7.1 INTRODUCTION

In the previous chapter it was discussed how the research methodology was formulated and the empirical study performed. The results of the experiment were also published and interpreted to obtain a more meaningful understanding of the information gathered in this way.

The purpose of this chapter is to conclude on the overall results of the study and give an overview of the specific objectives (see Section 1.5.2 in Chapter 1) and the way in which they were achieved. Recommendations and points of further research are given.

7.2 GENERAL RESEARCH OBJECTIVE

The primary objective of this study was to evaluate whether the learning and lecturing difficulties experienced by auditing students and lecturers can be addressed effectively through the integration of an educational auditing information technology-based game into the lecturing of chartered accountancy students in their third year of theoretical studies.

This general research objective was addressed by completing seven specific research objectives. An overview of these objectives as well as a summary of how they were addressed is now given, after which it will be concluded on how this study addressed the general research objective.

7.3 SPECIFIC OBJECTIVES

The following specific objectives were set in order to reach the general objective (see Section 1.5.2 in Chapter 1):

1. Gain an understanding of the difficulties involved in teaching auditing as a theoretical subject by reviewing the literature on the subject.

2. Plan the way in which the research will be conducted in order to effectively address the general objective of the study.
3. Gain an understanding of experiential teaching methodologies.

4. Gain an understanding of the benefits and challenges associated with experiential teaching methods by doing a literature review.

5. Through review of research done on the use of experiential teaching methods, identify best practice and restrictions to be taken into account when developing the prototype game.

6. Develop a prototype educational auditing computer game taking best practice from the literature study into account.

7. Test the students’ perceptions of the computer game as a learning tool by developing and administering a questionnaire.

7.3.1 Specific objective 1

Specific objective 1, Gain an understanding of the difficulties involved in teaching auditing as a theoretical subject by reviewing the literature on the subject, was addressed in Chapter 1.

Prior research indicates that prior work experience is a key factor that positively influences the academic performance of auditing students (Ferguson et al., 2000). Rudman and Terblanche (2011) report similarly that newly employed accountants find it difficult to see the big picture of how an entire audit process works and do not fully conceptualise the audit process. In this study, it is suggested that, taking the prior research into account, one of the reasons that students struggle with auditing can be attributed to the way in which the qualification process of chartered accountants in South Africa is currently structured. This process currently spans seven years; the first four of which relate only to university-level theoretical studies. The programme therefore makes no provision for practical experience or exposure of students during the first half of the training process. In turn, lecturers find it difficult to relate the important ideas of auditing to students who have not yet established in their own minds an adequate frame of reference in which to contextualise, analyse and understand the various auditing concepts (Arens et al., 1970).

Apart from the above-mentioned inherent restrictions of the structure of the qualification process, other factors (inherent to the population of auditing and chartered accountancy
students) also contribute to the perceived difficulty level of the auditing subject. Prior research suggests that students are motivated to study accounting because of future extrinsic rewards associated with the profession, perceive the chartered accountancy course to impose a substantial workload on its students, have negative stereotypical perceptions of accounting and tend to favour surface learning to deep learning approaches. These factors all negatively affect the way these students approach their subjects (including Auditing) and therefore contribute to the mix of challenging factors influencing the ‘difficulty’ level of the subject. The perceptions of the students who participated in this study of these factors were also measured in Section B of the questionnaire. The results are consistent with prior research (see Section 6.3.2 in Chapter 6).

Another set of factors that contribute to the difficulty level of the subject Auditing pertains to the traditional way in which auditing lecturers have approached the task of transferring knowledge to students who are already weighed down by all of the above-mentioned factors and considerations. Prior research reports a gap between the classroom and the real world (Stewart & Dougherty, 1993; Weil et al., 2001). Too much lecturing is being done (Maltby 2001; Siegel et al., 1997) and this has resulted in accounting graduates being unprepared for the world of work that awaits them upon graduation (Cheng, 2007). The result is that students are not adequately prepared for being effective auditors in the workplace (Helliar et al., 2009). The performance of entry-level accountants is unsatisfactory to their employers, despite the fact that they were satisfied with their level of theoretical knowledge (Coetzee & Oberholzer, 2009). Prior research proves the need for new and innovative teaching methods to address these factors. There needs to be some type of practical exposure added to the academic programme, even if it is only simulated (Rudman & Terblanche, 2011). It is these calls for innovation that inspired the creation of the educational game that attempted to address some of these deficiencies in the current curriculum. The perceptions of the students when interpreted indicate that the game addressed most of these challenges by adding to the enjoyability and motivation of the learning experience (see Section 6.3.3.2 in Chapter 6).

