correct answer without taking any letters if possible within the quickest time. The goal of the game was simple, but also challenging. The key concept here was that users gain points based on how they would answer each question. There was a clear meaning why users should enter the correct answer without taking any letters: to gain the maximum points.

The second guideline set by Malone states that we need to offer multiple approaches to the proposed problem. In the case of our application, the users should be able to have more than one way of answering the questions. This second guideline was achieved via the use of "Take Letter" feature (see Screenshot 1). This is the basic principle which our designed interactive quiz was based on. When a letter was taken, the application randomly displayed a single character from the answer in the expense of reducing the total points that could be won for that question. Users were also able to enter the correct answer for the full points without taking any letters, where as in a basic multiple choice quiz the user always answered the questions in the same way, by selecting the correct answer from a list of possible answers.

Third guideline set by Malone tells us that it should be flexible enough to adjust the difficulty to users' skill. This could have been easily achieved by tracking participant's performance and asking easier questions when the user struggles. There are two reasons why this wasn't included in the developed application. Firstly, it wouldn't have been a fair experiment as each participant would have been asked different questions based on their performance, and secondly it required longer development time and variety of questions ranging from easy to medium and medium to hard. But as an everyday self-assessment tool, this feature can be used effectively to respond user's skill level.

The fourth guideline set by Malone states that there should be randomness in terms of surprising the user. Again, this was achieved via the use of "Take Letter" feature. Every time a participant had taken a letter, the application randomly selected a letter, and played an animation in which series of letters were displayed before displaying the correct letter. We had two concepts of random elements that surprised the user. First

concept was the random selection of the taken letter. The participant didn't know the location of the next letter that would be displayed therefore every letter requested could be seen as an element of surprise, and the second concept was the animation played before displaying the correct letter, a series of letters were displayed as the participant eagerly waited to see what the correct letter was.

Guidelines by Bowman

In his first guideline Bowman argues that players' skills and challenges are gradually balanced. This was achieved via the use of different questions ranging from easy to difficult. As the participants progressed, the questions became difficult to keep the participants challenged. This was achieved by using answers that were longer in length. The second guideline set by Bowman is the same guideline set by Malone, in which they both state that users must clearly know the goals of the game.

The third guideline set by Bowman is that players should receive instantaneous and explicit feedback from the game. This was achieved via the use of "Info" section of the game. The application displayed the total points the participant would win within the current state of the game, the total points the participant would lose within the current state of the game, time elapsed, and the total score achieved until that point in the game. The game updated this information each time a letter was taken, and when the correct answer or the wrong answer was entered. Appropriate graphical and audio feedback was also given to the participant depending on whether he/she had entered the correct answer or the wrong answer. Participants received clear, effective instant feedback on their performance as they progressed.

The final guideline set by Bowman states that relevant stimuli can be differentiated from the irrelevant stimuli. Again, this was achieved via displaying the total score the participant would win for entering the correct answer, and the total score the participant would lose for entering the wrong answer. The participant was constantly reminded that the incentive was to enter the correct answer without taking any letters to gain the maximum points for each question.

Taking these guidelines set by Malone and Bowman into consideration, and other factors such as the duration of the project, skills required for the development of the interactive quiz which, suitability of the application for the experiment, and ease of use, an effective and challenging interactive quiz was designed and developed.

Usability Design

As well as following the guidelines set by Malone and Bowman, certain application design techniques were also taken into consideration in order to design effective usability experience for the interactive quiz. As stated by Fadeyev (2009) visual feedback for each of the user's interaction is one of the important user interface elements, and this can be achieved via the use of animations as users must notice something is happening behind the scenes. Fadeyev also states that it's important to select the right interface controls for the situation, and the control interfaces such as buttons should be disabled depending on the situation.

The designed application needed to contain animations to gather user attention and to give feedback on user interaction, the number of buttons needed to be kept to a minimum, and a simple, consistent colour scheme would need to be used. The duration of the project also affected the decisions made in this part of the design.

Therefore, it was decided that the animation that would be played when a participant takes a letter met this design technique. This would allow the participant to clearly see the result of his/her interaction with the system. Then it was decided that the buttons would need to flash indicating which actions participants can take. For example, when a new question was started, the buttons "Enter" and "Take Letter" would start flashing, indicating that the participant can only interact using those two buttons and the "Next Question" button would need to be disabled. Effectively, once the correct or the wrong answer was entered, or all the available letters were taken, "Enter" and "Take Letter" buttons would need to be disabled and the "Next Question" button would need to be flashing.

The interactive quiz required more screen space than a basic multiple choice quiz, as a result of this using pixels 800 by 600 was sufficient. This would ensure that all user

interface elements were clearly visible, and the amount of scrolling would be reduced to a minimum.

STAGE 7 – PLANNING THE EXPERIMENTS

Designing and developing the interactive quiz and the basic multiple choice quiz consisted major part of this project. Once both applications were designed and developed it was time to decide how exactly they could be adapted to and be presented to the participants in keeping with the objectives of this project.

Choosing a topic

As we didn't know the characteristics of the participants and their background, it was not possible to use any of the course material such as Information Systems, Information Retrieval, etc. This would have been unfair to those students who had never studies in those subject areas. To overcome this problem, it was essential to select a subject that would be interesting. In an attempt to find a suitable subject, a diverse range of subjects were covered. The subject had to be interesting, informative and gain participants' attention. As a result of this, a subject from the field of Health & Weight Loss was selected. The selected subject was about the fruit "Acai berry" and its effect on weight loss. The reason for selecting acai berry as the subject was the major marketing done by health companies stating the benefits of acai berry on weight loss, general health and the question marks raised by health professionals regarding these claims. Also, the subject itself was interesting and it was fairly current news, and the text that needed to be read contained scientific data which was ideal for producing effective questions to be used in the developed applications.

Content Organisation

The basic aim of this experiment was to determine whether the developed interactive quiz was more fun, challenging and enhanced learning compared to a basic multiple choice quiz. (In the proposal it was initially stated that there would be four predefined subjects for participants to select and answer questions on. This was not feasible due to the time constraints and it was a viable decision to keep it to one subject to make the

experiment fair and statistically sound.) Therefore, in order to achieve this, the same set of questions in the interactive quiz, was also asked using the basic multiple choice quiz. To obtain qualitative and quantitative data, two groups were required and both groups were required to answer 20 questions in total, 10 questions per application. The performance of the first group, answering questions using the interactive quiz, than the basic multiple choice quiz would be compared with the performance of the second group that would answer the same set of questions using the basic multiple choice quiz and then the interactive quiz.

Group allocation - Overview

	Questions 1-10	**Questions 1-10**
Group One	Interactive Quiz	Basic multiple choice quiz
Group Two	Basic multiple choice quiz	Interactive Quiz

In order to effectively compare the performance of both groups, certain information needed to be recorded. Each application recorded users' performance including time spent answering each question, whether the correct answer was given for each question, the total score, total time in minutes and seconds, and finally whether a letter was taken by the user for each question for the interactive quiz. Both groups were required to answer questions using both applications in order to sound statistical. This was required in order to obtain qualitative data from both groups in regards to their experience with each application. The results of the performance and the qualitative feedback from the surveys would be indicative of success or the failure of the developed interactive quiz as a self-assessment tool compared to a basic multiple choice quiz.

The following criteria were compiled which took into consideration the elements required to successfully obtain the required data and meet the objectives:

- The users should be introduced to the project and be given brief information about the experiments.
- Each experiment should start with the text that needs to be read in order for participants to answer the question.
- Detailed instructions should be given for the interactive quiz.

- The results from each part of the experiments should be recorded before forwarding the participant to the next part.
- Each experiment should end with a link to the feedback survey for the appropriate group
- Participants should complete the feedback survey at the end of each experiment.

Feedback survey

To gather qualitative data and to find out about characteristics of the participants, the feedback survey needed to be consisted of three parts. The first part was designed to assess whether the interactive quiz had met the guidelines set by Malone and Bowman based on participant feedback. The second part was designed to consist of questions regarding the experiment. The final part was designed to contain the demographic survey which would allow us to see if we have the correct target audience. In order to achieve this, two feedback surveys were created, one for each group to obtain qualitative data based on each group's experience.

Group Allocations

When deciding how to organise and allocate new participants to the groups, the following criterion was used:

- All participants should read the text and complete both parts of the experiment and the feedback survey at the end which also includes the demographic survey.

Both groups were required to read the same text and answer the same set of questions using different tools. In order to avoid bias, deciding which participant would be assigned to which group; a special function was developed in PHP. This function would check the number of participants in each group, and assign the next participant to the group with the lower number of participants in order to keep the number of participants in both groups even. Therefore, all participants were dynamically assigned to a group as they participated in the experiments.

Tracking Participants

Once the experiments were live, a control and tracking mechanism was required in order to follow each participant and making sure there were no incomplete results inserted into the database as this could cause problems at the analysis stage. The best method would have been to design the experiments around this issue; only inserting the results once both parts of the experiments were completed after the successful completion of the feedback survey. This was not feasible due to the time constraints, and the technical skills required.

A manual method was required, where each participant could be tracked as they completed the experiments. This included when a possible participant was reading the welcome page, when a participant was allocated to the appropriate group and forwarded to the next experiment, when the results of the first experiments were inserted into the database and the participant was forwarded to the feedback survey. At this stage, it was possible to log onto esurveyspro.com and see whether the feedback survey was completed or incomplete. This information needed to be sent to a mobile device in the form of e-mail in real-time which made it possible to track incomplete experiments.

Viewing results

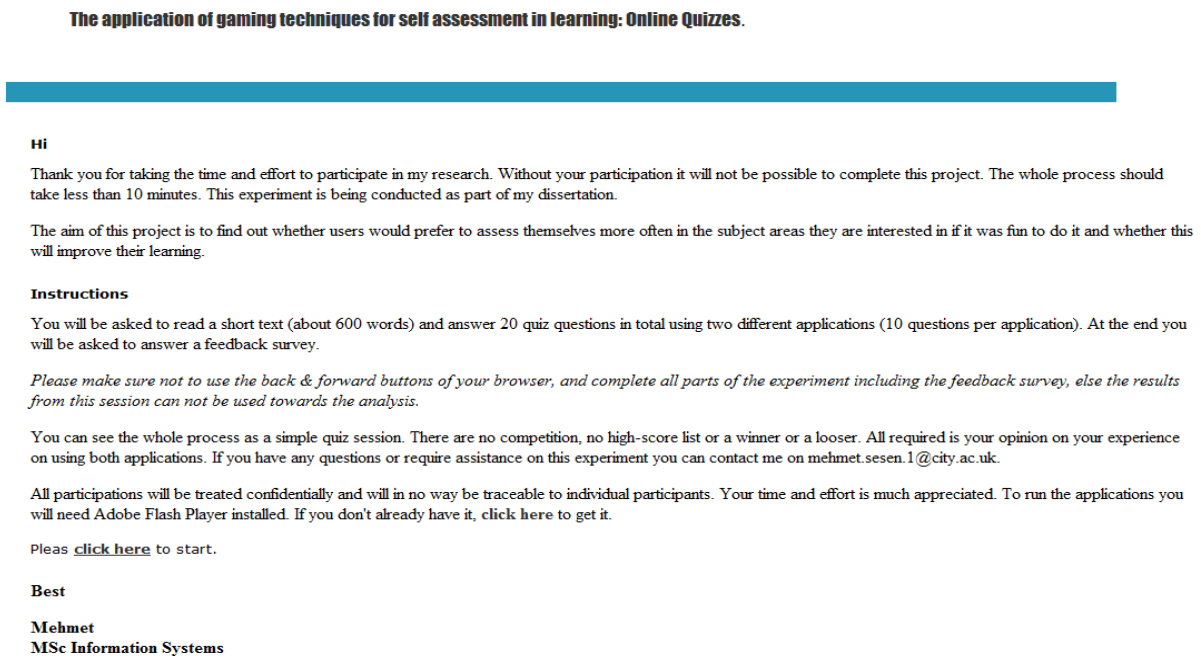
There needed to be an easy method of accessing the results as each experiment was completed and for the analyses. The easiest solution was to query the database using PHP and Mysql and display the results from each group in tabular format. Four tables were required for storing the results of experiments, two tables per group, and one table per application for each group. These would be called respectively: Group One Interactive Quiz Results, Group One Basic Quiz Results, Group Two Interactive Quiz Results and Group Two Basic Quiz Results.

STAGE 8 - DESIGNING THE EXPERIMENTS

The main objective when designing the experiments was to make the process straight forward and easily accessible. Participants were required to complete all elements of the experiment without any assistance. The experiments were designed keeping this simple principle as the basis. As explained earlier both application was designed in Adobe Flash CS3. The graphics were designed in Adobe Photoshop CS3 and the basic website was developed in Adobe Dreamweaver CS3. The following screenshots illustrate the process involved for participating in the experiments.

Screenshot 2: Welcome Page

This is a screenshot of the welcome page. It is kept very simple with only detailed information about the nature of the project and instructions regarding the experiments. For those participants who did not have flash player installed, a link was provided for them to install the flash player plug-in.



The application of gaming techniques for self assessment in learning: Online Quizzes.

Hi

Thank you for taking the time and effort to participate in my research. Without your participation it will not be possible to complete this project. The whole process should take less than 10 minutes. This experiment is being conducted as part of my dissertation.

The aim of this project is to find out whether users would prefer to assess themselves more often in the subject areas they are interested in if it was fun to do it and whether this will improve their learning.

Instructions

You will be asked to read a short text (about 600 words) and answer 20 quiz questions in total using two different applications (10 questions per application). At the end you will be asked to answer a feedback survey.

Please make sure not to use the back & forward buttons of your browser, and complete all parts of the experiment including the feedback survey, else the results from this session can not be used towards the analysis.

You can see the whole process as a simple quiz session. There are no competition, no high-score list or a winner or a looser. All required is your opinion on your experience on using both applications. If you have any questions or require assistance on this experiment you can contact me on mehmet.sesen.1@city.ac.uk.

All participations will be treated confidentially and will in no way be traceable to individual participants. Your time and effort is much appreciated. To run the applications you will need Adobe Flash Player installed. If you don't already have it, **click here** to get it.

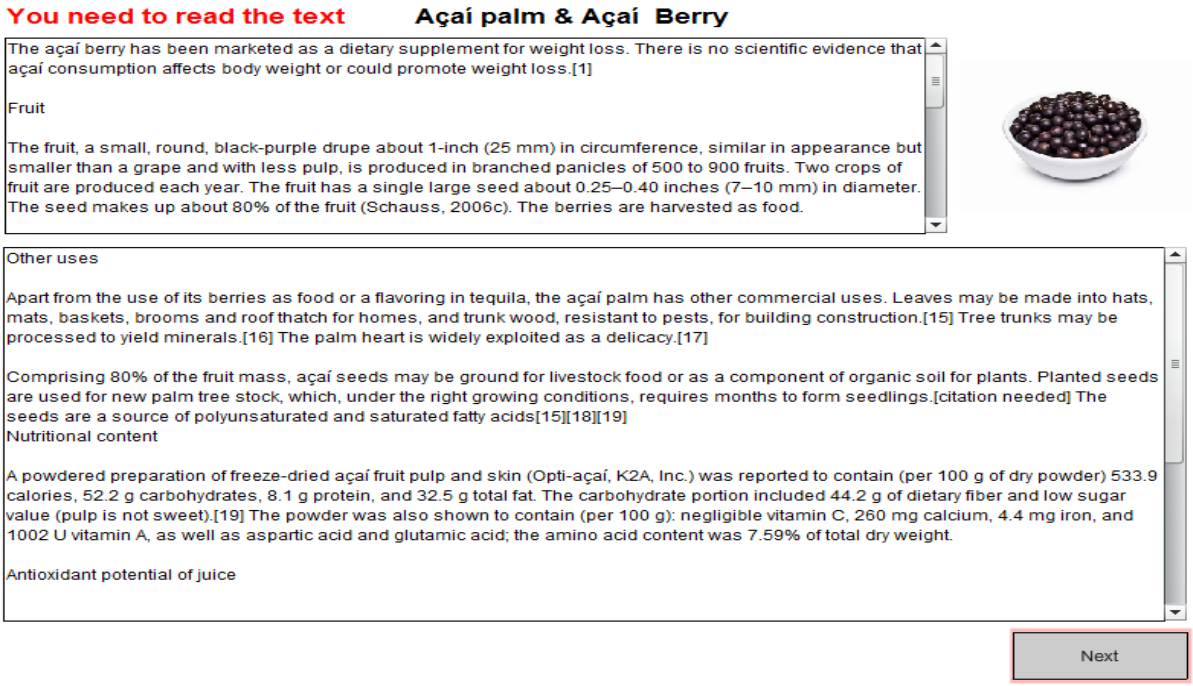
Pleas **click here** to start.

Best

Mehmet
MSc Information Systems

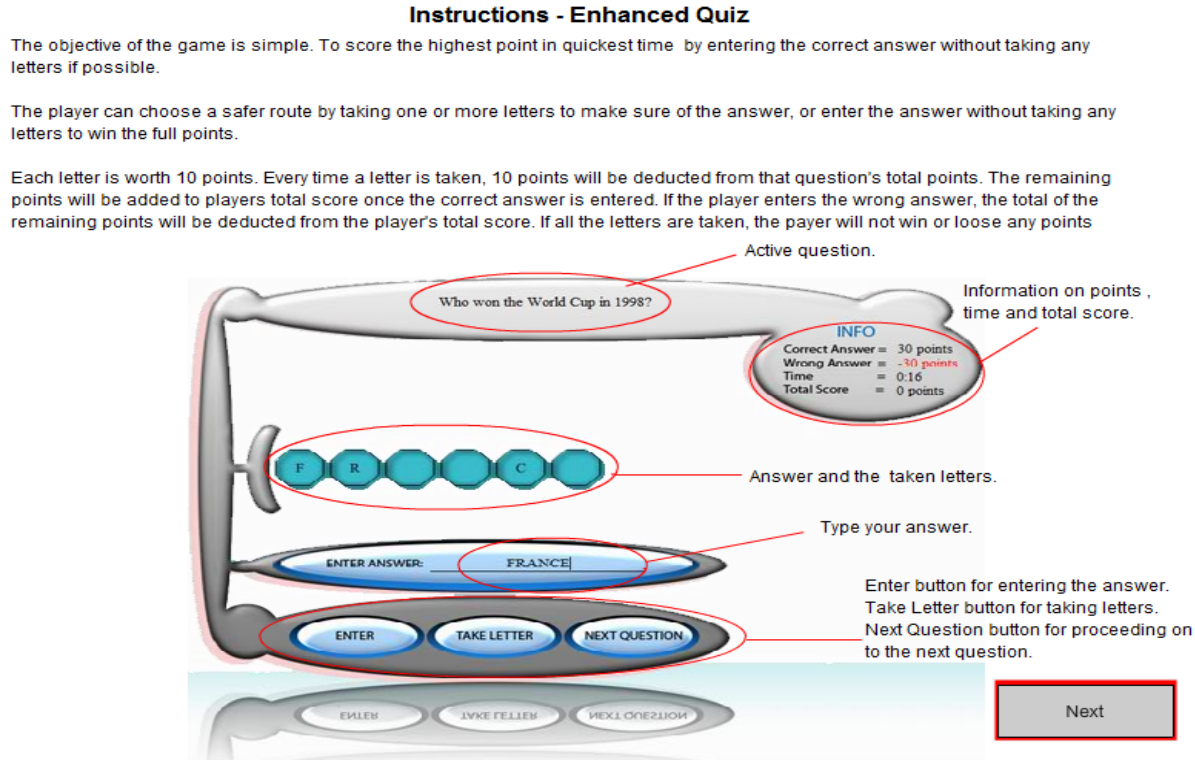
Screenshot 3: Reading Text

It is clearly indicated that the text needs to be read. This is the first screen participants see before proceeding on to the questions.

