

CHAPTER 6

RESEARCH METHODOLOGY AND RESULTS

6.1 INTRODUCTION

In the previous chapter, the process that was followed to design and develop the prototype educational game was discussed. The next step in the research process was the evaluation of this prototype educational game in order to find out how the target research participants would react towards and perceive this game as an educational aid. The research method and design that were followed in order to gather these data are discussed in this chapter.

Thereafter, the interpretation of the frequency analysis (percentages) and descriptive statistics (mean and standard deviation) is reported and discussed per statement as part of the interpretation of the results of each section. This addresses Specific objective 7: Test the students' perceptions of the computer game as a learning tool by developing and administering a questionnaire (see Section 1.5.2 in Chapter 1).

6.2 SOCIAL EXPERIENTIAL RESEARCH DESIGN

This research, as mentioned in Chapter 1, consisted of three phases, namely a literature review (covered in chapters 1 to 4), development of the prototype game (covered in Chapter 5) and an empirical study. The way in which the empirical study was designed and performed is discussed in this chapter.

The research method used in this study to measure the perceptions and reactions of third-year auditing students regarding the prototype educational game was designed around the following key concepts:

- Independent and dependent variables
- Sampling
- Experiential and control groups.

The application of each of these concepts is discussed below.

6.2.1 Ethical considerations

As this study involved participants who are students of NWU, ethical requirements had to be adhered to and specific ethics approval had to be obtained. This entailed that the total population of the AUDT 371 group was informed beforehand and during the session that participation in this study was completely voluntary. The day of the experiment also had to be planned in such a way that no student would be unfairly disadvantaged. Therefore, it was decided that both groups (the control and experimental groups) would have a chance to complete the case study and to play the game. The class period (which normally lasts two hours) was therefore divided into two sessions. During the first session, the control group completed the case study in their usual classroom with assistance from supervisor Prof. Nel and two other supervisors, while the experimental group played the computer game in two NWU computer rooms booked for the purpose, assisted by supervisor Prof. Fouché, the researcher and three other supervisors who were involved in the making of the game. After the first session, all participants recorded their perceptions by way of answering the questionnaire developed specifically for this purpose. During the second session, the two groups switched so that the experimental group had the chance to complete the case study, while the control group played the game. No data were gathered after the second session, as this session was arranged purely to ensure that all students receive equal treatment. The above planned proceedings were recorded and submitted to the Ethics Committee of NWU and ethics approval was obtained by way of the issue of an ethics approval certificate on 14 February 2013.

6.2.2 Validity

In order to ensure that the data gathered in this experiment were valid, the tools that would be used to gather this data had to be valid; in other words, the questionnaire had to measure what it was supposed to measure.

Bless and Higson-Smith (1995) advocate that the following criteria relating to validity should be satisfied in order to achieve a questionnaire that gathers data that are valid: content validity, construct validity and face validity.

6.2.2.1 Content validity

This form of validity refers to the questions included in the questionnaire and whether they are accurate, relevant and lucid. The accuracy, relevance and lucidity of questions can be tested through a pilot investigation of the questionnaire (Bless & Higson-Smith, 1995). The

pilot investigation of the questionnaire was undertaken by having nine academic clerks of NWU play the game and then complete the questionnaire. Their answers and feedback were analysed by the researcher and the supervisor (Prof. Fouché), and with the help of the NWU Statistical Consultation Services, a final questionnaire that included only accurate, relevant and lucid questions, were agreed upon.

6.2.2.2 Construct validity

This form of validity focuses on whether the questionnaire uncovers the information that it was designed to uncover (Bless & Higson-Smith, 1995). In the case of this study, the object of the study was to measure the perceptions of students regarding the use of an educational computer game as a teaching aid in auditing education in order to determine the value of this type of teaching aid. The literature review in chapters 1 to 4 has served to:

- define the challenges, problems and criticisms regarding traditional auditing education;
- highlight the various advantages and disadvantages of different experiential learning strategies;
- reveal how these strategies have been used to combat the above challenges, problems and criticisms regarding traditional accounting and auditing education; and
- explored the types of games that might be used, the objectives of said game as well as specific design considerations to take into account advocated by previous researchers.

This means that in order to determine the perceived value of the educational game as a teaching aid, the questionnaire had to be designed to uncover the following information:

- Background information – to determine any significant difference between the sample of participants participating in the control group versus the sample of participants participating in the experimental group (refer to Section A of the questionnaire)
- Perceptions regarding auditing education – to confirm whether these participants agree with any of the challenges, problems and criticisms of traditional auditing education, as discussed in Chapter 1; in other words, whether these participants

agree that they dislike the subject / need additional help, etc. (refer to Section B of the questionnaire)

- Perceptions regarding the case study and educational game as a teaching tool – to measure student perceptions about whether the previously researched advantages/disadvantages of this experiential teaching aid, as highlighted in chapters 2, 3 and 4, were experienced and whether the goals of the educational game as set out in Section 4.3 in Chapter 4 were achieved (refer to Section C of the questionnaire)
- Self-assessment in terms of learning outcomes achievement – to measure whether the students perceived that they had achieved the learning outcomes as set out in Section 5.2.1 of Chapter 5 and in effect to measure the perceived effectiveness of both the case study and the computer game as a teaching aid (refer to Section D of the questionnaire)
- Perceptions regarding the computer game design – to measure the success of the specific design considerations that had to be taken into account when designing the educational game, as set out in Section 4.4 of Chapter 4 (refer to Section E of the questionnaire).