7.3.2 Specific objective 2

Specific objective 2, Plan the way in which the research will be conducted in order to effectively address the general objective of the study, was addressed in Chapter 1.

Part of this study included a literature review on the challenges facing auditing education and accounting education in general, experiential methods as a possible way of
addressing these challenges and, more specifically, how educational computer games can be and have been used as an educational instructional method. This knowledge provided the backbone of the study and is discussed in Section 7.3.5.1. Based on the prior research, a list of principles to take into account when developing and designing an educational game for auditing students was extracted. The scope and goals of the game were established and the game was developed based on these principles. It was further planned that the newly developed prototype game would be tested. The target population was planned and the necessary lecture rooms were procured. The population asked to participate was the entire third-year auditing students group at NWU. This required an application to be submitted for review by the Ethics Committee of NWU, who gave the final approval before the experiment could be planned, arranged and conducted. The results were interpreted with the help of the Statistical Consultation Services of NWU, after which a conclusion was reached regarding the perceived usefulness of a game as an educational tool in the education of auditing.

7.3.3 Specific objective 3

Specific objective 3, Gain an understanding of experiential teaching methodologies, was addressed in Chapter 2.

Experiential learning is defined as a sequence of events that requires active involvement by the student at various points (Walter & Marks, 1981). There may be multiple learning objectives, but the central tenet is that the student learns best by active involvement (Marriott, 2004) in contrast to the traditional teaching method adopted by accounting lecturers in which the emphasis is placed on lectures and textbooks and students form a passive part of the learning process. Kolb and Kolb (2005) advocated the experiential learning theory. This theory maintains that learning occurs as the individual moves through the cycle of concrete experience (the real world; feeling), reflective observation (thinking), abstract conceptualisation (figurative presentation) and active experimentation (doing). Since that time, there have been many researchers who explored the possibilities and challenges of implementing this theory in deriving innovative methods of education. The methods that fall under the experiential learning theory and that have been researched in this study include, but are not limited to, case studies, problem-based learning, simulations, role play, annual projects and field experience. All these methods have their specific related challenges and potential benefits, as listed in Chapter 2, but are examined as a whole in this chapter. Some of the potential benefits of these methods are that they take students out of their comfort zone, demand active involvement and
engagement, facilitate deep learning and understanding, could add to the students’ intrinsic motivation and could, depending on the specific method, add a certain amount of joy to the educational experience. It is also important to note that at the heart of the experiential theory lies active involvement. This theory therefore effectively addresses the main concern and criticism regarding auditing (and accounting) education, namely that students find it difficult to learn theory relating to a bigger picture that they have not yet experienced. In this process, the value of education is lost and students graduate with knowledge that they have no idea how to use.

7.3.4 Specific objective 4

Specific objective 4, Gain an understanding of the benefits and challenges associated with experiential teaching methods by doing a literature review, was addressed in chapters 2 and Chapter 3.