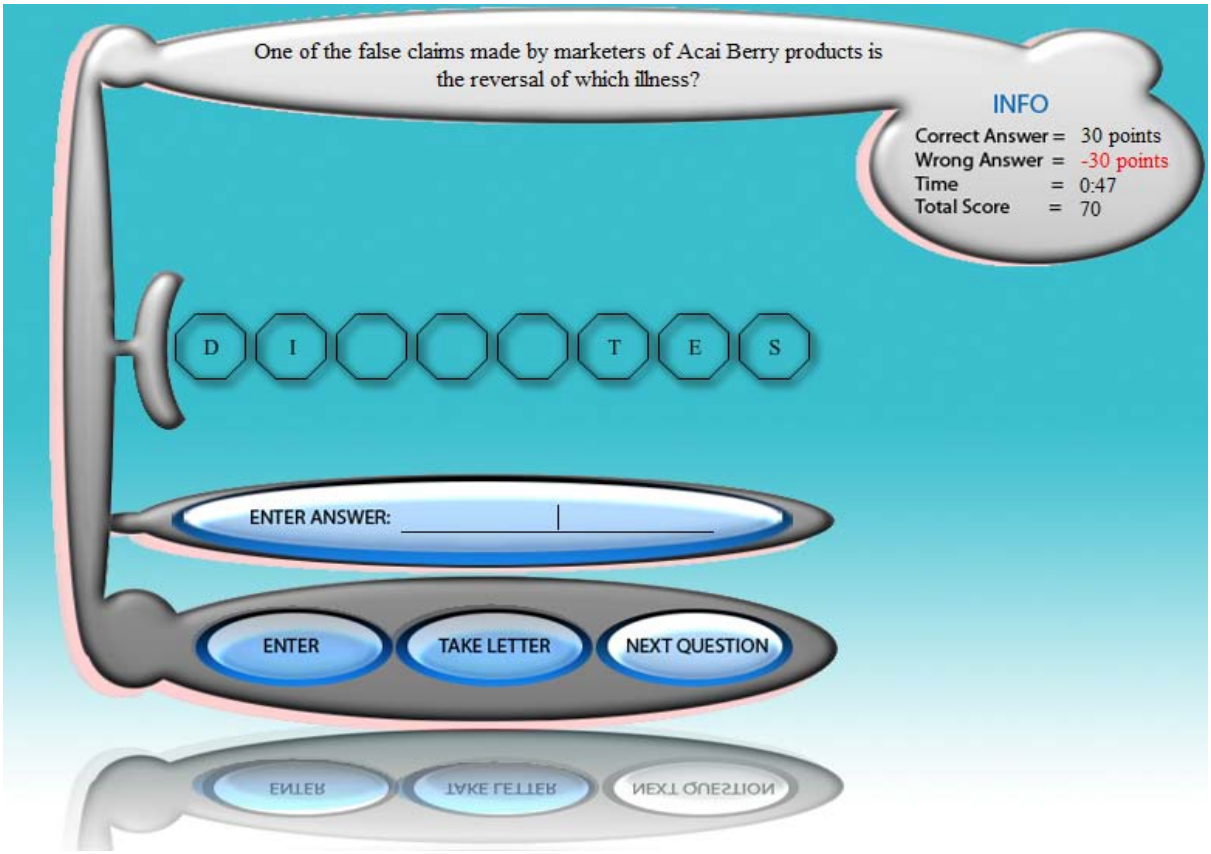


Screenshot 4: Enhanced Quiz instructions

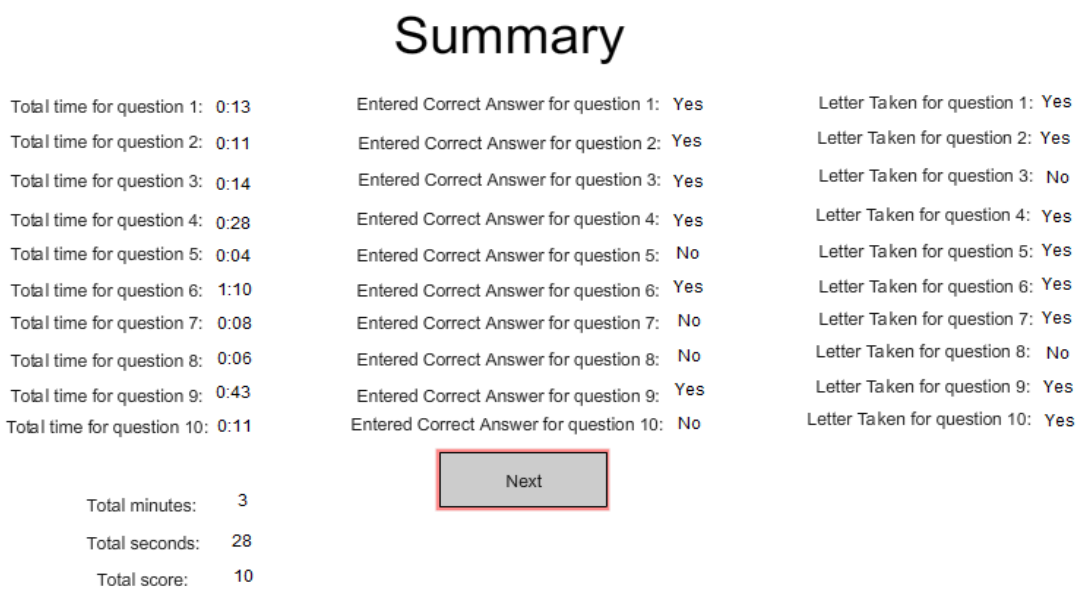
Clear instructions were given for the interactive quiz using a screenshot explaining the main features of the application.



Screenshot 5: Answering a question in Enhanced Quiz

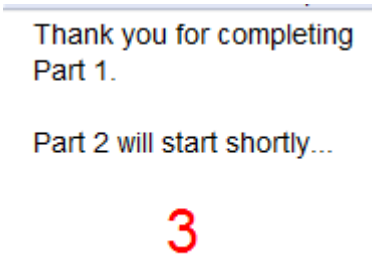


Screenshot 6: Summary screen of Enhanced Quiz (participant's performance)

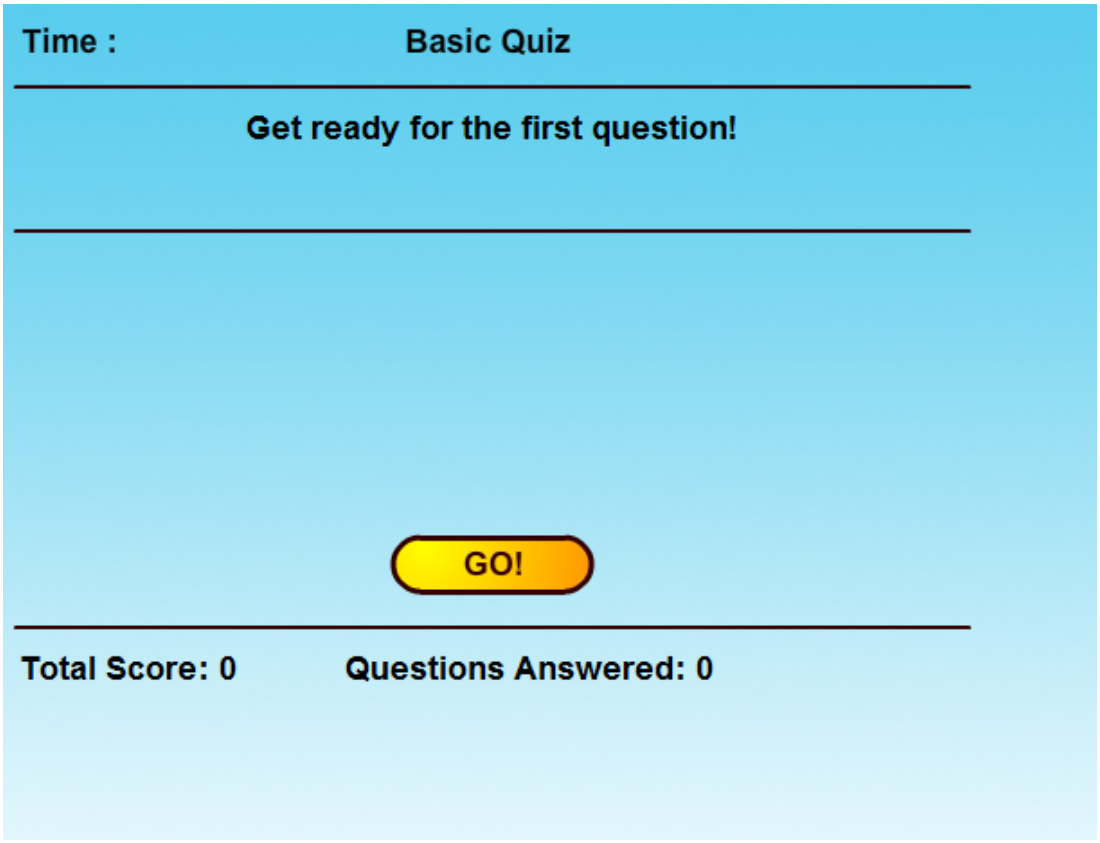


Screenshot 7: Forwarding participants to the next part

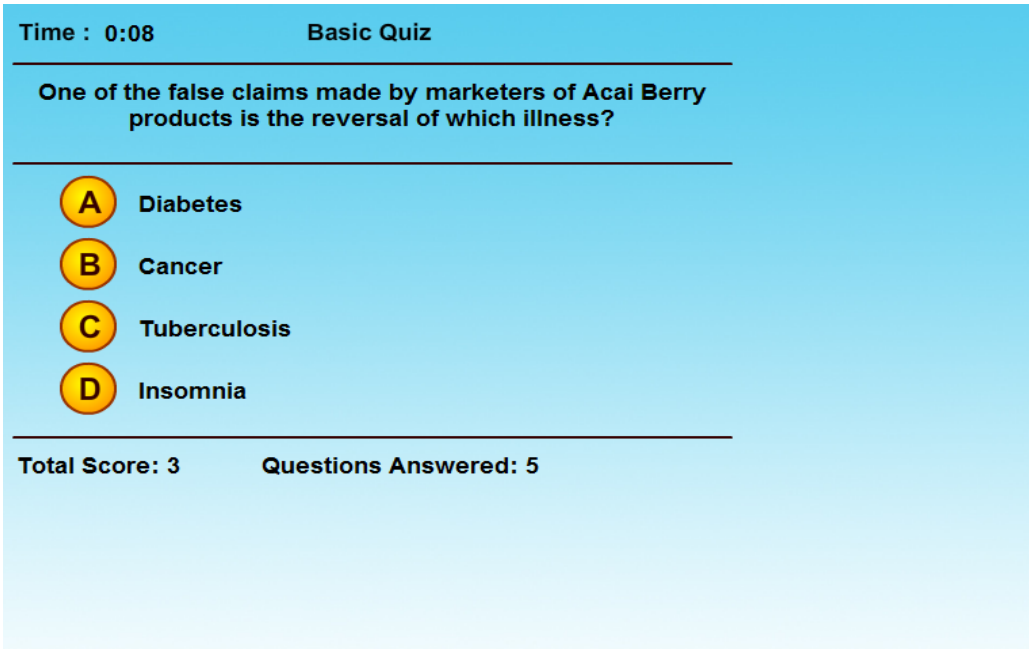
A countdown timer was used to inform participants that they are going to be forwarded on to part two.



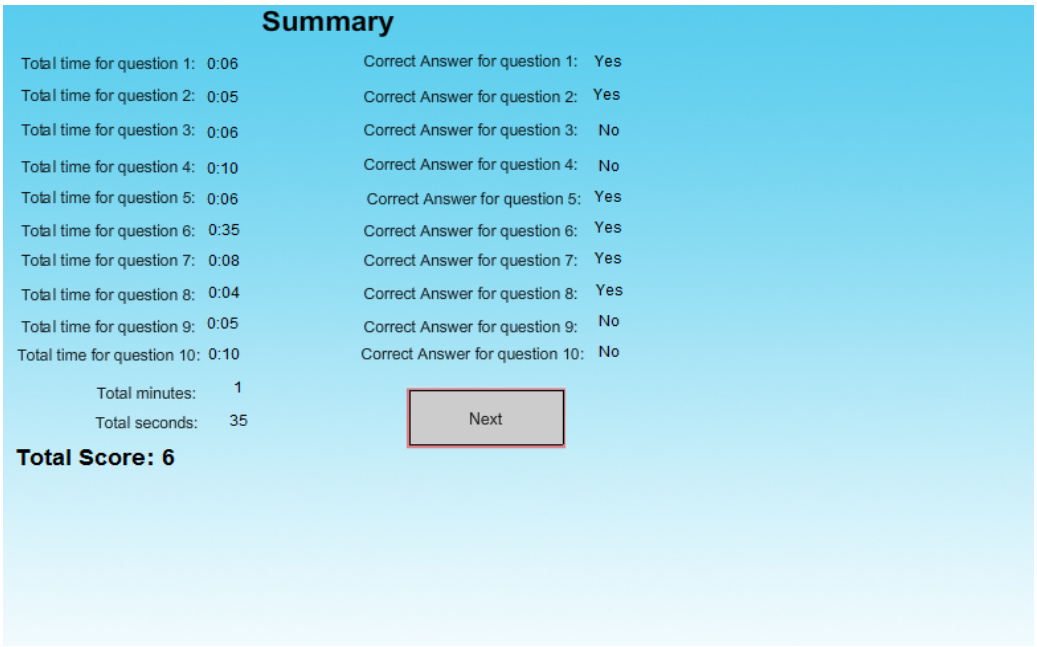
Screenshot 8: Start screen of the basic multiple choice quiz (there were no instructions provided for the basic multiple choice quiz due to the nature of the application. After the reading text screen, participants were forwarded straight on to the start screen)



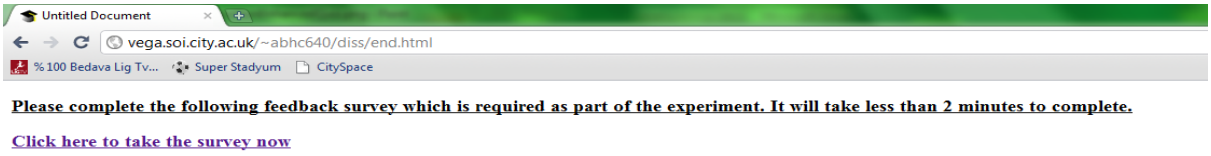
Screenshot 9: A question being answered using the basic multiple choice quiz



Screenshot 10: The summary screen at the end of the basic multiple choice quiz



Screenshot 11: Displaying the link for the feedback survey at the end of the experiment

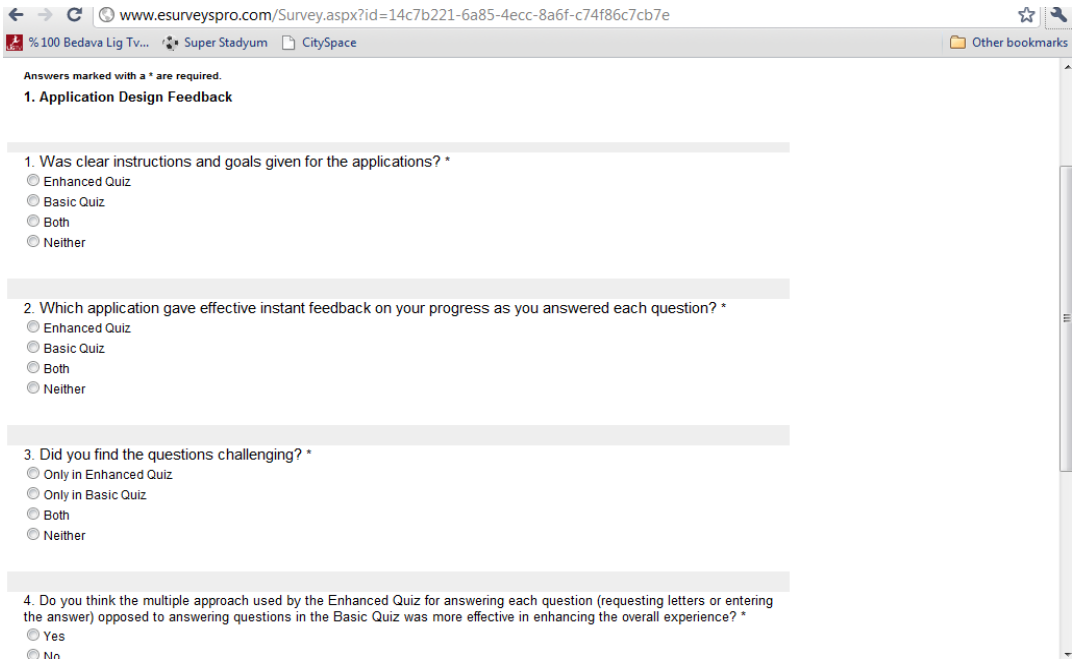


Feedback Surveys

Two feedback surveys were created, one for each group. Both feedback surveys had the same set of questions. The feedback survey consists of three parts: 'Application Design', 'Experiment', and 'About You'. The feedback forms were kept short, consisting of a mixture of closed and open-ended questions in order to obtain detailed qualitative feedback. The feedback survey also included questions on whether participants had previous knowledge of the selected text.

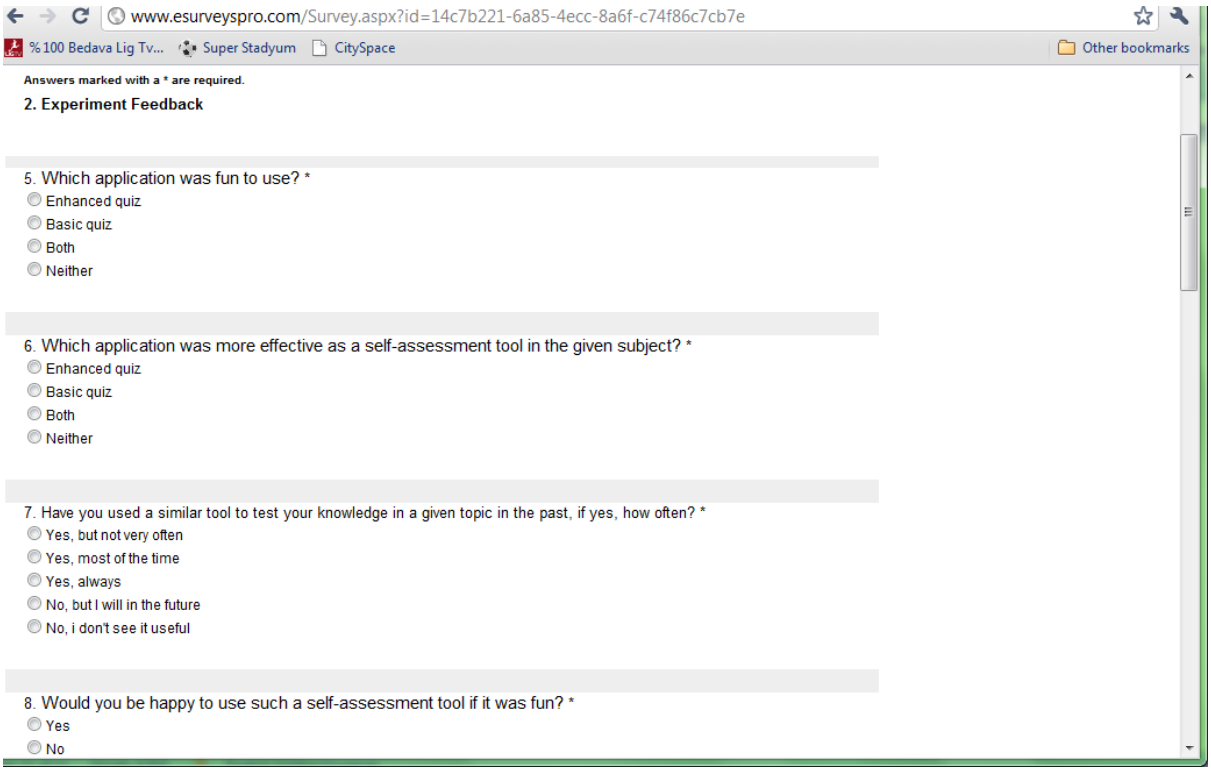
The following is a screenshot from the first part of the feedback survey. This part of the survey was designed to obtain qualitative feedback on the design of the applications and, from the participants' point-of-view, whether the designed applications met the guidelines set by Malone and Bowman. First part only contained closed questions.

Screenshot 12: First part of the feedback survey (Application design)



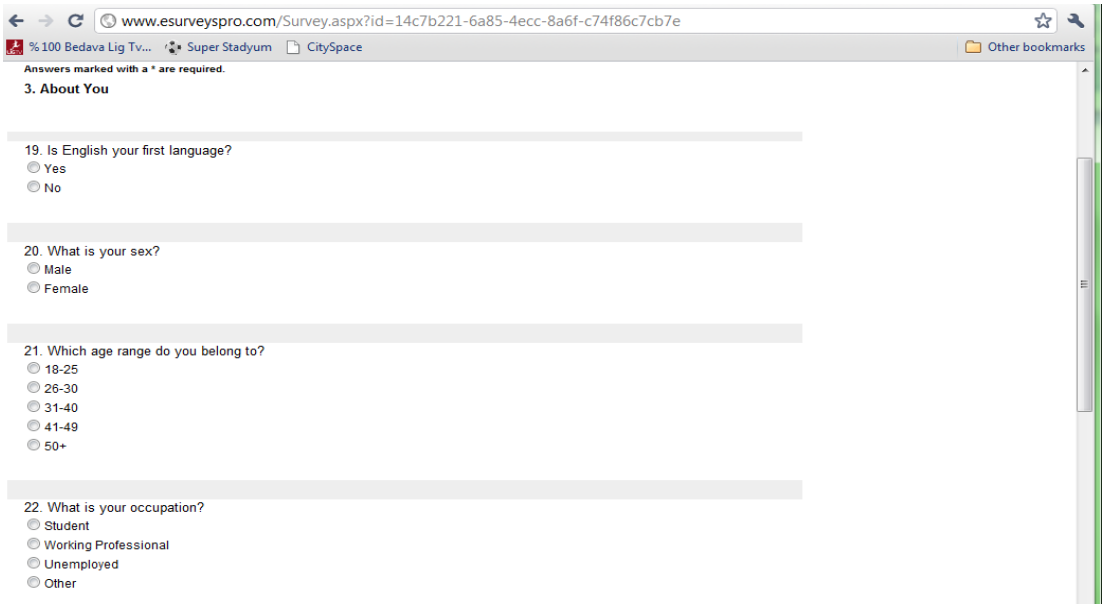
The following screenshot illustrates part two of the feedback survey. This part consists of closed and open-end questions. The purpose of this part was to gather qualitative feedback from the participants based on the experience of using both applications: the interactive quiz and the basic multiple choice quiz.

Screenshot 13: Second part of the feedback survey (Experiment feedback)



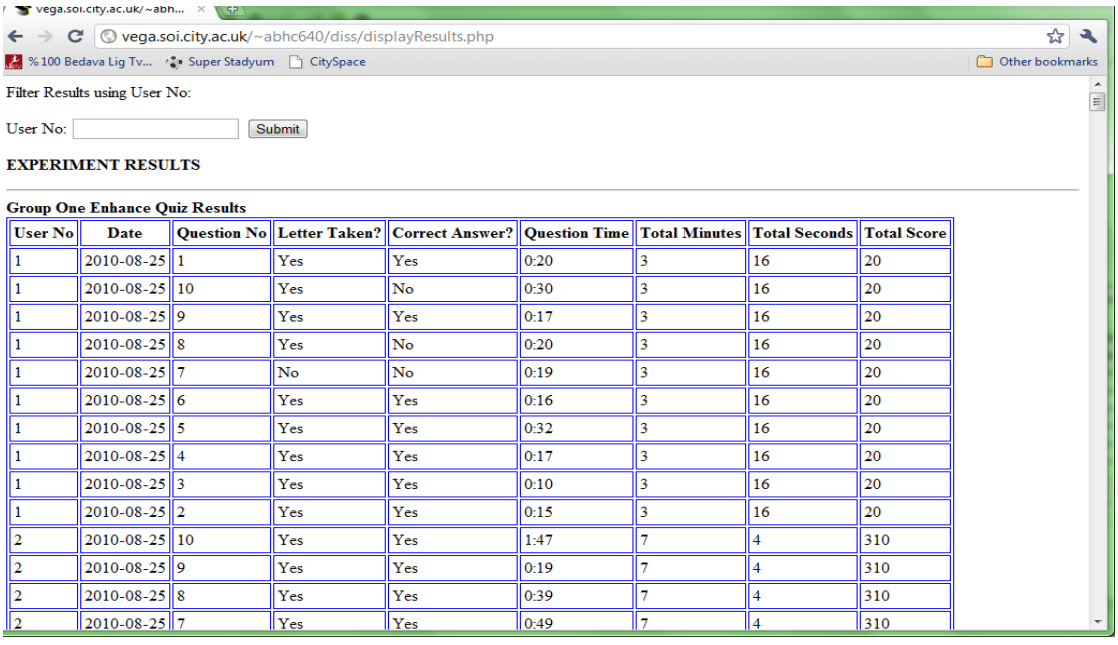
The final part, as explained earlier, was designed for the purpose of obtaining personal and demographic information in order to identify the characteristics of the participants. Basic closed questions were asked about their occupation, latest educational qualification, age range, etc.

Screenshot 14: Final part of the feedback survey (Demographic survey – About you)



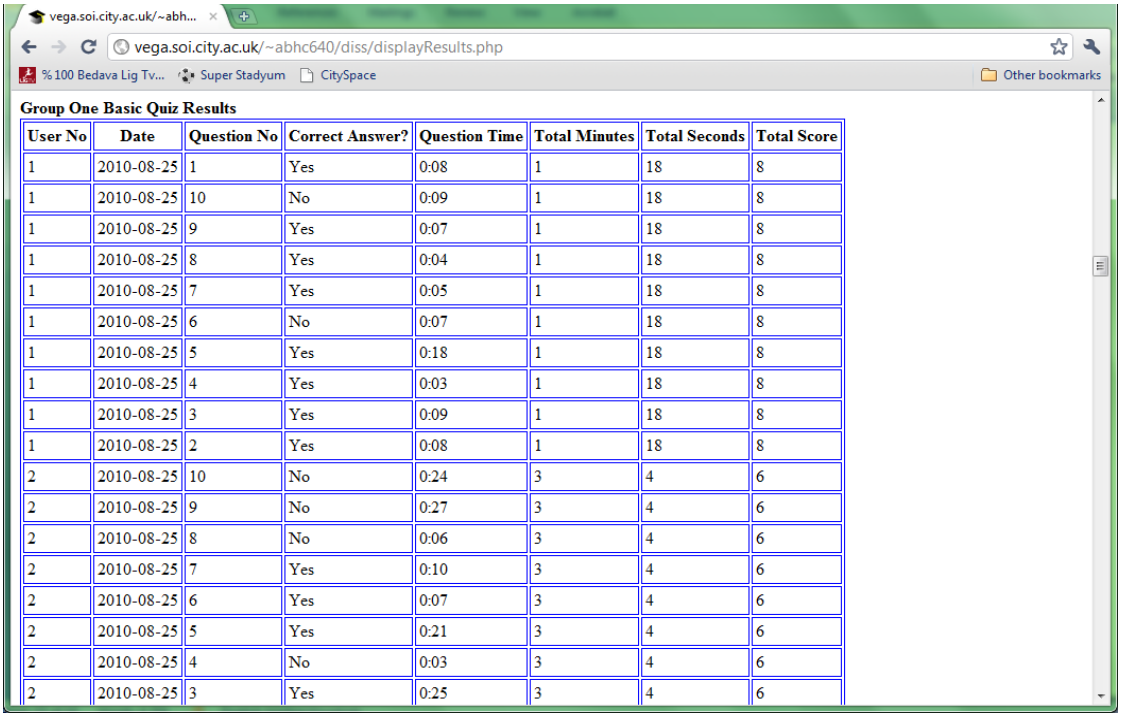
Screenshot 15: Viewing results – Group One Enhance Quiz

As we can see from the below screenshots, each experiment's results were recorded separately for ease of analysis, and each participant was given a user no, and based on that user no, it was possible to link participant's performance between both applications. For example, participant with the "user no 1" in Group One Enhance Quiz and the participant with the "user no 1" in Group One Basic Quiz is the same participant, therefore we can link both performances to the same participant. Same method is used for Group 2 experiments.



User No	Date	Question No	Letter Taken?	Correct Answer?	Question Time	Total Minutes	Total Seconds	Total Score
1	2010-08-25	1	Yes	Yes	0:20	3	16	20
1	2010-08-25	10	Yes	No	0:30	3	16	20
1	2010-08-25	9	Yes	Yes	0:17	3	16	20
1	2010-08-25	8	Yes	No	0:20	3	16	20
1	2010-08-25	7	No	No	0:19	3	16	20
1	2010-08-25	6	Yes	Yes	0:16	3	16	20
1	2010-08-25	5	Yes	Yes	0:32	3	16	20
1	2010-08-25	4	Yes	Yes	0:17	3	16	20
1	2010-08-25	3	Yes	Yes	0:10	3	16	20
1	2010-08-25	2	Yes	Yes	0:15	3	16	20
2	2010-08-25	10	Yes	Yes	1:47	7	4	310
2	2010-08-25	9	Yes	Yes	0:19	7	4	310
2	2010-08-25	8	Yes	Yes	0:39	7	4	310
2	2010-08-25	7	Yes	Yes	0:49	7	4	310

Screenshot 16: Viewing results – Group One Basic Quiz



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vega.soi.city.ac.uk/~abhc640/diss/displayResults.php

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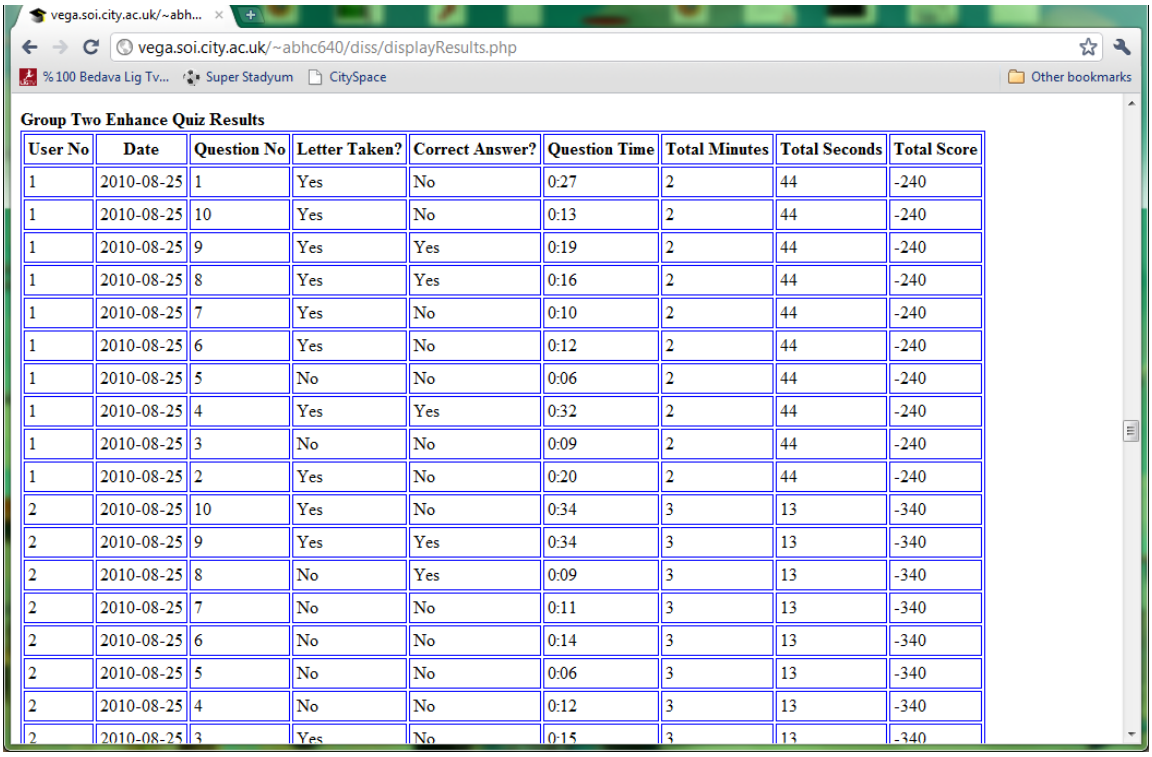
Group One Basic Quiz Results

User No	Date	Question No	Correct Answer?	Question Time	Total Minutes	Total Seconds	Total Score
1	2010-08-25	1	Yes	0:08	1	18	8
1	2010-08-25	10	No	0:09	1	18	8
1	2010-08-25	9	Yes	0:07	1	18	8
1	2010-08-25	8	Yes	0:04	1	18	8
1	2010-08-25	7	Yes	0:05	1	18	8
1	2010-08-25	6	No	0:07	1	18	8
1	2010-08-25	5	Yes	0:18	1	18	8
1	2010-08-25	4	Yes	0:03	1	18	8
1	2010-08-25	3	Yes	0:09	1	18	8
1	2010-08-25	2	Yes	0:08	1	18	8
2	2010-08-25	10	No	0:24	3	4	6
2	2010-08-25	9	No	0:27	3	4	6
2	2010-08-25	8	No	0:06	3	4	6
2	2010-08-25	7	Yes	0:10	3	4	6
2	2010-08-25	6	Yes	0:07	3	4	6
2	2010-08-25	5	Yes	0:21	3	4	6
2	2010-08-25	4	No	0:03	3	4	6
2	2010-08-25	3	Yes	0:25	3	4	6

Screenshot 17: Viewing results – Group Two Enhance Quiz



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vega.soi.city.ac.uk/~abhc640/diss/displayResults.php

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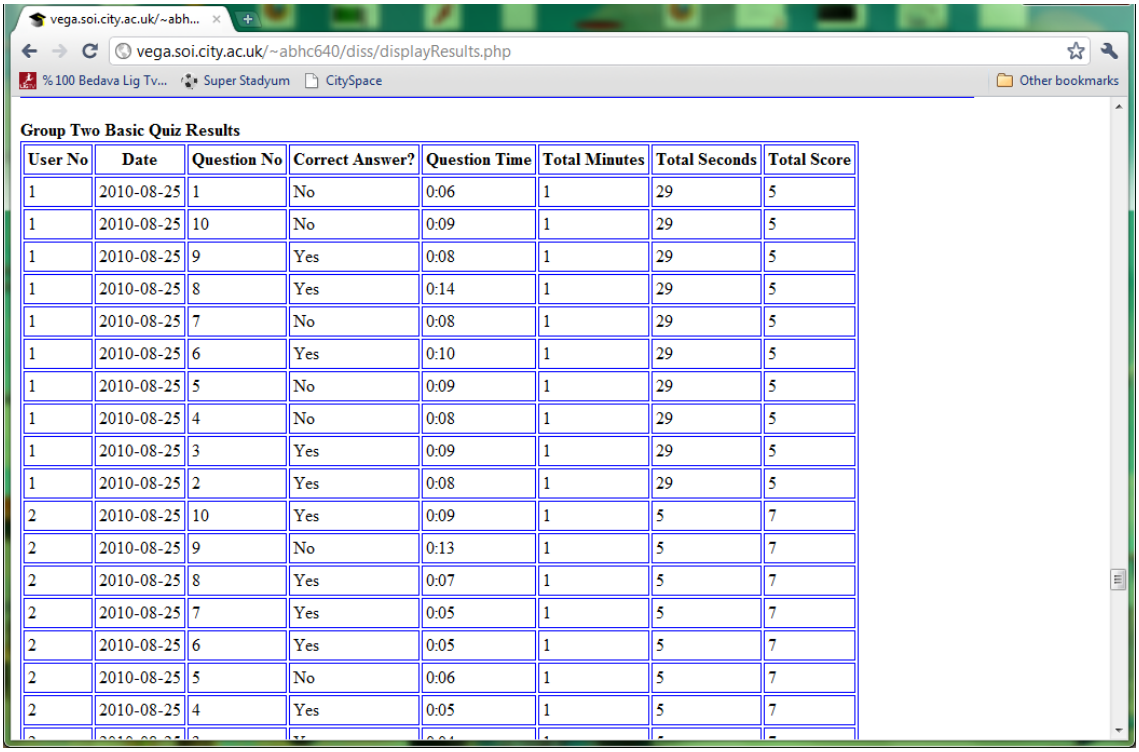
Group Two Enhance Quiz Results

User No	Date	Question No	Letter Taken?	Correct Answer?	Question Time	Total Minutes	Total Seconds	Total Score
1	2010-08-25	1	Yes	No	0:27	2	44	-240
1	2010-08-25	10	Yes	No	0:13	2	44	-240
1	2010-08-25	9	Yes	Yes	0:19	2	44	-240
1	2010-08-25	8	Yes	Yes	0:16	2	44	-240
1	2010-08-25	7	Yes	No	0:10	2	44	-240
1	2010-08-25	6	Yes	No	0:12	2	44	-240
1	2010-08-25	5	No	No	0:06	2	44	-240
1	2010-08-25	4	Yes	Yes	0:32	2	44	-240
1	2010-08-25	3	No	No	0:09	2	44	-240
1	2010-08-25	2	Yes	No	0:20	2	44	-240
2	2010-08-25	10	Yes	No	0:34	3	13	-340
2	2010-08-25	9	Yes	Yes	0:34	3	13	-340
2	2010-08-25	8	No	Yes	0:09	3	13	-340
2	2010-08-25	7	No	No	0:11	3	13	-340
2	2010-08-25	6	No	No	0:14	3	13	-340
2	2010-08-25	5	No	No	0:06	3	13	-340
2	2010-08-25	4	No	No	0:12	3	13	-340
2	2010-08-25	3	Yes	No	0:15	3	13	-340

Screenshot 18: Viewing results – Group Two Basic Quiz



Group Two Basic Quiz Results

User No	Date	Question No	Correct Answer?	Question Time	Total Minutes	Total Seconds	Total Score
1	2010-08-25	1	No	0:06	1	29	5
1	2010-08-25	10	No	0:09	1	29	5
1	2010-08-25	9	Yes	0:08	1	29	5
1	2010-08-25	8	Yes	0:14	1	29	5
1	2010-08-25	7	No	0:08	1	29	5
1	2010-08-25	6	Yes	0:10	1	29	5
1	2010-08-25	5	No	0:09	1	29	5
1	2010-08-25	4	No	0:08	1	29	5
1	2010-08-25	3	Yes	0:09	1	29	5
1	2010-08-25	2	Yes	0:08	1	29	5
2	2010-08-25	10	Yes	0:09	1	5	7
2	2010-08-25	9	No	0:13	1	5	7
2	2010-08-25	8	Yes	0:07	1	5	7
2	2010-08-25	7	Yes	0:05	1	5	7
2	2010-08-25	6	Yes	0:05	1	5	7
2	2010-08-25	5	No	0:06	1	5	7
2	2010-08-25	4	Yes	0:05	1	5	7

Interactive Self-Assessment Tool & Basic Multiple Choice Quiz Questions

Since the questions played a critical role, and the results would affect the analyses, much thought and work was put into them in order to make sure the questions were balanced in terms of difficulty and they would meet the guidelines set by Malone and Bowman. It was an obvious criterion that both applications would have the same number of questions, and same set of questions would need to be used for both groups to keep the experiments fair.