After identifying that one possible way of addressing the challenges and criticism facing current auditing education was by making use of educational methods, which complies with the experiential learning theory as advocated by Kolb and Kolb (2005), the next logical step was to examine prior research attempts at doing this. The findings of these previous studies were explored in order to generate ideas of what considerations should be taken into account during the use of any such method. In order to identify all possible relevant studies, it was decided to cast the net widely initially and then focus the research more specifically on auditing education. The three spectrums, as discussed in Chapter 3, that were included in the research were firstly education in general, secondly accounting education and lastly and most importantly, auditing education (see Flowchart 7.1).
During the general education overview, it was discovered that the field in which the use of experiential teaching methods has been attempted most and most successfully has been in the medical and engineering fields. This is because the nature of these fields of knowledge is inherently most susceptible to the use of active learning methods. A medical student will, for example, complete case studies that involve examining and diagnosing a patient who will display simulated symptoms of disease. Similarly, engineering students will benefit from having visualisations and animations incorporated into their various study courses (Ebner & Holzinger, 2002). Prior research therefore indicates that for the active learning method to be successful, the course material taught has to be susceptible to this type of lecturing method. The course material will be susceptible to active learning when it is possible to involve the students in a physical or simulated process, which would result in learning taking place. This study therefore argues that the auditing field is especially susceptible to active learning methods, as the main challenge in auditing education is that students need to be able to apply (and in order to do this, understand) the knowledge they are taught. In other words, the goal of any auditing course should be to enable graduates of the course to perform an audit.
Experiential teaching methodologies have been researched in the accounting sector (Section 3.3 of Chapter 3), although the concept was not as widely explored by prior research as was the fact with the medical (Section 3.2.1) and engineering sectors (Section 3.2.2). The focus of these methods was also on case studies (with problem-based case studies begin predominant) and simulations, although some research on board and business games was also conducted. Prior research indicates that case studies especially have been widely used in accounting education and some considerations on the effective design of a case study to be used in accounting education were noted.

In the field of auditing education (sections 3.3.1.2, 3.3.2.2 and 3.3.3.2 in Chapter 3), studies regarding the following experiential methods were found and examined: case studies, simulations and educational games. Of these, the case method is the one that was more extensively utilised in an effort to address the challenges facing auditing education. It was noted that various case studies have been successfully used to complement other teaching aids in auditing education; however, various researchers report that one of the main shortcomings of this method is the time-consuming nature and lack of flexibility of the method. Students also tend to feel that these types of methods add work to a course that is already perceived as having a very substantial course load; however, if implemented correctly, it should help the students move away from their rote memorisation approach towards understanding the mechanics of the subject matter and the concepts. The results of the experiment done in this study, however, proved that all of the above challenges could be successfully addressed through the effective design and implementation of the chosen method (as discussed in Chapter 6). In the case of this educational computer game, these challenges were combated by careful consideration of the extent of the course material that would form part of the educational game as well as by including guidance and tutor options in the game, which would lead to a more effective educational experience. The students in this case did not report that they felt the game was too time-consuming or added too substantial a workload to the course. This is consistent with a study conducted by Gelinas et al. (2001) with integrated information technology for which the students did not perceive the time invested in the simulation as an impediment.

Dittenhofer (1992) noted that in order for case studies teaching auditing-related topics to be effective, the following best practice principles must be applied:

- The case study must be realistic.
- It must be related to the material being covered in the course.
• It must be presented in such a way that the student is drawn into the situation as a participant.

• The situation must be resolvable.

• The case study must be credible to the degree that the student views it as an actual occurrence or a situation that in all probability will occur.

The aim of this study was to incorporate all of the strengths of these above-mentioned methods (simulation, gaming and information technology) into designing an educational aid not previously researched within the auditing field. This study will therefore contribute to the literature in providing an empirically tested prototype simulation game to be used in an undergraduate auditing class. For a detailed schedule of all the considerations to take into account during the design of the educational computer game as identified from previous research, refer to Section 4.4 in Chapter 4.

7.3.5 Specific objective 5

Specific objective 5, through review of research done on the use of experiential teaching methods, identify best practice and restrictions to be taken into account when developing the prototype game, was addressed in Chapter 4.

Kiili (2007) advocates that the educational goals and gameplay should be balanced in order to achieve a meaningful unit. This principle formed the foundation of the entire game design. The game needs to be anchored in educational principles if it is to be of any value, yet it has to utilise and incorporate the potential benefits gained from the ‘gamification’ of the theory in order to be worth anything as an experiential teaching method (see Figure 7.1 below).
7.3.5.1 Principles anchored in pedagogy

Various researchers emphasise the importance of having a pedagogical foundation on which to build the educational game design. Prior research indicates that the main principles of PBL – contextuality, collaboration and experientialism (Boud & Feletti, 1991) – can also be utilised in educational games. This adaptation of the problem learning method is called the problem-based gaming method. It is thought that games provide a meaningful framework for offering problems to students. In fact, a game itself is a big problem that is composed of smaller casually linked problems (Kiili, 2007). As students are confronted by these problems, learning occurs through a construction of cognitive structures through action (learning by doing) in the game world (Kirriemuir, 2002). The pedagogical foundation that this game was therefore built on is active (experiential) learning theory, which was discussed in chapters 2 and 3. The theoretical principle of active learning formed the backbone for the creation of the game used in this study.

As the educational gaming method is a relatively new concept to accounting education, knowledge from previous research done on various other methods had to be drawn into the study to provide a scientifically sound starting place from which to design the game. In this way, the following key pedagogical elements were identified as key elements to be
Elements of motivation include competition and realism. Competition was included in the game through scorekeeping and problem-based gaming scenarios in which the gamer had to demonstrate a certain set of knowledge and skills before being enabled to advance to the next game level. Realism was included in the game through including real-world ambiguities and complexities in decision making. The results of the experiment showed that the students were motivated by the way the game was structured (see sections 6.3.3 and 6.3.5 in Chapter 6).

Student activity needs to be meaningful if it is to have any educational value. Hendricks (1987) refers to meaningful activity as activity that provides direction without dictation, is induced by what the student wants to learn, is supported by previous knowledge taught to the student, has a planned purpose and outcomes, is realistic and include problem-solving.
situations. In order to provide an environment for realistic activity to take place, it was decided that a teaching plan with planned learning outcomes, deduced from the ‘normal’ auditing third-year curriculum, would form part of the backbone of the educational content to be included in the educational game. This content would then be ‘gamified’ and dispersed with non-interactive storytelling elements, which would lead the students to perform meaningful activities that would lead to them achieving the specific learning outcomes of the game. The participants in the experimental group and the control groups reported exactly the same accomplishments of learning outcomes (see Section 6.3.4.1 in Chapter 6). This led the researcher to deduce that valuable meaningful activity did take place in the gaming environment.

Biggs (1989) advocates that for any experiential learning method to be successful, it has to include at least some interaction with others. Because gaming can be defined as neither an individual nor a social event (Kiili, 2007), the use of a game as a teaching tool provides various opportunities to include this call for ‘interaction with others’. Interaction could be simulated or real; could involve real people or programmed characters and tutors who are acquainted with the student, or foreign students and lecturers whom the student has never met; could be streamed via video or audio only; or could be achieved via chat functions, LAN groups or online discussion boards – the possibilities are endless. The interaction options that were chosen to be incorporated into the prototype game developed in this study included interaction with pre-programmed tutors and characters via video streaming. The experiment took place in a lecture room setting where students could consult one another and the invigilators and interact in this way regarding the computer game that was played simultaneously by all participants of the experimental group. The questionnaire included questions on whether any other social integration options were preferred, to which the students did not respond particularly positively. The result was interpreted as the students being satisfied with the degree of social interaction included in the prototype game (see Section 6.3.5 in Chapter 6).

Previous research suggests that the experiential teaching method should relate to theory with which the students have previously been confronted. This was taken into account in the design of the teaching plan based on which the experimental game was developed (see Section 5.2.2 in Chapter 5). This teaching plan was developed taking into account the theoretical knowledge relating to the audit of inventory that the third-year auditing students who participated in the study should have learnt and had in fact learnt in the second academic year of chartered accountancy studies at NWU. The theory that they had to understand in order to reach the learning outcomes of the teaching plan was therefore not new to them. To further jolt their memory and ease the recall process of the
knowledge, tutorials that explained all necessary principles from scratch were included in the gameplay. Both the control and the experimental groups reported feeling neutral about reaching the learning outcomes of the experience (see Section 6.3.4.1 in Chapter 6). This means that, in terms of educational value and knowledge transfer, this specific teaching tool was moderately successful in assisting students to reach their educational goals. This is adequate, though not outstanding. A plausible explanation would be that their previously acquired knowledge was not sufficient or that they did not remember all of the theory taught in the second year of their studies. The second scenario is supported by the fact that prior research shows that chartered accountancy students tend to favour surface learning versus deep learning, and therefore retention suffers (see Chapter 1).