Due to the experiments being not conducted under controlled conditions, an element of control was applied, which had ensured that there wouldn't be any cheating. It was decided on 10 questions per application, in total 20 distinctive questions. More questions meant more text for participants to read before the experiments hence 10 questions per application was a feasible number. Also, a time limit was introduced in order to keep the experiments fair. Due to the nature of the applications and the questions, a minimum of 30 seconds and a maximum of 10 minutes were set for the basic multiple choice quiz, and a minimum of 2 minutes and a maximum of 15 minutes were set for the interactive quiz. With the basic multiple choice quiz, questions took less

time and effort answering the questions compared to the interactive quiz, hence the lower time limit.

To eliminate double participations; participants' IP addresses were recorded and observed within www.esurveyspro.com as soon as the feedback survey was completed after tracking participants' progress. Unknown, multiple participations with the same IP address was removed from the final results, in order to have results from unique participants.

STAGE 9 – TESTING OF THE APPLICATION

Once both applications were developed and ready, and all aspects of the experiments were implemented including the feedback surveys, and the online database for storing the results were set up, test sessions were carried out. This would ensure that all parts of the experiments would go without any problems due to the whole procedure being developed from scratch. All parts of the experiments including the feedback surveys were tested by 4 volunteers who corresponded to the target audience. Two of the volunteers were asked to test the experiments in terms of usability, and the remaining two volunteers to test the experiments for possible technical problems that could arise.

Both volunteers gave informative advice, and some of the possible problems were identified, and the required amendments were made. An example of a reported problem was that, initially at the end of the experiment the feedback survey would be embedded inside the participant's browser. This seemed to work fine with Internet Explorer, but in Firefox only the first few questions were rendered, as a result participants using Firefox were not able to complete the feedback survey. As a solution, a design decision was made, a link was provided to the participants at the end of the experiment which would redirect participants to the feedback survey.

STAGE 10 – LAUNCHING EXPERIMENTS & GATHERING PARTICIPANTS AND MONITORING PROGRESS

Once all parts of the experiments and the feedback survey were tested and the required changes were made, the updated files were uploaded to the City University's web server making sure the links were accessible. Once everything was set up it was time to gather participants.

Finding suitable participants for the experiments was not an easy task due to the timing of the project which coincided with summer vacations, which meant not all City University students were available for the experiments. Most students were away from campus and it was difficult getting in touch with them. To produce statistically sound results, the number of participants required for the experiments was set to 24.

A detailed e-mail was sent to fellow masters students at City University, but as explained above not everyone responded due to the timing of the project. As a result, the major source of participants was Facebook (www.facebook.com). Facebook is a social networking site which connects friends around the world. Again, a detailed message was crated explaining the project, the experiment and the instructions. This message was sent to the potential participants who met one or more of the criteria set for the experiments.

As participants completed each experiment, an e-mail was sent to a mobile device with the details. Every stage of the experiment was monitored as participants progressed. Any results that had not met the criteria set for the experiments were removed from the results immediately in order to keep the results consistent. The results of participant who didn't complete the feedback survey were also removed.

STAGE 11 – ANALYSING RESULTS

Once all the experiments were completed by the participants, the results were analysed. The analysis included the average correct answers given in percentage for each experiment and per group, and average time taken for answering the questions for each experiment and per group. Also, the Student's T-Test statistical analysis was used to

determine whether there was a significant difference between the group of participants that answered the questions using the basic multiple choice quiz and the group that answered the same set of questions using the interactive quiz.

To effectively analyse the qualitative feedback obtained from the participants, the following guidelines were followed:

- Was the participants represented of the target audience?
- What conclusion could be drawn from the comparison of results between each experiment (basic multiple choice quiz and the interactive quiz) and group results?
- Was the interactive quiz designed according to the guidelines set by Malone and Bowman?

In order to keep the experiments fair and prevent statistical bias, those participants who did not take the experiments seriously were removed on one of the following criteria:

- Those participants who took less than 30 seconds, and more than 10 minutes to complete the basic multiple choice quiz.
- Those participants who took less than 2 minutes, and more than 15 minutes to complete the interactive quiz.
- Those participants who partially completed the experiments.
- Those participants who did not fully complete the feedback survey.

EXPERIMENT RESULTS

This section will look at the quantitative results obtained from the interactive quiz and the basic multiple choice quiz and perform statistical analysis on the average performance scores. The statistical analysis will be supplemented with analysis of the qualitative feedback obtained through feedback forms. The results from both analysis will be combined and critically analysed in order to determine whether the interactive quiz improved learning and made the process fun compared to the basic multiple choice quiz. For this part of the project, the proposed self-assessment tool will be stated as Enhanced Quiz, and the basic multiple choice quiz will be stated as Basic Quiz to keep it simple.

Demographic Survey Results

We will analyse the demographics survey results to determine the characteristics of our participants and whether they represented the target audience. The results will be displayed in the form of a graph where x-axis represents the characteristics and the y-axis percentage of respondents out of 100.

Figure 2: Is English your first language?

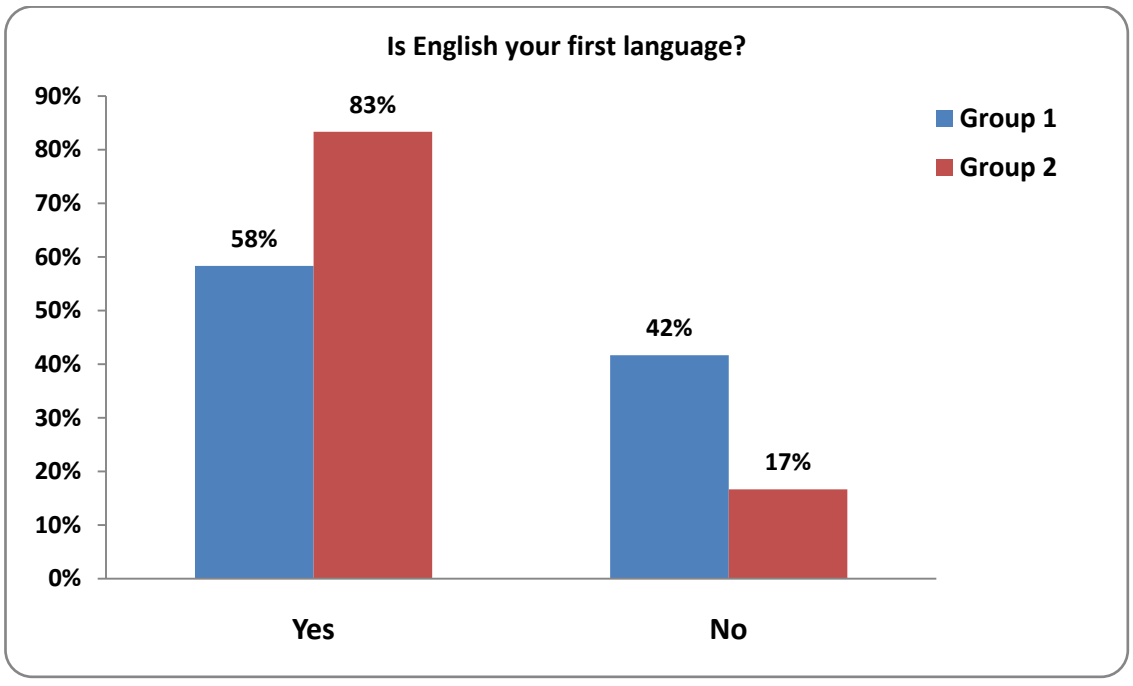


Figure 3: Gender

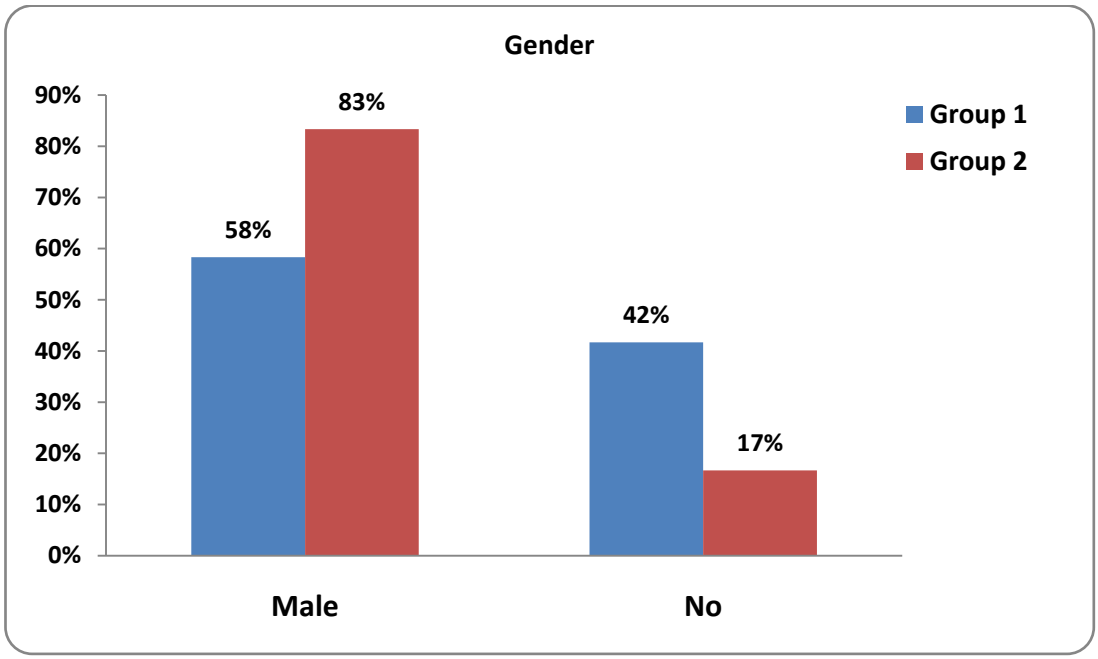
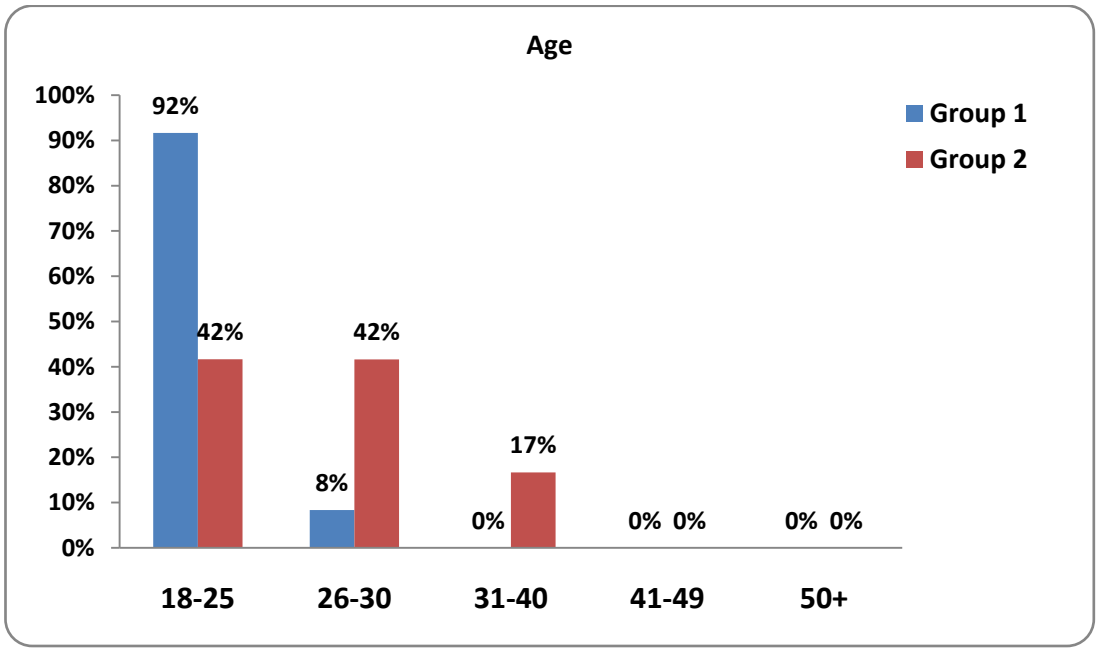


Figure 4: Age



From the above graphs we can see that English was the first language of a significant number of participants of Group 2, but the number of participants whose first language was English in Group 1 was just above 50 percent. We will see whether this would affect the overall performance of Group 1. Majority of Group 2 participants were males, and Group 1 participants were generally males too but not by a significant number. A

significant number of participants were in the age range of 18-25 in Group 1, whereas Group 2 had an equal number of participants in the age range of 18-25 and 26-30, and a small percentage was in the age range of 31-40.

Figure 5: Occupation

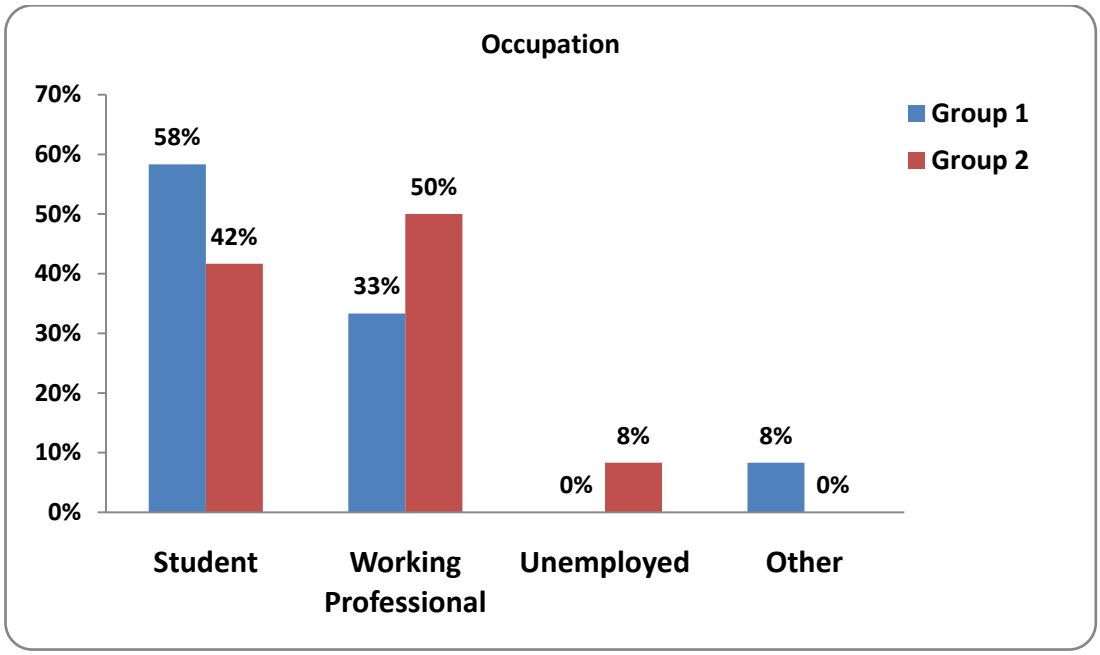
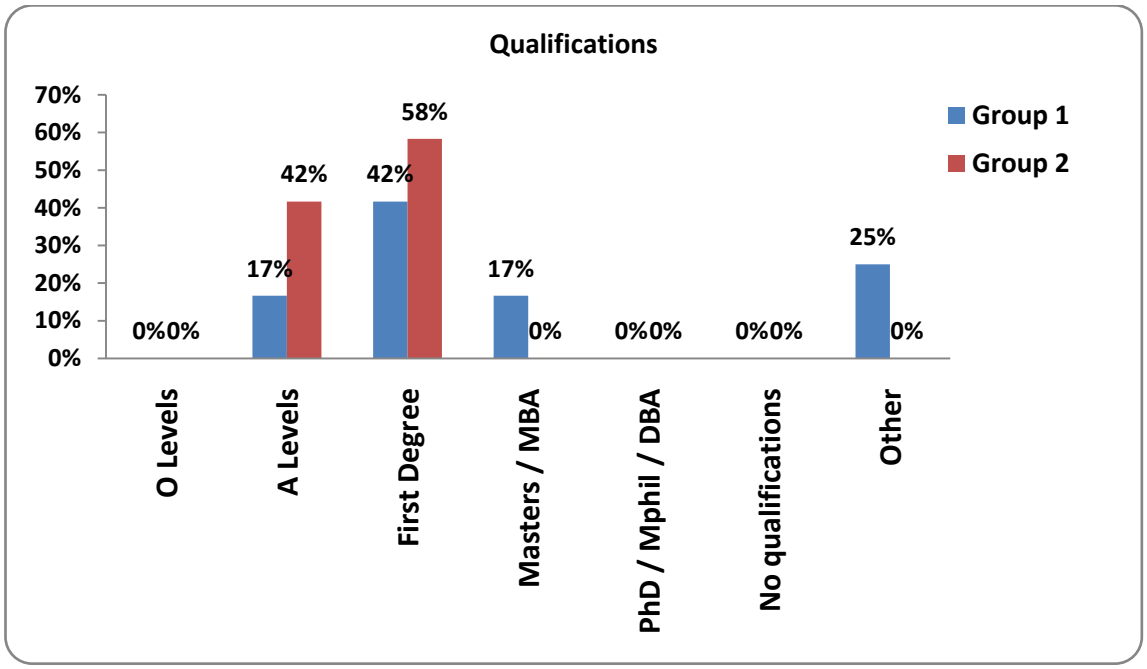


Figure 6: Qualifications



The graphs above show that majority of Group 1 participants were students, but in Group 2 majority of participants were working professionals. In terms of qualifications,

the results being divided between ‘A Levels’ and ‘First Degree’, only a small percentage in Group 1 stated ‘Other’. The results show that participants had met the minimum requirement of holding a minimum qualification of ‘A Levels’ or being a student thus making them suitable for the experiments.