7.3.5.2 Principles of gameplay

The aim of the literature review on this topic was to identify which elements should be given consideration to when planning the design of the educational game. The elements are depicted in Figure 7.3 below:

![Figure 7.3: Elements of gaming](source: Constructed by the author (2013))
It was discovered that various types of educational games exist, all based on various pedagogical theories. The types of games include the following:

- Direct instructional approach
- Experiential learning
- Guided experiential learning
- Learning by doing
- Case method teaching
- Inquiry-based learning
- Discovery-based learning
- Guided inquiry and discovery-based learning

The type of game that mostly corresponds to the experiential learning theory is the experiential learning gaming type. In this type of game, knowledge is constructed as a result of experiencing and interacting with the simulated environment. The game design therefore was based on the underlying continuous process of experience and reflection. The gamer is confronted with a simulated scenario, has a chance to experience this scenario through animated video and sound, and is then called upon to react to the scenario and give a possible solution in order to advance to the next level. Other elements that have an impact on game design and therefore the learning experience were identified as being game flow, usability and skill level.

Game flow could be seen as the goal of any game (be it educational or commercial) and has been described as an optimal experience that places a person in a state of complete absorption or engagement in an activity (Kiili, 2007). Past research has shown that the flow state has a positive impact on learning, exploratory behaviour (Webster et al., 1993). Therefore, it should be taken into account when designing an educational game. The factors that influence game flow include a clear set of goals, immediate and appropriate feedback, potential control, a perception of challenges that are matched to the person's skills, playfulness, and speed and ease of use of the user interfaces. When asked whether they found the experience engaging, the students of the experimental group responded noticeably more positively than did the students of the control group (see Section 6.3.3.2 of Chapter 6). It seems, therefore, that the game design was successful in taking into account the game flow experience.
The literature review provided no evidence that the development of a computer-assisted simulation game in auditing education has been attempted before. Simulations and case studies have, however, been extensively researched and used in auditing education and there is evidence that these experiential methods are an effective way of addressing the various challenges facing current auditing education. The literature also provides evidence that lecturers as well as public accountants have recognised the impact of information technology on the training requirements of chartered accountants and that there has been a tendency among researchers and lecturers to favour computer-assisted methods. In addition, the method of educational gaming has been introduced and researched in both the accounting and auditing fields and the findings show that the strength of this method lies in motivating and engaging students. The aim of this study was to incorporate all of the strengths of these methods (simulation, gaming and information technology) in designing an educational aid not previously researched within the auditing field. This study therefore contributes to the literature in providing an empirically tested prototype simulation game to be used in an undergraduate auditing class, which was well planned and supported by a teaching plan, written case study and storyboard and of which all technical clichés had been eliminated through pilot studies and re-programming until, at the day of the experiment, no technical errors were experienced.

7.3.6 SPECIFIC OBJECTIVE 6

Specific objective 6, Develop a prototype educational auditing computer game taking best practice from the literature study into account, was addressed in Chapter 5.

This chapter provided an overview of how the educational computer game was developed. Best practice principles regarding gameplay (such as game flow, feedback, guidance, usability and skill level) and educational theory (such as motivation, knowledge base structuring, interaction with others and meaningful activity) and content were taken into account during the design of the case study question and memorandum. It was determined that the appropriate knowledge to be included would be all the theory regarding the audit of the inventory balance throughout the audit cycle. Learning outcomes were established accordingly. The teaching plan was drawn up with reference to various textbooks and previous papers and with input from the third-year auditing lecturer at NWU, Prof. Nel. Based on the teaching plan, a case study was written that would lead students to accomplish the learning outcomes of the teaching plan. The case study consisted of a question paper and memorandum. This question paper and memorandum were the teaching aids given to the control group.
The case study was further developed into a storyboard, which could be animated to tell the story behind the case study that would lead the students playing the educational game to accomplish the pre-determined learning outcomes of the teaching plan. This storyboard served as a guideline for which animations and recordings were needed in order to provide enough resources to the programmer to ‘gamify’ the case study. The storyboard also served as a guideline for the programmer to know how to develop the case study into a game. The game was programmed making use of Rad Studio 3 Delphi xe3 software and the animations were animated using Anime Studio Pro 9. The sound clips were recorded using the MAGIX sound mixer software. After initial programming, the game was tested and evaluated. After initial valuation, the game and questionnaire were also subjected to a pilot study. All clichés in the gameplay identified during these two stages of evaluation were communicated to the programmer, animator and voice artists, who reworked the problem areas. The result of these processes was the prototype educational game developed and tested in this study.