AVERAGE PERFORMANCE AND STUDENT’S T-TEST RESULTS

This section will analyse performance of participants in Enhanced Quiz and Basic Quiz, and the average time taken to complete each experiment. We will also analyse overall group performance in regards to Enhances Quiz performance and Basic Quiz performance. For performance, we will analyse the correct answers given.

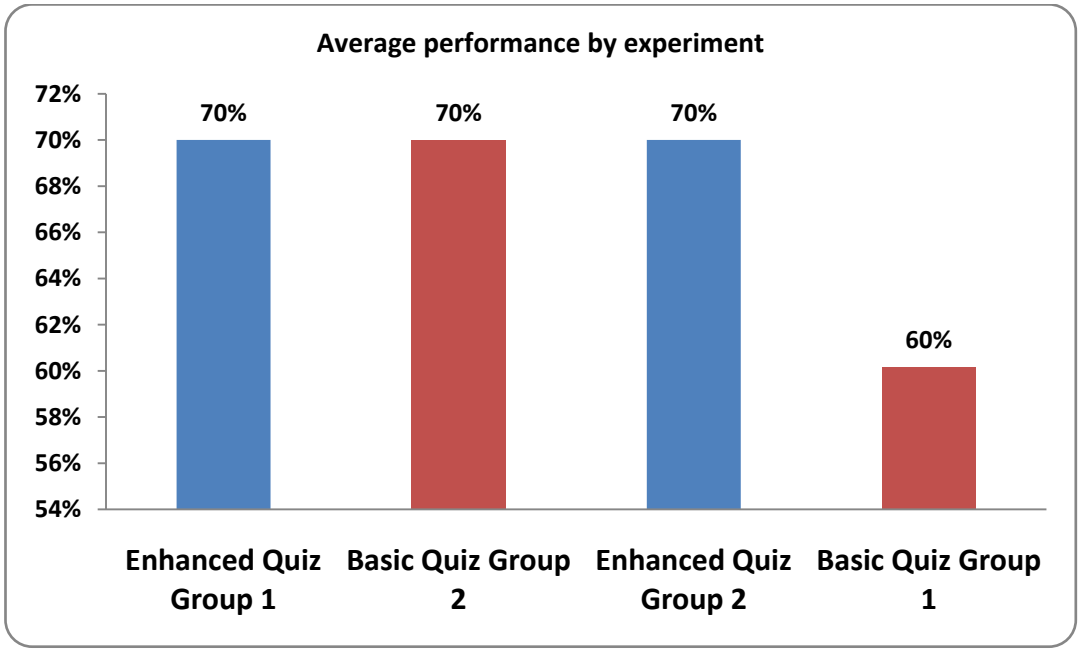
Average performance by Enhanced Quiz and Basic Quiz per group

The following table illustrates the average score obtained for each Enhanced Quiz and Basic Quiz experiment per group and the Student’s T-Test results for each Enhanced Quiz:

Table 2: Average performance by each experiment per group

	Group	**No of Participants**	**Average Score in %**	**Student’s T-Test**
Enhanced Quiz	**One**	12	%70.00	0.87
Basic Quiz	**Two**	12	%70.08	
Enhanced Quiz	**Two**	12	%70.08	0.31
Basic Quiz	**One**	12	%60.16	

Figure 7: Average Performance



Average score of each experiment do not show significant differences when compared between both groups that answered the same set of questions in 'Basic Quiz'. The Student's T-Test results showed a P-Value which was noticeably above the value of 0.05, which indicates that there was no difference between the scores that involved answering the same set of questions in 'Enhanced Quiz' and 'Basic Quiz', and therefore the differences between average scores were not statistically significant and could not be used to prove or disprove whether 'Enhanced Quiz' improved final score and enhanced learning compared to 'Basic Quiz'. However, when comparing Group 2 'Enhance Quiz' results with Group 1 'Basic Quiz' results we can see that there was an increase in the final score for those who did 'Enhanced Quiz'.

Average time

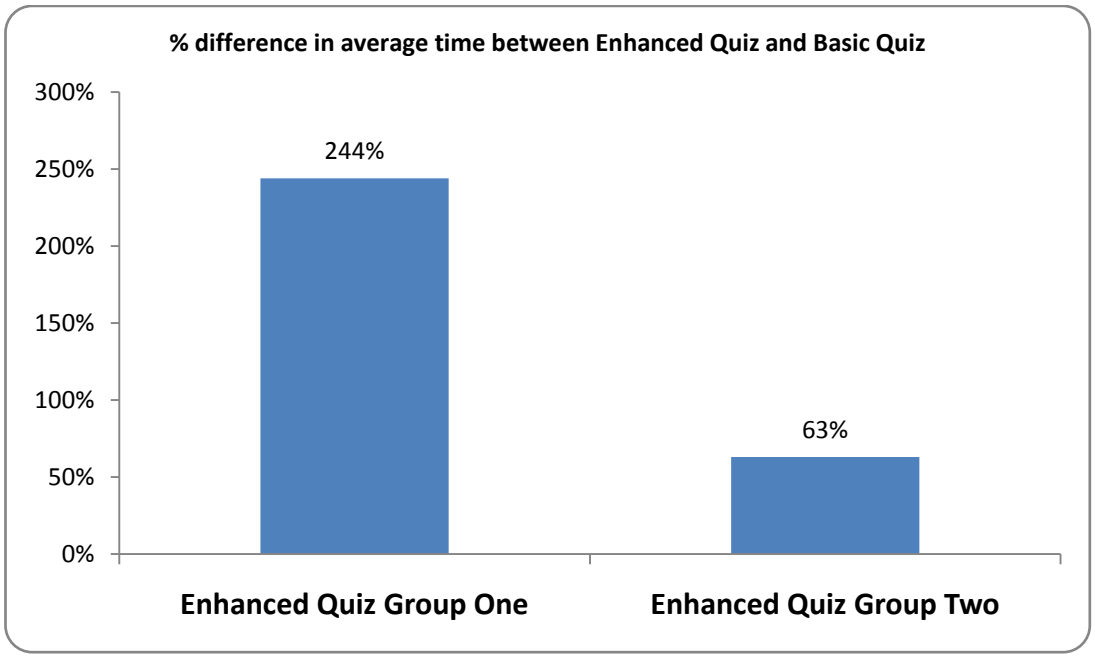
The following table illustrates the average time taken for answering questions in 'Enhance Quiz' compared to answering the same questions in 'Basic Quiz' between both groups:

Table 3: Average time by experiment

	Group	No of Participants	Average time - Minutes: Seconds (Rounded to nearest second)
Enhanced Quiz	**One**	12	4:16
Basic Quiz	**Two**	12	1:21
Enhanced Quiz	**Two**	12	3:36
Basic Quiz	**One**	12	2:06

The following graph illustrates the percentage difference in average time between 'Enhance Quiz' and 'Basic Quiz' for each group:

Figure 8: % Difference in average time



Although there were no major differences between 'Enhance Quiz' and 'Basic Quiz' results between both groups in terms of average score, there were significant differences in average time taken to complete each experiment. In average, participants in Group 1 'Enhance Quiz' took nearly three times longer compared to participants that answered the same set of questions in Group 2 'Basic Quiz'. Similarly, Group 2 'Enhance Quiz' results also show that, in average, participants took nearly twice more time compared to Group 1 'Basic Quiz' results.

Average Performance by Group

In terms of group performance we can see from the graphs below that Group 2 performed better than Group 1 overall as a group, in particular Group 2 scored higher in 'Basic Quiz' results.

Figure 9: Overall average score

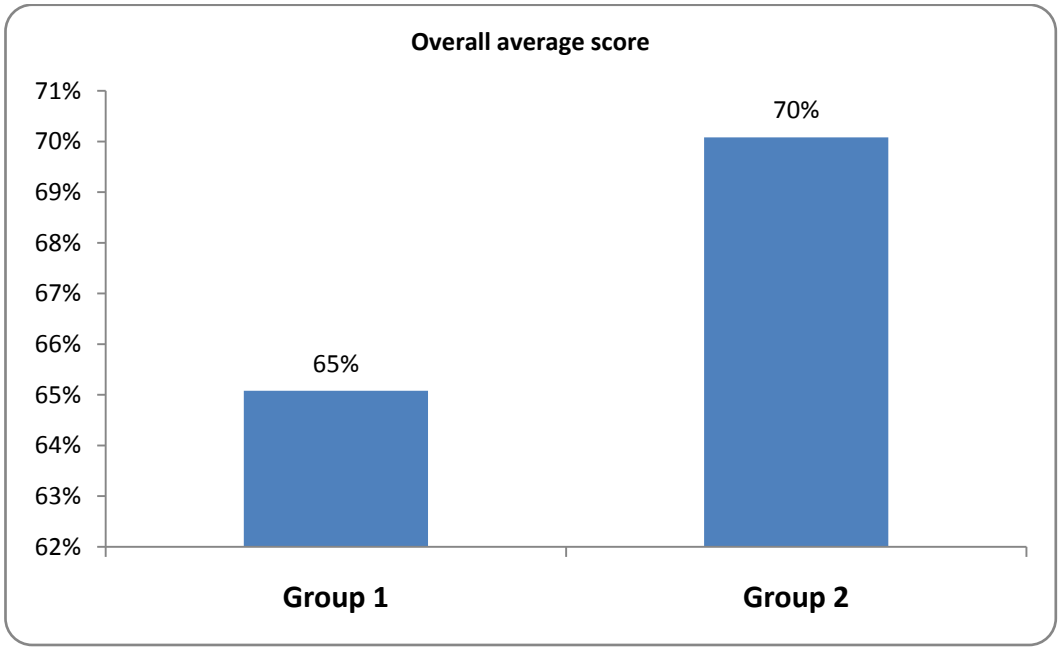


Figure 10: Enhanced Quiz score

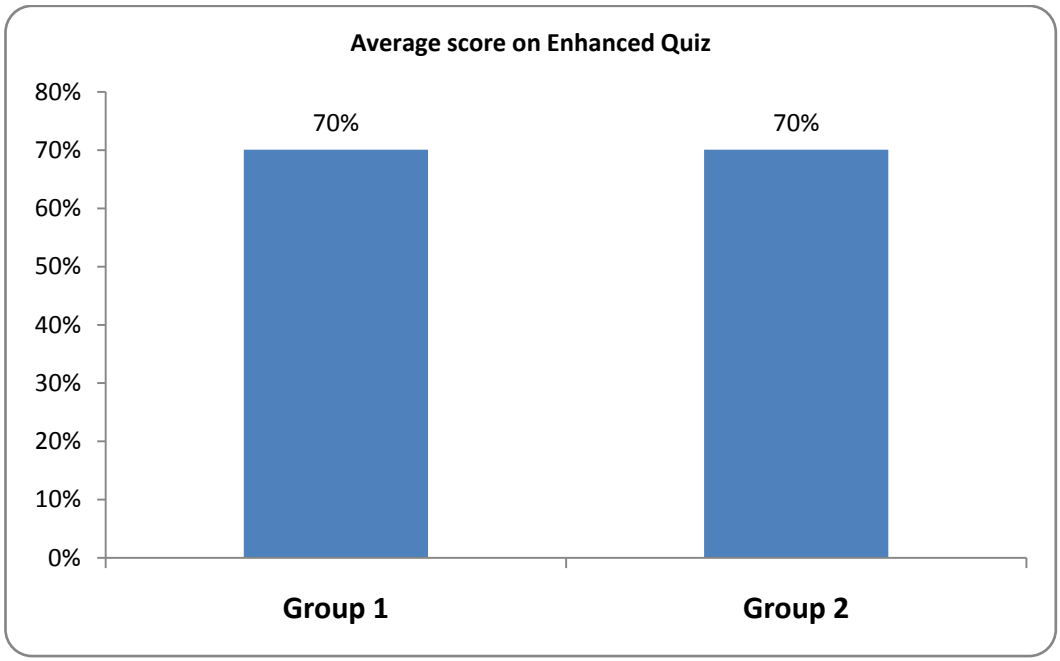
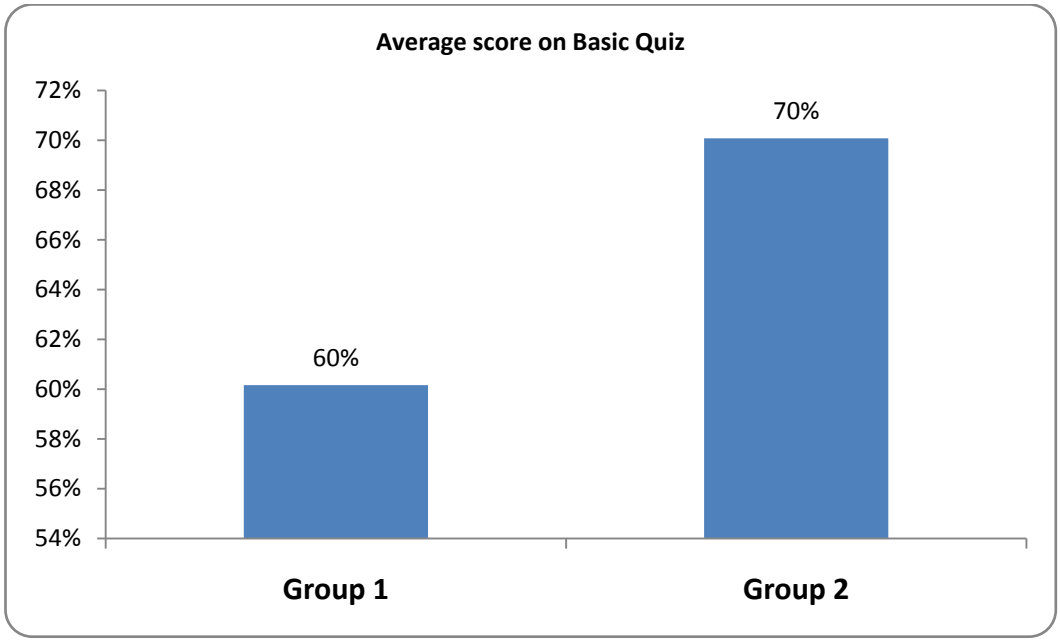


Figure 11: Basic Quiz score



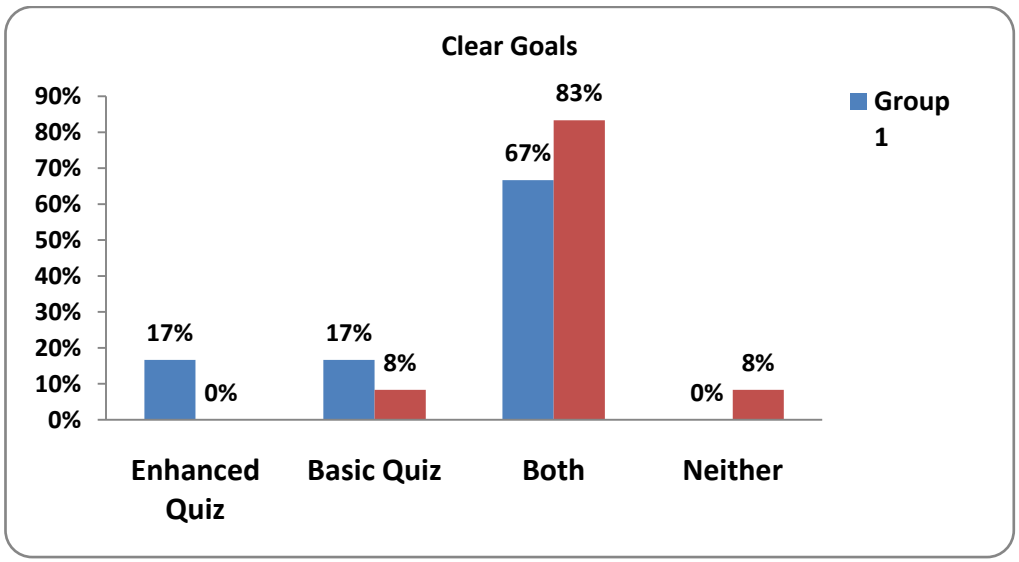
The above results show that both groups that answered questions in Enhance Quiz, on average, achieved the same score or more when compared with the same questions that were answered in Basic Quiz. On average performance, Enhance Quiz was as effective as Basic Quiz, but there weren't significant differences. In order to find out whether Enhanced Quiz made the process more enjoyable and enhanced learning, we will analyse the feedback obtained from both group.

QUALITATIVE FEEDBACK RESULTS

This section will consist of two parts. First part will analyse the feedback obtained from groups in order to gain insight into whether the applied design decisions based on the guidelines set by Malone and Bowman for Enhance Quiz had been met from participant's points of view. The second part will look at the quantitative and qualitative feedback obtained from both groups in regards to their experience of answering questions in Enhance Quiz and Basic Quiz as well as describe comments left from participants. This would give insight into whether Enhanced Quiz made the process enjoyable and enhanced learning compared to answering the same questions in Basic Quiz.

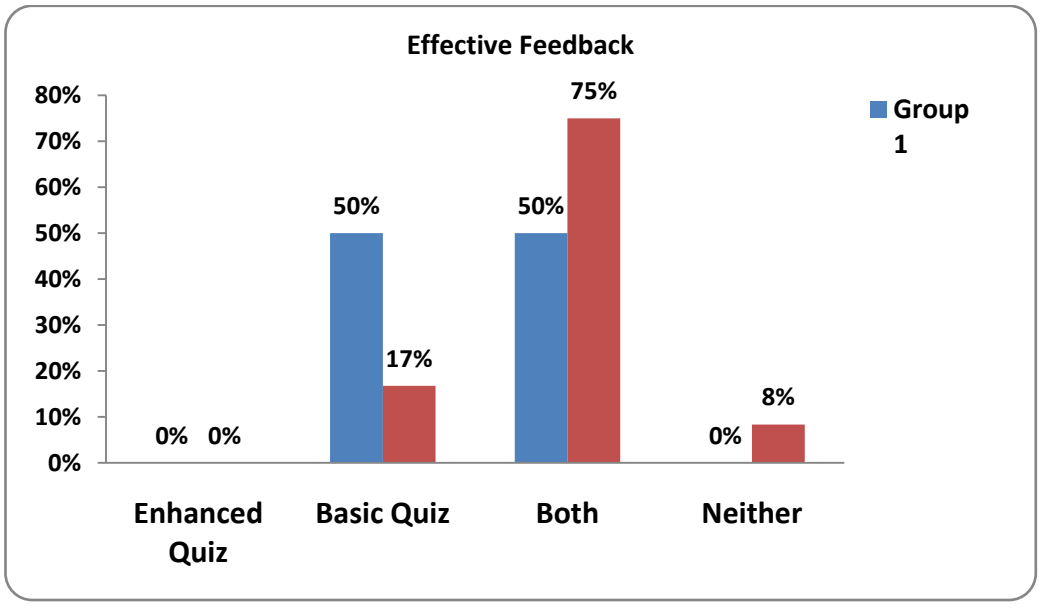
Application Design: Enhance Quiz & Basic Quiz

Figure 12: Clear goals



The above graph illustrates that a significant number of participants in both groups said clear instructions were given for both applications. This shows that Enhanced Quiz had met this particular guideline.

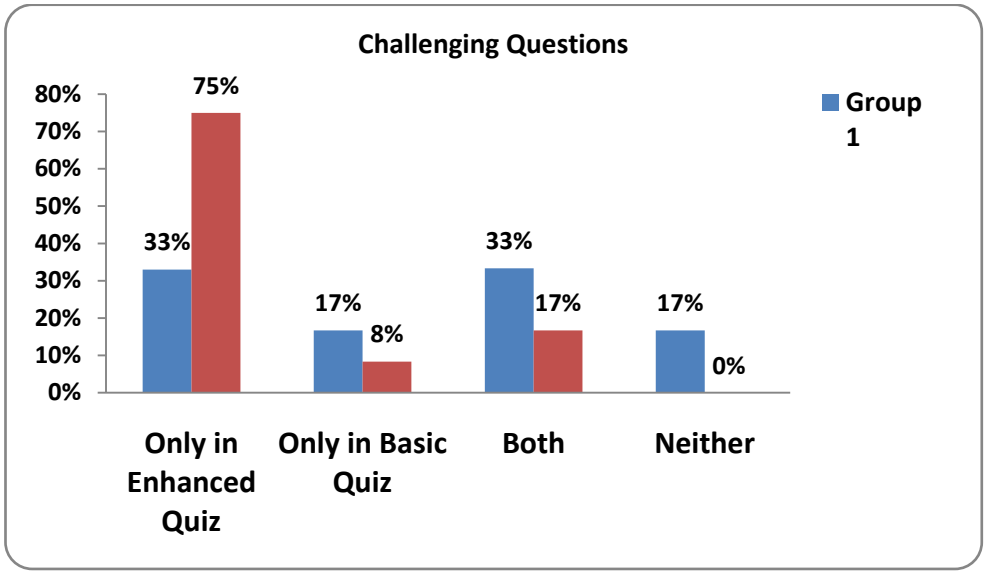
Figure 13: Effective Feedback



The above graph illustrates that only half of the participants in Group 1 said effective feedback was given by both application which includes Enhanced Quiz, and the other half only agreed on Basic Quiz. This could be due to the simplicity of Basic Quiz as it

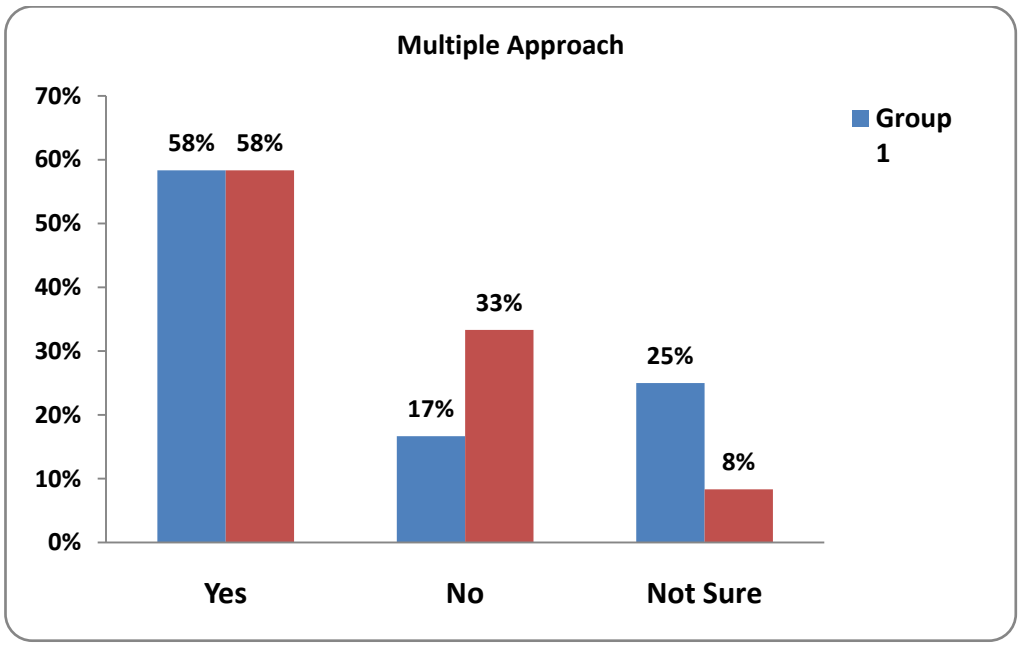
utilised a simpler interface, and a less number of variables that was involved when answering questions. A significant number of participants in Group 2 stated that both applications including Enhance Quiz gave effective feedback, which was also reflected on the average performance results where Group 2 Enhance Quiz had better performance compared to Group 1 Basic Quiz when answering the same questions.

Figure 14: Challenging Questions



The graph above illustrates that most participants in both groups stated that they have found the questions challenging. This shows that Enhanced Quiz had met this guideline.

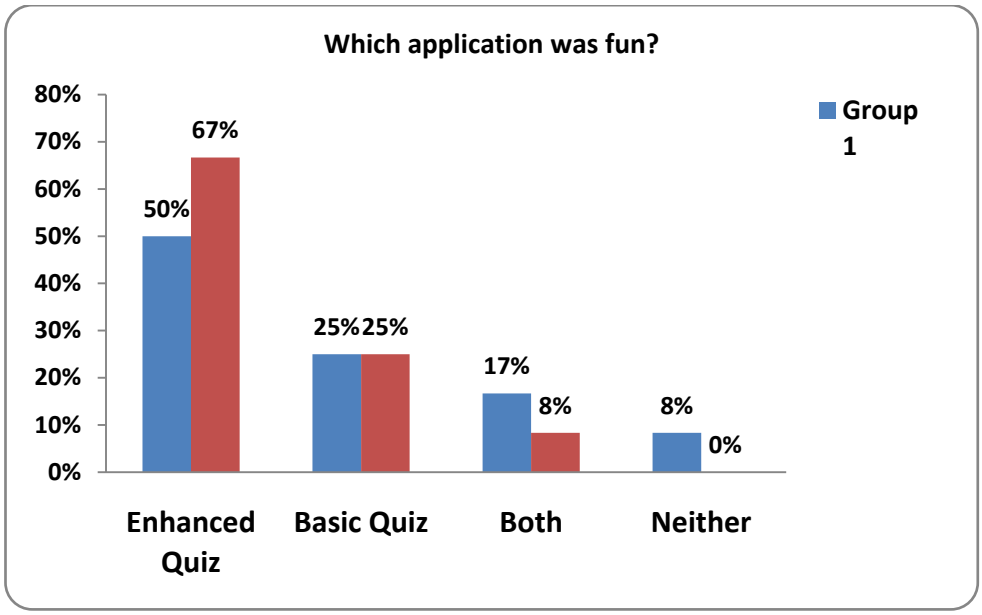
Figure 15: Multiple Approach



The majority of participants in both groups stated that they have found the 'Take Letter' feature utilised by Enhance Quiz more effective than answering questions in Basic Quiz. From the above results we can conclude the guidelines that were utilised in the design of Enhance Quiz which have been set by Malone and Bowman have been met.

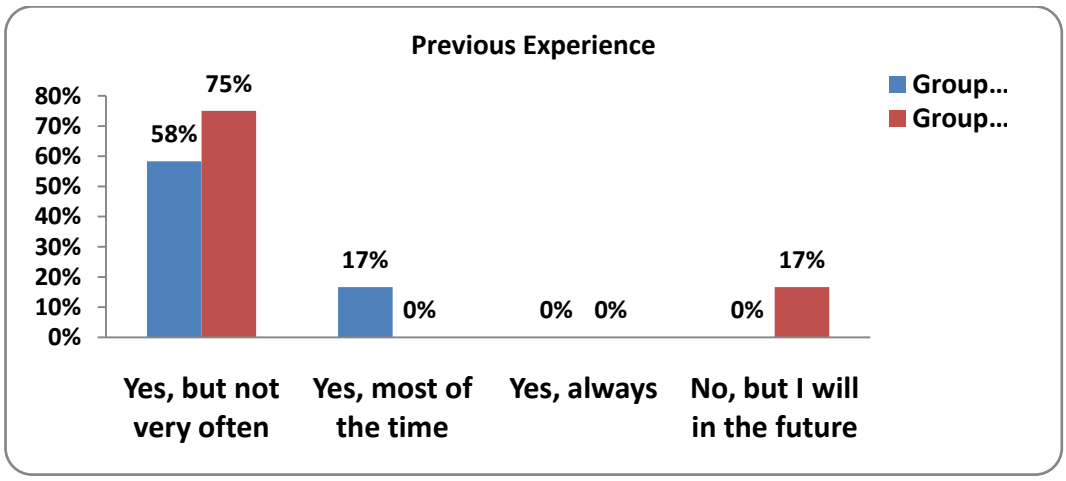
Experiment Feedback

Figure 16: Which application was fun?



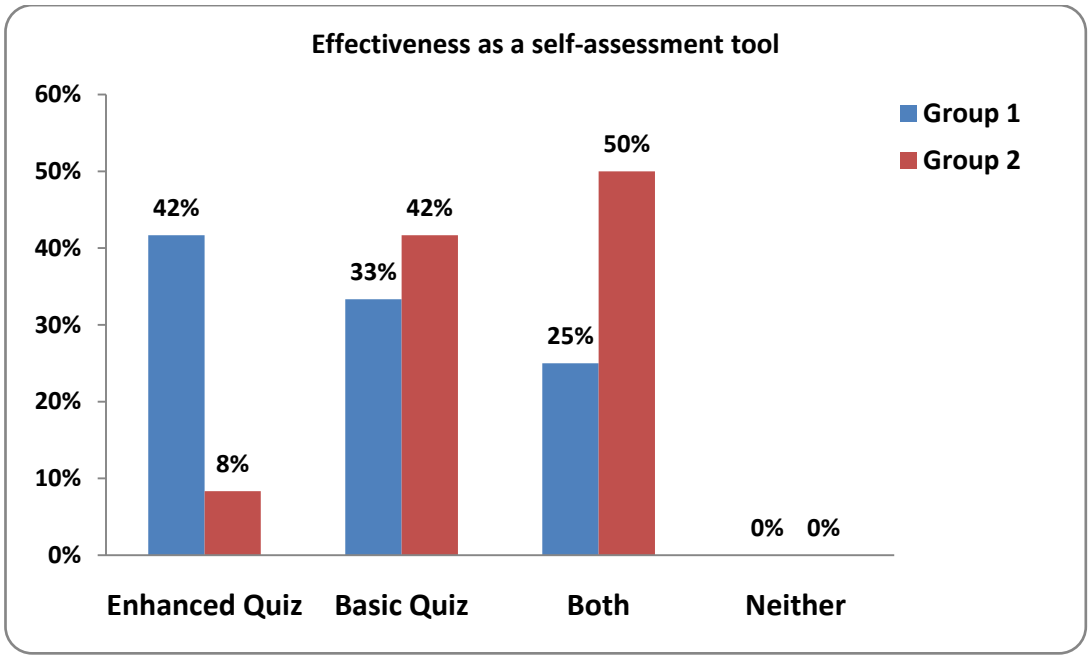
The results show that majority of participants in Group 1 and Group 2 stated that Enhance Quiz was more fun to use than Basic Quiz. In the average performance comparison, Group 1 Enhance Quiz achieved the same score with Group 2 Basic Quiz, whereas Group 2 who had higher number of participants stating that Enhance Quiz was more fun than Basic Quiz achieved a higher score in average performance comparison between Group 2 Enhance Quiz and Group 1 Basic Quiz.

Figure 17: Previous experience in using self assessment tools



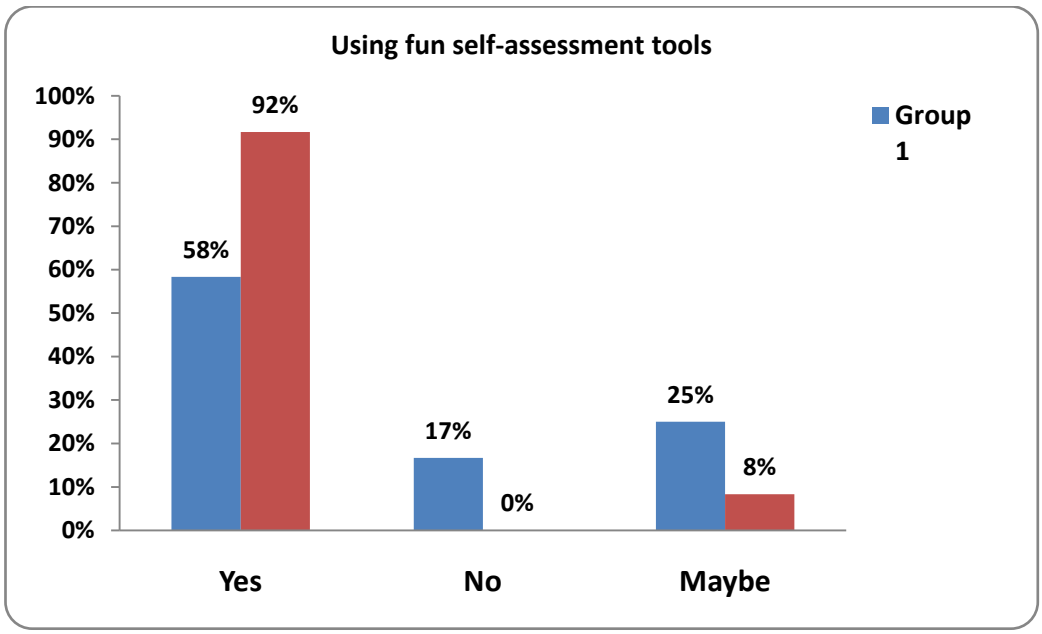
The results show that significant number of participants in both groups have used some form of self-assessment tool in the past, with Group 2 yielding the highest number.

Figure 18: Effectiveness as a self-assessment tool



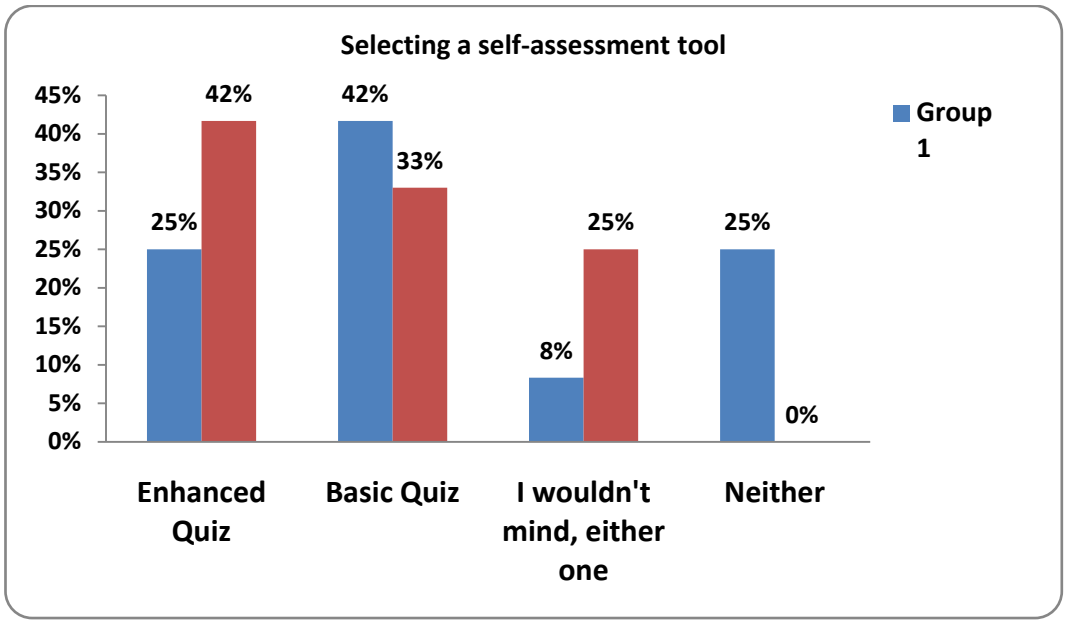
The results show that majority of participants in Group 1 stated that Enhanced Quiz was more effective as a self-assessment tool than Basic Quiz. But the half of participants in Group 2 stated that both applications were equally effective as a self-assessment tool with Group 2 having higher number of participants stating Basic Quiz was more effective.

Figure 19: Using fun self-assessment tools



The results show that a significant number of participants in Group 2 stated that they would be happy to use a self-assessment tool if it was fun. The majority of Group 1 also stated that they would be happy to use a self-assessment tool if it was fun. Only a small percentage of Group 1 participants stated that they will not use it, and one fourth said they might.

Figure 20: Selecting a self-assessment tool

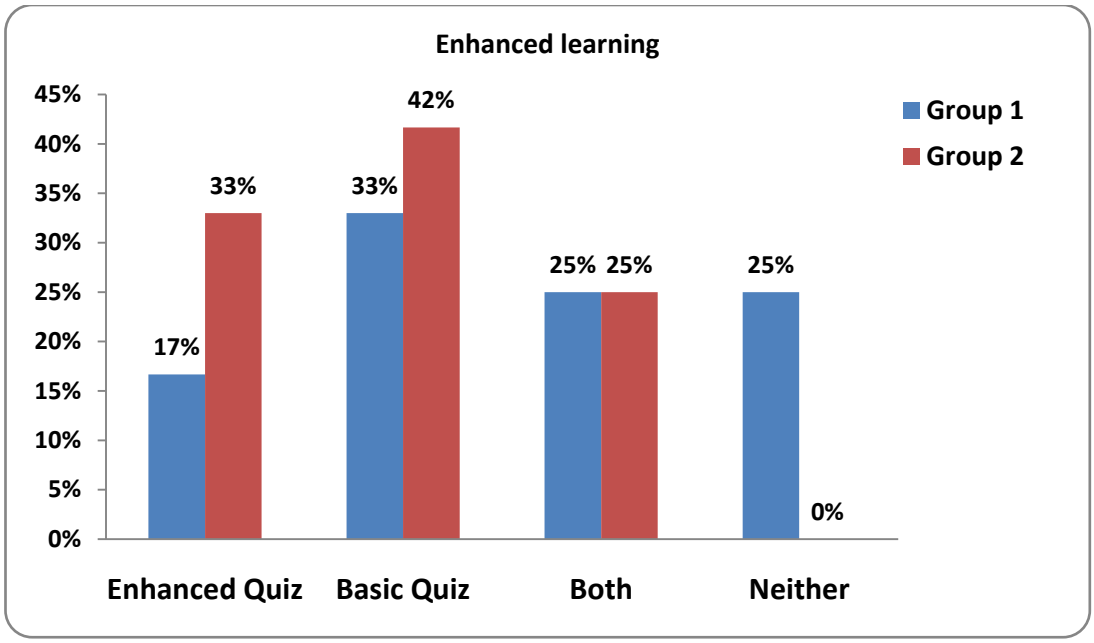


The results show that majority of participants in Group 1 stated that they would use Basic Quiz as a self-assessment tool in the future. As we have seen earlier, one of the reasons for this could be the time taken for answering questions in Enhance Quiz which is significantly longer compared to Basic Quiz. The majority of participants in Group 2 stated that they would use Enhance Quiz as a self-assessment tool and one fourth of the participants stated they wouldn't mind.