7.3.7 SPECIFIC OBJECTIVE 7

Specific objective 7, Test the students’ perceptions of the computer game as a learning tool by developing and administering a questionnaire, was addressed in Chapter 6.

The research methodology was designed to take into account that valid and reliable data had to be gathered in order to be able to interpret the data to gain a reliable and appropriate understanding of the perceptions of third-year auditing students of the use of the educational game developed in this study as a teaching tool. A literature review was conducted in order to gain a broader understanding of the various challenges and criticisms facing auditing lecturers and students of auditing. A computer game was developed with the principle goal of addressing these challenges and criticisms in a new and innovative way. The perceptions of students of this educational game were then tested with a questionnaire and interpreted through statistical analysis. In order to maximise the reliability and validity of the gathered data, the case study comprising the storyline of the game was reviewed by Prof. Nel (CTA lecturer at NWU). The game was also tested by the researcher and pre-tested by a group of test subjects with a similar background as the students who would play the prototype game in order to ensure that no technical difficulties would be experienced and that the educational content of the game makes sense. A control group was included in the study by having half of the participants complete the case study on which the game was built without any computerisation or ‘gamification’. These results were then compared to the results of the experimental group in order to have a benchmark against which to measure the perceptions of the game as
an educational tool. The questionnaire that was developed to measure these perceptions were also pre-tested by a group of test subjects with a similar background to the students who would play the prototype game and evaluated by the Statistical Consultation Services of NWU. All confusing terms/questions that could be interpreted in different ways were identified and eliminated/amended through this process. The principles that were taken into account in order to design the research method include considerations regarding independent and dependent variables, reliable sampling and the use of experiential and control groups.

The research methodology for this study included three phases, namely:

- a literature review;
- the development of the prototype game; and
- an empirical study.

The literature review was conducted in order to gather information on prior research conducted in the following fields of research:

- Challenges facing auditing education
- The theory behind experiential teaching methodologies – how and why they are used as teaching tools
- The potential benefits and challenges associated with implementing experiential teaching methods in tertiary education
- The possibility and theoretical foundations governing the use of computer games as teaching tools
- Considerations when designing and developing educational computer games
- Considerations and notes on effective research design and implementation.

The important principles realised through this research were used to establish the direction of the rest of the study.

The educational prototype game was developed by taking into account important knowledge gained through the literature review. A schedule of factors to take into account when designing the game was drafted in this way and led the way to the development of
the teaching plan and all subsequent versions of the game itself. For a detailed discussion of how the game was developed, refer to chapters 4 and 5.

### 7.3.7.1 Validity and reliability

The validity and reliability of the research design were ensured in a number of ways. This included ensuring the validity and reliability of the questionnaire as measuring tool in a number of ways (refer to sections 6.2.2 and 6.2.3 in Chapter 6). A control group was also included to enhance the reliable interpretation of the data (refer to Section 6.2.3). Cronbach’s alpha (Field, 2009) measured the reliability of the factors included in the factor analysis (refer to Section 6.2.2).

### 7.3.7.2 Developing the questionnaire (refer to sections 6.2.2 and 6.2.4)

The empirical study involved the measurement of perceptions of third-year auditing students of the use of the educational game as a teaching tool. The first step was the development of the questionnaire. This was done by referring back to the literature review, developing expectations of possible perceptions that the students might have when experiencing the educational game for the first time, and then documenting this as questions to be asked to the participants. This questionnaire was reviewed by a senior statistical analyst of the Statistical Consultation Services at NWU in order to ensure its reliability and validity in gathering data. After the first review, improvements were made and a pilot study was planned. The pilot study included five students of a background similar to that of the final participants of the study. The aim of the pilot study was to identify any misleading or inconsistent questions or questions that could have a double meaning in order to ensure that reliable and valid data would be gathered when this questionnaire was given to the final participants to complete. The results of the pilot study were examined and all necessary improvements were made with the aid of the Statistical Consultation Services.

### 7.3.7.3 Ethical considerations (refer to Section 6.2.1)

The final participants of the experiment were the third-year auditing students enrolled at NWU. To obtain permission to ask these students to participate in the study, a rigorous ethics review process had to be completed, after which approval was given by the NWU Ethics Committee. These participants were then asked by the co-supervisor of this study to participate in the study; however, participation was strictly voluntary and 104 students of the total population of 280 participated.
7.3.7.4 **Sampling (refer to Section 6.2.5)**

The total population of students were divided into two groups – the control and the experimental groups. The students were allocated between the two groups by assigning numbers to the students on the class list of total third-year students from top to bottom. All odd numbers were allocated to the control group, while even numbers were allocated to the experiential group. The students on the class list were given the choice to participate in the study or not. The students who decided to participate then checked this class list and either participated in the control group or the experimental group.

7.3.7.5 **Results of the experiment (refer to section 6.3)**

The control experiment involved the students answering the written case study while having lecturers available as facilitators. The students in the experimental group played the computer game. Both environments were controlled through the presence of invigilators. The detailed results of the two experiments and the interpretation of these results have been discussed in Chapter 6 of this study. The most important findings of the study can however be summarised as follows:

7.3.7.5.1 **Results of the experiment: Section A (refer to Section 6.3.1)**

The students in the control and the experimental groups were found to fairly represent each other and the total population of third-year auditing students at NWU (see Section 6.3.11). There were no significant differences between the two groups, except for three variables, which include the following:

- **Age** – The control group consisted mainly of participants aged 20 years, while the rest of the participants were 21; whereas the experimental group consisted mainly of participants aged 21 with the rest of the participants aged 20.
- **Historical year of study** – Both the groups mainly had participants who were in their third year of study. The remainder of the participants in the experimental group were in their fourth year of study, while the remainder of the participants in the control group were spread out between students in their second, fourth and further years of study. This could have had some impact on the results of the study, but overall, the marks reported between the two groups did not differ significantly and the possible effect of this differing characteristic was therefore mitigated.
- **Vacation work experience** – The participants of the control group reported that more than half of them have had some vacation work experience, while the participants of
the experimental group reported that less than half of them had some vacation work experience. The possible impact of this characteristic on the findings of the rest of the study was taken into account.

- Most of the participants reported that they approach auditing examinations and tests by studying the theory by heart. It seems that these students are unable to link the theoretical and practical world of auditing in their minds (see Section 6.3.2.1). It was also confirmed that the participants felt that auditing is a fairly difficult subject to master.

7.3.7.5.2 Results of the experiment: Section B (refer to Section 6.3.2)

- It was confirmed that the students generally felt that auditing is a difficult subject, which they deal with by learning the content by heart.

- The control group felt more confident regarding their understanding of the auditing process than did their experimental peers. This could be attributed to the fact that all participants who reported that they had some form of work experience were included in the control group, or it could be interpreted that the experimental group only realised their gap in understanding when they were confronted with a simulated auditing environment.

7.3.7.5.3 Results of the experiment: Section C (refer to Section 6.3.3)

- The participating students who played the educational computer game, rather than those who completed the written case study, reported that they felt more engaged in the experience and enjoyed it more (see Section 6.3.3.2).

- These students also reported a higher comfort level when interacting with the educational game as did their peers in the control group (see Section 6.3.3.2).

- They also reported their development of practical skills and future workplace application ability as higher than the control group that was required to complete the written case study (see Section 6.3.3.2).

- The control and experimental groups reported to derive an equal amount of educational value and examination preparation from the experience (see Section 6.3.3.2).
7.3.7.5.4 Results of the experiment: Section D (refer to Section 6.3.4)

- The control and experimental groups reported perceiving equal achievement of learning outcomes. This is consistent with their answers in Section C, which reports that they perceived the two teaching aids to be of equal educational value.

7.3.7.5.5 Results of the experiment: Section E (refer to Section 6.3.5)

- The experimental group was asked a series of questions relating to the design of the game. They did not respond negatively to any of the design features and responded positively to enjoying the animations and tutorials integrated in the game, which indicate that overall, the game was regarded as being well designed.