Participants were also asked to justify their choice of self-assessment tool. Group 1 participants that selected Enhanced quiz stated that the approach was very unique to self-assessment and it forces users to think when answering the questions, it was more challenging and fun and enables users to test their knowledge in the given subject rather than selecting an answer from a given list. Group 1 participants that selected Basic Quiz stated that it was quicker, it was more fun, and it helped remember the text better.

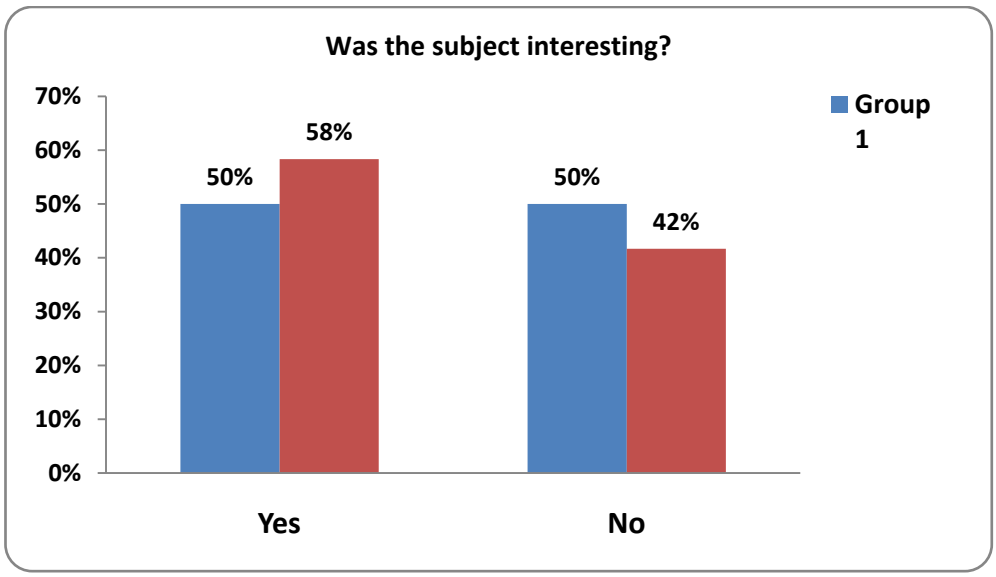
Group 2 participants that selected Enhanced Quiz stated that it makes the process enjoyable and challenging, it requires more time and thinking from the user but it was more engaging and interesting to use, has more ways to play and improves spelling too. Group 2 participants that selected Basic Quiz stated that it was more suitable for learning as recognition is better than recall, and is quicker for testing retained knowledge.

Figure 21: Enhanced learning



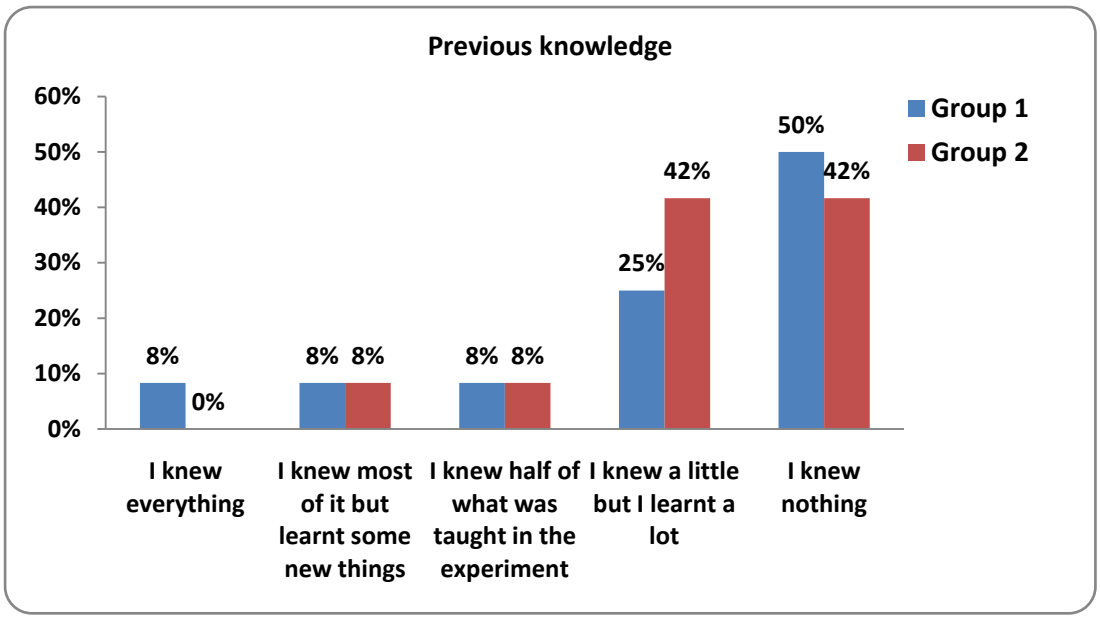
The results here were not as expected. The majority of the participants of both groups stated that Basic Quiz was more effective in enhancing their learning in the given subject. Based on the research which stated that fun applications are more effective in enhancing user learning, and by looking at the average performance between groups and the feedback, Enhanced Quiz should have been more effective in enhancing learning in the given subject.

Figure 22: Was the subject interesting?



The results show that half of Group 1 participants did not find the given subject interesting. There was a slight increase in the number of participants of Group 2 who found the given subject interesting, which could also be seen as a reason on the Group 2's performance increase in Enhance Quiz compared to Group 1 Basic Quiz.

Figure 23: Previous knowledge



The results show that a significant number of participants of both groups had no previous experience, or had little experience in the given subject with very minor percentage stated that they knew most of it. Although, logically it would make sense to assume that the more previous knowledge a group had, the better they would perform; there is no clear pattern to suggest that this is the case. We cannot confidently say that previous knowledge had an impact on performance.

Advantages / Disadvantages and Recommendations

Participants were also asked to express what they felt were the advantages and disadvantages of the experiments and what changes, if any, they would like to see that would make the experiments better. This was a good way to find out whether there were any faults in the experiments themselves, which could have influenced the performance of participants.

Participants of Group 1 stated that the experiments could make the process of self-assessment fun and interesting and would also make an ideal revision tool. Participants of Group 2 stated the advantages of the experiments as it could help improve learning, could help students understand what they have learned, it makes learning fun, Enhanced

Quiz was fun and it could help people who resist traditional testing tools, makes learning interactive and Enhanced Quiz promotes thorough thinking.

Participant of Group 1 described the disadvantages of the experiments as users can get bored from the same routine, the timing feature of Enhanced Quiz could be an disadvantage as users might feel they are rushed and pushed along too fast and the sound effect used for taking letters in Enhance Quiz was distracting. Participants of Group 2 stated the disadvantages of the experiments as time requirements where Enhanced Quiz took significantly longer than Basic Quiz, Enhanced Quiz takes lot of thinking for answering the questions and Basic Quiz can be guess works thus not show the user's true knowledge.

Participants were also asked what changes they would like to see in the experiments. Group 1 participants stated that they would remove the timing feature and the sound effect from Enhanced Quiz. Participants of Group 2 also stated that they would change the sound effect, and enable users to input answers using the keyboard 'return or enter' key.

At the end of the feedback survey, participants were asked if they had additional comments. Participants of Group 1 stated that, overall both tools were great and were happy to use them in the future, both experiments were found to be challenging and fun and Enhanced Quiz was more interesting and less boring than Basic Quiz. Participants of Group 2 also stated that, overall they have really liked the concept of Enhance Quiz and they have enjoyed the experiments.

CONCLUSION

The aim of this project was to produce an interactive self-assessment tool that would enhance learning and make the process fun. The results show that not all objectives were met.

Firstly, the sample group that was used in the experiments were the representative of the target audience, which were students and users with academic qualification, therefore the results obtained would reflect the behaviours and performance of the target audience. We can conclude that in general, the results of this research would be applicable to students and users with academic qualification. Also, we can conclude that the guidelines set by Malone and Bowman had been successfully implemented in the design and development of Enhanced Quiz. Feedback obtained also showed that in general, participants had acknowledged these guidelines and found them effective.

Secondly, the major conclusion that can be drawn from the results of analysis was that, based on the research in the fields of online learning, online quizzes, self-assessment and video games in education and the previous studies conducted in these field show that online quizzes, and the use of video games in education improved overall learning, but the results of this research does not tally up with this. Average performance results of Enhance Quiz should have been better than Basic Quiz results, but there weren't significant differences. Participants of Enhance Quiz haven't statistically performed better than participants of Basic Quiz when answering the same set of questions. Although, participants of Group 2 Enhanced Quiz achieved a better average score than participants of Group 1 Basic Quiz when answering the same set of questions, the statistical Student's T-Test analysis showed no differences between the average performances of both groups, in effect nullifying the average difference in average performance.

In fact there could be other factors for the overall average performance difference of Group 2 Enhance Quiz being better than Group 1 Basic Quiz. From the demographic survey we can see that English was not the first language of approximately 40% of Group 1 participants, which can be seen as the reason for the performance drop of Group 1 Basic Quiz.

There were significant differences in the amount of time that was taken to answer questions between Enhance Quiz and Basic Quiz. Participants significantly took longer to answer questions in Enhance Quiz compared to answering the same set of questions in Basic Quiz. The main objective here was to promote thinking and make the process challenging and fun, which was achieved based on the feedback obtained, but participants have also complained that it significantly took longer when answering question in Enhance Quiz. Participants significantly took less time when answering the same set of question in Basic Quiz, which can be due to the phenomenon known as 'recognition over recall'. As stated by Cousins (n.d.) recognition makes the process easier when the correct answer is provided out of a group of possibilities such as multiple-choice tests, but generally tests that involve fill-in the blanks such as Enhance Quiz are harder in which users have to think for the answer without any clues. As a result of this participant had to think more when answering questions in Enhance Quiz and that would be the reason for the significant time difference. This could also be the reason why a higher percentage of participants stated that Basic Quiz was more effective in enhancing their learning.

The other major conclusion that was derived from the feedback questions was that Enhance Quiz was more enjoyable and interesting to use. This was one of the aims of this project, to design and develop an interactive fun self-assessment tool. This should have resulted in higher average performance in Enhance Quiz results for both groups compared to the results of Basic Quiz when answering the same set of questions, but as mentioned above the T-Test analysis showed no statistically significant differences between the average scores of Enhance Quiz and Basic Quiz. As a result of this we can conclude that, although the developed application was fun to use and incorporated video gaming techniques effectively, it did not produce significantly better average performance results, hence cannot be validated as a tool that enhances learning when compared to traditional self-assessment tools such as a multiple choice quiz.

RECOMMENDATIONS

As we can see from the results, Enhanced Quiz results were statistically not better than Basic Quiz results. When looking at previous research and studies conducted in the field of self-assessment, online quizzes and educational video games, a success condition were achieved mainly in controlled tests. In those situations a learning environment is set for the participants and all the elements are equal. We can see an example of this in the feedback obtained; most participants stated that Enhance Quiz was more time consuming thus they have rushed the experiment, which could have an direct influence on the overall average score achieved. Also there was no control methods for making sure all participants equally read the text and understood before answering the questions.

In order to produce statistically sound results, it would have been more appropriate to conduct this study under controlled conditions with a higher number of participants who are enrolled on an academic course. This would also ensure that all participants would be taught the same material in classes, and they would be assessed on the same knowledge.

When looking at the results, the points achieved for not taking a letter in Enhance Quiz were not included in analysis; rather it was used as an incentive for participants when answering the questions. This concept can be further refined and the overall average performance could be based on the points won, rather than on the number of correct answers. Of course, this would bring new design decision and rules to Enhanced Quiz, as in the current state, the points cannot be used for the purpose of analysing the overall performance. This is mainly because a participant is allowed to earn points even when 90% of the letters are displayed, which would make the results unfair, and would not reflect users' true knowledge.

The results also show that participants significantly took longer in answering question when compared to Basic Quiz, but the overall average performances were near identical. Also, when they were asked which application enhanced their learning, Basic Quiz was more popular. A further study would be beneficial in terms of identifying the relationship between the overall average score and the time taken for answering

questions, and the results of this study would also give insight whether recognition over recall is more effective in self-assessment tools, thus eliminating the need of promoting thorough thinking.

In conclusion, the experiments conducted would be best carried out under controlled environments with participants enrolled on an academic course where all elements are kept constant, in order to produce statistically sound results.

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APPENDIX A: REFLECTION

Throughout the dissertation process I have learned many valuable lessons and gained important skills. When I look back at the last couple of months I can see that being over-ambitious with a project could cause problems if the duration of the project is not balanced with the aims and objectives. Due to the nature of this project I have had to go through extensive time management phases. This has taught me critical time management skills and the importance of focusing on the key areas and eliminating doing any unnecessary work.

Having chosen a topic that was related to my previous academic studies and aroused my curiosity and interest, the limited time affected my approach to the proposed problem. Due to this time constraint, when designing the interactive quiz I constantly kept changing the design elements and features of it. More time could have been spent in the design part in order to produce an even more effective interactive self-assessment tool. As a result of constantly coming up with new game play ideas and trying to keep within the guidelines set by Malone and Bowman, I have lost track of time and neglected important game play elements which could have resulted in a different outcome for the project.

Everything was designed and developed from scratch including writing up the codes for the interactive quiz, multiple choice quiz and the web pages. Extensive numbers of coding hours were put into the development phase, and at times it caused so much frustration that no software development concepts were followed. The basic aim was to get both applications (interactive quiz and the multiple choice quiz) up and running keeping true to the objectives. The most basic control methods were implemented for tracking progress and also the simplest method was implemented for storing and viewing results of the experiments in order to reduce development time.

In my proposal I have stressed that the experiments will not be conducted under controlled conditions to make the results authentic. Looking back at the project I believe for such an experiment, it is more appropriate to conduct it under controlled conditions where all elements are set and equal. Also, in my proposal one of the aims of the project was to assess whether users would be willing to use a self-assessment tool more often if

it was fun, thus improving their learning. But this wasn't a significant evaluation criteria when analysing the results, instead the average performance of the interactive quiz and the multiple choice quiz were statistically compared with qualitative feedback supplementing the final results. This seemed more appropriate to test the main aim of this project which was to enhance user learning using a fun self-assessment tool. My initial expectation was that the interactive quiz would score significantly better due to the concept of the application and previous studies conducted in video games in education, but it only met my expectations as being more fun than the multiple choice quiz. Finally, this process taught me not to be over-ambitious when undertaking projects and to be realistic in terms what can be achieved from a project within the available time.

APPENDIX B: ACCESS TO EXPERIMENTS AND FEEDBACK RESULTS

To access each experiment please use the following links:

- Welcome Page

http://vega.soi.city.ac.uk/~abhc640/diss/

- Group 1 Enhanced Quiz

http://vega.soi.city.ac.uk/~abhc640/diss/strings.html

- Group 1 Basic Quiz

http://vega.soi.city.ac.uk/~abhc640/diss/BasicQuiz.html

- Group 2 Enhanced Quiz

http://vega.soi.city.ac.uk/~abhc640/diss/stringsGroupTwo.html

- Group 2 Basic Quiz

http://vega.soi.city.ac.uk/~abhc640/diss/BasicQuizGroupTwo.html

- View Results

http://vega.soi.city.ac.uk/~abhc640/diss/displayResults.php

Feedback Survey Results

To access the feedback survey results, the following username and password can be used to login to http://www.esurveyspro.com/ManageSurveys.aspx

Username : mehmet.sesen.1@city.ac.uk
Password : 123456789

APPENDIX C: FEEDBACK QUESTIONNAIRES

Application Design Feedback

1. Were clear instructions and goals given for the applications?

Enhanced Quiz
Basic Quiz
Both
Neither

2. Which application gave effective instant feedback on your progress as you answered each question?

Enhanced Quiz
Basic Quiz
Both
Neither

3. Did you find the questions challenging?

Only in Enhanced Quiz
Only in Basic Quiz
Both
Neither

4. Do you think the multiple approach used by Enhanced Quiz for answering each question (requesting letters or entering the answer) opposed to answering questions in Basic Quiz was more effective in enhancing the overall experience?

Yes
No
Not sure

Experiment Feedback

5. Which application was fun to use?

Enhanced Quiz
Basic Quiz
Both
Neither

6. Which application was more effective as a self-assessment tool in the given subject?

Enhanced Quiz
Basic Quiz
Both
Neither

7. Have you used a similar tool to test your knowledge in a given topic in the past, if yes, how often?

Yes, but not very often
Yes, most of the time
Yes, always
No, but I will in the future
No, I don’t see it useful

8. Would you be happy to use such a self-assessment tool if it was fun?

Yes
No
Maybe

9. If you were given the option of using one of the applications used in this experiment in your everyday study as a self assessment tool, which application would you use?

Enhanced Quiz
Basic Quiz
I wouldn’t mind, either one
Neither

10. Could you please briefly justify your answer for the above question?

---

11. Which application was more effective in improving your knowledge in the given subject (Acai Palm & Acai Berry)?

Enhanced Quiz
Basic Quiz
Both
Neither

12. Did you find the subject interesting (Acai Palm & Acai Berry)?

Yes
No

13. How much did you already know about the subject matter (Acai Palm & Acai Berry)?

I knew everything
I knew most of it but learnt some new things
I knew half of what was taught in the experiment
I knew a little but I learnt a lot
I knew nothing

14. What advantages, if any, do you see in using the tools used in this experiment in everyday study?

---

15. What disadvantages, if any, do you see in using the tools used in this experiment in everyday study

---

16. If you were to use the applications used in this experiment in everyday study, what changes, if any, would you like to see?

---

17. Do you have further comments you would like to add?

Demographic Survey

18. Is English your first language?

Yes
No

19. What is your sex?

Male
Female

Which age range do you belong to?

18-25
26-30
31-40
41-49
50+

21. What is your occupation?

Student
Working Professional
Unemployed
Other

22. What is your latest educational qualification?

O Levels
A Levels
First Degree
Masters / MBA
PhD / MPhil / DBA
No qualifications
Other

APPENDIX D: EXPERIMENT QUESTIONS

1. What type of supplement has acai berry being marketed as?

2. It is similar in appearance but smaller than which fruit?

3. What makes the 80% of the fruit?

4. The berries are harvested as what?

5. Acai Berry products are sold in many different forms including:

6. One of the false claims made by marketers of Acai Berry products is the reversal of which illness?

7. Quackwatch noted that Acai juice has only middling levels of:

8. Acai Berry juice has less antioxidants than concord grape, black cherry and:

9. Acai Berry juice has more antioxidants than cranberry, apple juices and:

10. In minute concentrations, which group of chemical substances found in Acai Palm may affect cell-to-cell signaling, receptor sensitivity, inflammatory enzyme activity or gene regulation.

11. The Acai Palm's leaves are resistant to what?

12. The palm heart is widely exploited as a:

13. Comprising 80% of the fruit mass, Acai seeds may be ground for livestock food or as a component of organic soil for what?

14. What colour is the fruit (Acai berry)?

15. A powdered preparation of freeze-dried Acai fruit pulp and skin was reported to contain (per 100 g of dry powder) 52.2 grams Of what?

16. The carbohydrate portion includeS 44.2 grams of dietary:

17. The powder was also shown to contain (per 100 g): negligible amounts of which vitamin?

18. The average antioxidant capacity was ranked lower than which wine?

19. Planted seeds are used for new palm tree stock, under the right growing conditions, how long is required to form seedlings?

20. Tree trunks may be processed to yield what?

APPENDIX E: EXPERIMENT READING TEXT

The açaí berry has been marketed as a dietary supplement for weight loss. There is no scientific evidence that açaí consumption affects body weight or could promote weight loss.[1]

Fruit

The fruit, a small, round, black-purple drupe about 1-inch (25 mm) in circumference, similar in appearance but smaller than a grape and with less pulp, is produced in branched panicles of 500 to 900 fruits. Two crops of fruit are produced each year. The fruit has a single large seed about 0.25–0.40 inches (7–10 mm) in diameter. The seed makes up about 80% of the fruit (Schauss, 2006c). The berries are harvested as food. Recently, the açaí berry has been marketed as a dietary supplement. Companies sell açaí berry products in the form of tablets, juice, smoothies, yogurt, instant drink powders, and whole fruit.

Marketers of these products make unfounded claims that açaí and its antioxidant qualities provide a variety of health benefits, none of which has scientific confirmation to date. False claims include reversal of diabetes and other chronic illnesses, as well as expanding size of the penis and increasing men's sexual virility and sexual attractiveness to women.[8] As of June 2010, there are no scientifically controlled studies backing up any of these claims.

Quackwatch noted that "açaí juice has only middling levels of antioxidants—less than that of Concord grape, blueberry, and black cherry juices, but more than cranberry, orange, and apple juices." The extent to which polyphenols as dietary antioxidants may promote health is unknown as no credible evidence indicates any antioxidant role for polyphenols in vivo,[10][11] In minute concentrations, polyphenols may affect cell-to-cell signaling, receptor sensitivity, inflammatory enzyme activity or gene regulation.[11][12]

According to the Washington, D.C. based Center for Science in the Public Interest (CSPI) thousands of consumers have had trouble stopping recurrent charges on their credit cards when they cancel free trials of açai-based products.[13][14] Even some web

sites purporting to warn about açai-related scams are themselves perpetrating scams.[1]

Other uses

Apart from the use of its berries as food or a flavoring in tequila, the açaí palm has other commercial uses. Leaves may be made into hats, mats, baskets, brooms and roof thatch for homes, and trunk wood, resistant to pests, for building construction.[15] Tree trunks may be processed to yield minerals.[16] The palm heart is widely exploited as a delicacy.[17]

Comprising 80% of the fruit mass, açaí seeds may be ground for livestock food or as a component of organic soil for plants. Planted seeds are used for new palm tree stock, which, under the right growing conditions, requires months to form seedlings.[citation needed] The seeds are a source of polyunsaturated and saturated fatty acids[15][18][19]

Nutritional content

A powdered preparation of freeze-dried açaí fruit pulp and skin (Opti-açaí, K2A, Inc.) was reported to contain (per 100 g of dry powder) 533.9 calories, 52.2 g carbohydrates, 8.1 g protein, and 32.5 g total fat. The carbohydrate portion included 44.2 g of dietary fiber and low sugar value (pulp is not sweet).[19] The powder was also shown to contain (per 100 g): negligible vitamin C, 260 mg calcium, 4.4 mg iron, and 1002 U vitamin A, as well as aspartic acid and glutamic acid; the amino acid content was 7.59% of total dry weight.

Antioxidant potential of juice

When three commercially available juice mixes containing unspecified percentages of açaí juice were compared for in vitro antioxidant capacity against red wine, tea, six types of pure fruit juice, and pomegranate juice, the average antioxidant capacity was ranked lower than that of pomegranate juice, Concord grape juice, blueberry juice, and red wine. The average was roughly equivalent to that of black cherry or cranberry juice, and was higher than that of orange juice, apple juice, and tea.[26]

Full text available : http://en.wikipedia.org/wiki/A%C3%A7a%C3%AD_palm [Accessed 09/08/2010].

Image available: http://acaiberrydetoxpower.com/tag/acai-berry-natural-supplements-ingredient/ [Accessed 09/08/2010].

APPENDIX F: DISSERTATION PROPOSAL

Working Title

The affect of self assessment in learning: Can application of video games techniques enhance the process in e-learning?

Introduction

Most of Web 2.0 applications are mainly consists of social network sites, blogging, information sharing and user generated content. By using some of these Web 2.0 technologies we can produce an interactive application which could be used by users to test their knowledge and improve their learning, and have fun at the same time.

To produce such an application we will look at the current methods used in the field such as online quizzes and it's effectiveness in helping learners understand the areas of interest or in the areas being studied. Once we identify the current methods used we will look at how we can improve it. We will look at video games in particular and find out which elements we can borrow from them to make our online application fun, addictive, and educational. As a result of our research we will design and develop an interactive online application for users to test and comment on the functionality, enjoyability and effectiveness in improving their learning.

Aims

The aim of this project is to find out whether users would prefer to assess themselves more often in the subject areas they are interested in if it was fun to do it and whether this will improve their learning? For the project we will need to produce an original interactive online education application which will be fun to use. In by doing so we can enable students to interact more often with the subject and help them understand it better. As Vollmer (2010) reports that students tend to produce better performance if they are having fun while learning**.**

Objectives

1. To research the benefits of online learning, online quizzes and video games in education.
2. To identify video games techniques to be used in our learning application.

3. Combine identified video games techniques with online quizzes and design an interactive and fun online learning application.
4. To come up with a web hosting solution for the developed application and make it simple to access for participants
5. To develop the designed application in short period of time.
6. Select topics and prepare the questions.
7. Run the tests
8. Gather and produce results for analysis.
9. Evaluate the results for the conclusion of whether the developed application is fun to use and effective as a learning tool.
10. Determine whether the developed application can be fun and effective as a learning tool and enhances user learning.

Scope and Definition

The idea of using video games in education has been utilised in many forms. From interactive maths applications to interactive language training. It is still an area that could be improved and the full potential of video games could be used in education. This study incorporates two different concepts, e-learning and the application of video games techniques in a simple self-assessment tool which will be delivered online. This principle idea makes this study unique compared to other e-learning studies, and within the studies of video games in education. The participants will not be asked to use the applications in a controlled room, but rather in their own time and at a place they feel comfortable, which should also make this study more authentic.

Within the available time, a thorough, extensive research and experimentation will not be feasible. As a result of this we will adopt a qualitative and quantitative approach to the project with 20-30 participants. Due to the nature of the study, it will be very difficult to assess the validity of the developed application as a learning tool and whether it improves the users learning in a short period of time. The purpose of this study is to observe user feedback and produce qualitative, detailed results and if successful, it will demonstrate that applying video game techniques to a self-assessment tool; it is possible to improve user learning and make the process fun. However, a detailed quantitative/statistical approach with significant number of participants who is

enrolled on an academic course is required to produce valid results for the effectiveness of the application as a learning tool.

We will develop two applications, first one being an interactive quiz and the second one will be a basic online quiz. Both applications will be developed from scratch using Adobe Flash CS3 authoring tool. This should allow us to produce the desired applications in a short period of time, and we will be able to customize the applications as required by the aims and objectives of this study.

Ethics

No ethical issues should arise with the project.

Confidentiality

No confidentiality issues should arise with the project.

Literature Review

We can produce better interactive self assessment applications to help us improve our performance in assessments, or just improve our general knowledge. Boud (1995:13) investigates the importance of self assessment in higher education and states that “self assessment is coming to be regarded as an accepted and significant part of course because it relates to one of the central goals of a university education: enabling students to become effective and responsible learners who can continue their education without intervention of teachers or courses”. There are number of texts, journal papers and online information evaluating the effectiveness of technology in education and enhancing user knowledge through interactive applications such as online quizzes.

We will look at three key areas which will form the basis of our literature review. The first one is 'online learning' as our research application will be delivered online using web 2.0 components. The second area is 'effects of quizzes on student's performance'. We will look at previous studies conducted in this area as our application will be similar to a quiz with more interaction. The final area is 'video games in education', where we will look at the ways in which we can make our application fun to use.

Online Learning

The advent of affordable computers and Internet access has introduced new ways for students to study. As a result of this “the Internet or the World Wide Web (www) is being used as a major teaching resource in the United Kingdom “ (Kuraishy, Bokhari, 2009:2). Online learning is being utilized by many of the higher education institution, academic and professional organizations. “According to CCA consulting, nearly 50% of higher education institutions currently engage in some type of online learning. Academic and professional organizations agree that using web-based learning environments can offer sound pedagogical benefits” (Blackboard, 2000:1)

A questionnaire was carried out to find out whether online learning tools such as WebCT websites contributed to student's learning. And the results showed that “Students are interested in having course web sites that complement the courses in which they are enrolled. An analysis of the questionnaire completed by around 400 students who participated in courses that had WebCT-based web sites found that 57% of the students believed that WebCT web sites should be built for all Technion courses. In general, it may be said that the students were satisfied with the WebCT system. Fifty-five percent of them thought that using the system contributed 'a lot to a great extent' to learning” (Frank, Barzilai, 2004:39). In his analysis Brisilovsky talks about the benefits of web based education. The author states that “Benefits of Web-based education are clear: classroom independence and platform independence. Web courseware installed and supported in one place can be used by thousands of learners all over the world that are equipped with any kind of Internetconnected computer” (Brisilovsky, 1999).

An example study which uses the combination of quizzes and technology to enhance student performance, the study discusses the effectiveness of technology in language teaching , especially the use of online quizzes. The results of the study show that “quizzes, especially when used interactively, can be of great value to motivate students in the study of a foreign language”. It is also stated that “the use of technology for language teaching and learning is much more effective, motivating and challenging than the use of the traditional classroom tools: pen, paper and chalkboard” (Mello, 1997).

Quizzes

Quizzes are being used everywhere to test our knowledge whether on a specific topic or just for testing our general knowledge. Effects of quizzes on student's performance have been an interesting question and several studies have been carried out to find out whether quizzes enhance student's performance when used as an additional tool in academic courses. A study shows that incorporating online quizzes enable students to see how the concepts they are learning in lectures applied in the real world, and students indicated that the assignments and quizzes were helpful in understanding the material (Cooper, Tyson and Sandheinrich 2007: 214, 220).

Another study shows that the use of online assessment methods on average produced better results in the final mark compared to those students who had taken the more traditional approach, and it is there are two affects of the online quizzes on students, “it allows learners to test their knowledge, and understand the course unit materials” (Stanfield, McLellan, Connolly 2003:181, 185). As Dobson (2008: 297) concludes that incorporating technology in the form of online quizzes can enhance summative exam performance and the results from these quizzes can be a valid predictor of one's exam performance.

In a different study “the members of both focus groups firmly believed that the quiz was a valuable learning tool that helped them to gain a better understanding of the area of disclosure" (Maxwell, Pastellas, n.d.). An interesting study which illustrates the effectiveness of taking daily essay quizzes on student's writing skills. The results conclude that “daily essay quizzes would show better retention of information, clarity of ideas, and critical thinking when asked to write about an unfamiliar article in their discipline than would students who did not engage in daily graded writing. These findings suggest that students who wrote daily essay quizzes went beyond simply learning the course material to develop reading and thinking skills that generalized to a new assignment outside the realm of their class” (Green, Murdoch, 2000:21).

By looking at the studies we can conclude that most students benefit from quizzes whether it's online or offline when used as an additional tool in their course. Again, indicated by “An Action Research project studying a group of final year undergraduates indicates that quizzes accompanied by brief discussions can be more valuable.Students

on a one semester Technical Editing course were given a short quiz every three weeks. Most of the students felt that these activities helped them to understand concepts or even to apply them" (Hulbert, n.d.).

Video Games in Education

We can introduce key elements to make the whole process more intuitive, fun and addictive. Most quizzes that are used to test a user's knowledge only consist of a question and a list of answers with the possibility of one or more correct answers. Nearly all quizzes utilize this blueprint.

To produce an interactive, fun and original interactive application to allow users to test their knowledge, we have to look and analyse a different medium, in particular video games and find out what makes certain video games fun and addictive. In their analysis Greenidge and Daire (n.d.) talk about the potential application of video games in counselor education programs. The authors discuss that "the ability to immerse students in high-risk situations and with high-risk populations provides another benefit in using gaming in counseling preparation programs" as one of the benefits of using games as educational tools.

Malone (1981: 333-369) outlines several guidelines for producing fun education applications. He argues that in order to produce enjoyable education applications it should have clear goals that users find meaningful, multiple approach to proposed problem and feedback on their progress, flexible enough to adjust the difficulty to users skill, randomness in terms of surprising the user and an emotionally appealing theme that is related to game skill. We can almost apply all of those key areas defined by Malone to our idea of producing an online interactive application. The basic quizzes utilized by many organisations don't follow the key guidelines set by Malone. In fact, when those studies were carried out, if the type of interactive application used had followed the guidelines of what Malone set, the results could have been much more significant and the effects of using online quizzes could have had much wider influence on the overall performance of those students.

Methodology

A qualitative and quantitative approach will be used. From the above studies we can see that using interactive online applications such as online quizzes help learners improve their overall performance. I will extend on this theory and my research will try to find out whether we can get users to test their knowledge, improve their learning and have fun simultaneously. Qualitative aspect of the research will be formed by observing the data obtained from users to find out whether they had fun using the developed application and whether the application improved their learning opposed to answering similar questions in the same topic in a traditional online quiz. This will be achieved by developing an enhanced version of a basic quiz and using video game level functionality to achieve an enjoyable experience for the user. Quantitative aspect of the study will be formed by counting the time spent using each application, in particular time spent answering each question.

Both applications will be developed using Adobe Flash CS3 authoring tool. Both applications will be put online for participants to test. The questions will be derived from a four predefined topics to keep it consistent for each user. Users will have a different incentive when answering the questions using the developed application opposed to answering the questions using a traditional online quiz. In the developed application users will try to gain the highest score by trying to find the correct word. They will get more points in the way each question is answered. This will give users two incentives when using the application. First incentive will be to answer the questions in the best way to get the highest score for that question. The second incentive will be to get the highest score overall. Where-as in a traditional online quiz user's only incentive is to get the most questions correct, which sometimes results in users guessing the correct answer. We will find out if a simple change such as changing the way users answer a question in a more intuitive and engaging way in the concept of a question-answer based application changes the experience of using a knowledge based interactive application, and whether it enable its users to learn and have fun throughout the process.

At the end of the test session users will be asked to complete a survey based on their experience of using both applications. The questions will be based on the topic of whether they find the developed application fun and whether it helped them learn and

understand the selected topic more effective than a basic online quiz and which one they would prefer to use if they had the option in the future.

By analysing the results we can come to conclusion whether users can learn, test their knowledge and have fun at the same time, or just prefer the traditional online quizzes. There is a possibility that the developed application may not be effective as a learning tool, or it may be effective as a learning tool but not more fun than a basic online quiz.

Work plan

Start date	Task	Deadline	Completed? Yes/No
28/06/10	Literature review	11/07/10	
12/07/10	Determine four topics for the questions	14/07/10	
15/07/10	Produce test questions for each topic	17/07/10	
18/07/10	Produce the feedback survey	19/07/10	
20/07/10	Design the application	22/07/10	
23/07/10	Finalise design	23/07/10	
24/07/10	Develop the application	08/08/10	
09/08/10	Implement the test questions	11/08/10	
12/08/10	Test the application	12/08/10	
13/08/10	Develop a multiple choice quiz	13/08/10	
14/08/10	Implement the selected questions for the quiz	14/08/10	
15/08/10	Test developed quiz	15/08/10	
16/08/10	Implement the feedback survey	16/08/10	
17/08/10	Test both applications	17/08/10	
18/08/10	Identify participants	18/08/10	
19/08/10	Produce instructions for the participants	19/08/10	
20/08/10	Contact participants	27/08/10	
28/08/10	Run the tests	08/09/10	
09/09/10	Produce results	09/09/10	
09/09/10	Analyse results	09/09/10	
10/09/10	Conclusion	10/09/10	
11/09/10	Write dissertation	22/09/10	
22/09/10	Finalise dissertation	22/09/10	
23/09/10	Submit dissertation	24/09/10	

Resources

The test will not be carried out under controlled conditions, therefore web space with Mysql and PHP is required.

APPENDIX G: PHP CODE FOR DYNAMICALLY ALLOCATING PARTICIPANTS TO GROUPS

```
//PHP Source Code for assigning participants to groups dynamically
//Mehmet Sesen 2010
//Developed for the completion of the dissertation project for MSc Information Systems
//Database and password is masked for security purposes

$con = mysql_connect("vega.soi.city.ac.uk", "abhc640", "******") or die ("Could not
connect");

mysql_select_db("*****", $con) or die ("dead");

$userNo1 = 0;
$userNo2 = 0;

$query = "SELECT userNo FROM grouponeenhance";

$result = mysql_query($query) or die(mysql_error());

while($row = mysql_fetch_array($result))
{
        //Get last user number for Group 1
        $userNo1 = $row['userNo'];
}

$query = "SELECT userNo FROM grouptwobasic";

$result = mysql_query($query) or die(mysql_error());

while($row = mysql_fetch_array($result))
{
        //Get last user number for Group 2
        $userNo2 = $row['userNo'];
}
```

```
//Compare user numbers and decide which group is the next
if (isset($userNo1))
{
	if (isset($userNo2))
	{
		if ($userNo1 > $userNo2)
		{
		header ("Location: BasicQuizGroupTwo.html");
		}

		else

		{
		  header ("Location: strings.html");
		}
	}

	else
	{
	header ("Location: BasicQuizGroupTwo.html");
	}
}

else

{
header ("Location: strings.html");
}

?>
```