The primary objective of this study was to evaluate whether the learning and lecturing difficulties experienced by auditing students and lecturers can be addressed effectively by the integration of an educational auditing information technology-based game into the lecturing of chartered accountancy students in their third year of theoretical studies. There is sufficient evidence in prior research to substantiate that experiential teaching methods can and have been used successfully to do this. Some research suggests that educational games have been used to this effect in other areas of tertiary education.

However, this was the first study of its kind to use this type of educational game as a teaching tool in auditing education and it does seem that the game was moderately successful in achieving its purpose. The results of this study show that the prototype game developed as part of this study has the potential to be successfully employed as a teaching tool in undergraduate auditing education and that it, while educating, also introduces engagement and joy to the learning experience, making the educational experience well rounded and introducing factors of motivation into the students’ educational experience.

This study therefore contributes to the research in the following ways:

- A new case study as a teaching tool in auditing education was developed (see Appendix A).
- A prototype educational game (the first of its kind) with a guided experiential pedagogical foundation was developed to be used as a teaching tool in auditing education (see Appendix E).
• A questionnaire that tests the perceptions of students regarding the case study and educational game as educational tools in auditing education was developed (see Appendices C and D).

• A questionnaire that assesses the success of a specific educational game design was developed (see Appendix D, Section E).

• Perceptions regarding using an educational game as a teaching aid in auditing education were measured and it was found that this is a viable method of teaching auditing. Not only did the participants who played the game report deriving the same educational value from it as did the participants who completed the case study question, but they also reported the experience being more engaging and joyful, which in itself provides valuable learning opportunities and benefits.

• A number of viable areas for future research were highlighted.

7.3.8 Limitations of the study

There were some limitations placed on this study that need to be taken into account along with the results of the study. One of the main constraints was the budget available for the research. The ideal would have been to have the game programmed by professional programmers using C++ or Java programming and utilising cutting-edge technology to give life to the animations; however, this was not possible due to budget constraints. Instead, the educational game was programmed by amateur programmers using Rad Studio 3 Delphi xe3 software and Anime Studio Pro animation software.

Another limitation of the study was the fact that the test was only performed at one university on one year group of students. Results that are more meaningful might have been achieved if the population was broadened to include students from other year groups and universities.

7.3.9 Areas for further research

The following areas for possible future research have been identified throughout the progression of this study:

• Ways to improve the educational game in order to cover different aspects of the auditing module, or even CTA level auditing or other areas of education within the chartered accountancy syllabus
• Examining of the design of the computer game to identify areas for improvement of the educational game
• How students measure whether they have learnt problem-solving skills or not
• How to determine the level of difficulty at which the game should be set
• Integration of social aspects into the game design and the effect on educational value
• Different ways of providing access to educational games and the impact on educational value
• The language in which educational games should be made available and the impact on educational value
• How to illustrate to students how experiential learning might improve their marks
• Determining whether students who play the game actually achieve better results in tests
• Determining whether students who play the game actually perform better in a work environment
• How to choose a storyline that is emotionally appealing to students of auditing in their third year
• The impact on educational value when the game is made available to students to study in their own time
• Comparing the perceived usefulness of this educational game to the perceived usefulness of other known educational aids
• Research on the design principle of fantasy versus authenticity, in other words, how much fantasy versus authenticity should be included in an educational game in order to achieve the optimal mix of engagement and educational value.

7.3.10 Conclusion

This study attempted to explore whether an educational computer game can be successfully developed and utilised to address the specific challenges, problems and criticisms regarding traditional accounting education. The perceptions of students of the usefulness of this computer game as a teaching aid in auditing education were tested.
The main findings were that the educational game provided equal educational value as the case study method (an experiential method that has been tried and tested and explored by previous researchers in accounting and auditing education). The educational game also introduced a higher amount of joy and engagement than did the case study method. One design feature of the game that the students were very positive about was the use of integrated tutorials with animated content. This study therefore contributes to the research community by providing an educational computer game, grounded in the pedagogical foundation of guided experiential learning, to be used in teaching auditing education. The literature review in this study did not reveal that this has ever been researched or attempted before in South Africa. It also contributes by providing empirical evidence that this method holds the promise of added educational value as well as a way of addressing the various challenges facing auditing education through added motivation, joy, engagement and visualisation.