The above-mentioned sections of the questionnaire are discussed in more detail in Section 6.2.4 and the full questionnaires for the control group and experimental group respectively are separately attached as appendices C and D.

A factor analysis was used to identify the structure and factors of Section C and in essence define which questions belong together due to the fact that it measures the same factor. Through this process, the structural validity of the survey was also determined (Pietersen & Maree, 2007). For more information on the performance and interpretation of the factor analysis, refer to Section 6.3.3.1.

6.2.2.3 Face validity

This form of validity concerns itself with how the participants perceive the questionnaire. The questionnaire should not seem to be too difficult, simple, boring, etc. (Bless & Higson-Smith, 1995). The face validity of the questionnaire was evaluated by asking the participants in the pilot study to give their feedback on whether the questions are clear and understandable, not too difficult or simplistic and to give any other valid feedback. No negative comments regarding the questionnaire were received.

6.2.3 Reliability

Reliability refers to the accuracy and consistency of measures (Pietersen & Maree, 2007). In this study, the internal consistency reliability of the factors obtained from the factor analysis was explored.

Cronbach's alpha coefficients were calculated for each factor in order to determine the reliability of the factors. The Cronbach's alpha should preferably be above 0.7 (Field, 2009); however, Cortina (1993, as cited in Field, 2009, p. 675) states that the Cronbach's alpha is to a large extent dependent on the number of statements in the factor, and the larger the number of statements, the larger the possibility that the Cronbach's alpha will be higher. It is therefore possible to get a large Cronbach's alpha due to a considerable number of statements and not because the factor is reliable and, conversely, a smaller number of statements might lead to a lower Cronbach's alpha (Field, 2009).

6.2.4 Independent and dependent variables

This study focused on exploring the perceptions and reactions of students regarding the prototype educational game as an educational aid in auditing education. Therefore, the independent variables are the biographical data and grouping and the dependent variable is the students' perceptions and reactions regarding the educational aid.

This means that the participants had to be isolated in order to get them in a situation where they could concentrate only on the educational game (intervention) so that the reactions and perceptions measured from them after interaction with the game would be purely created by the interactions with the game. Therefore, it was decided that the experiment would be conducted in a secure computer room. Each participant had access to his/her own computer, which in turn provided exclusive access to the prototype computer game. The participants were asked to bring their own earphones, which resulted in isolated student interactions with the sounds and graphics that make up the environment of the game. The supervisors were asked to be present in order to ensure that the experiment would progress without interruptions so that the participants could focus their attention solely on interacting with the game.

6.2.5 Sampling

The total population of participants who were asked to participate in this experiment consisted of 280 third-year students at NWU. In order to divide this population between

the experiential and design group, it was decided to utilise the principles of random systematic sampling, which would most likely result in two groups of equal numbering that fairly represent the population as a whole. The class list (alphabetically sorted) was therefore obtained and the students were assigned numbers from top to bottom. The odd numbers were allocated to the control group, while the even numbers were allocated to the experiential group.

This sampling process was reviewed by a statistical expert, Dr Ellis, which ensured maximum reliability and validity of the experiment.

6.2.6 Experiential and control group

In order to further ensure the validity and reliability of the data gathered in this experiment, the research methodology was designed to utilise the principles of experimental and control groups. According to Babbie (2012, p. 241), the definition of a control group is “a group of subjects to whom no experimental stimulus is administered and who resemble the experimental group in all other respects”. The chosen participants of the study (the group of third-year auditing students) were therefore assigned to either the control or experimental group through a process of random allocation. Section A was included in the questionnaire to establish whether the experimental group and control groups resembled each other in all respects other than what was being tested through the experiment (see Section 6.2.7).

“Using a control group allows the researcher to detect any effects of the experiment itself” (Babbie, 2012, p. 241). This suggests that it would not be sufficient to examine only an experimental group, but that it would be valuable to observe a control group that does not receive the experimental stimulus.

The participants in the experimental group were therefore assigned to the computer rooms (as described under Section 6.1) and the control group was assigned to a separate lecturing room. The control group received the case study on which the development of the educational game was based (see Appendix A), but did not engage in any gaming action. They were required to complete this case study, while having access to help from the lecturer and other academic staff. After completion of the question, they received the memorandum and graded each other.

“The comparison of the control group and the experimental group at the end of the experiment points to the effect of the experimental stimulus” (Babbie, 2012, p. 241). The effect of this exercise was that they interacted with exactly the same educational material

as the experimental group and went through exactly the same processes (were introduced to the scenario, were required to apply their knowledge, received extra help with the educational material if needed and were graded). The only variable that they therefore were not exposed to was the gaming experience itself. In this way, the independent variable was the only difference in the experience of the two groups.

6.2.7 Questionnaire

The questionnaire aimed to establish the basic background information of the participants in the study. The background of the participants might influence the way the different participants respond to the subsequent questions and would therefore influence the interpretation of the results.

The questions dealt with gathering information in order to measure the following perceptions and reactions of the groups (in other words, how the participants felt about the experiences):

- Educational impact
- Motivational impact
- Joy factor
- Basic understanding and background of their studies.

The questionnaire given to the experimental group also included an extra section on the gameplay experience itself. This data could be used in order to identify future areas of improvements to the game itself or to identify factors that had an influence on the participants' answers to the questions and could be used to further explain the data that were gathered from them.

The first questionnaire design attempt was overviewed by and discussed with the Statistical Consultation Services of NWU. All recommended improvements were made in order to ensure that the questionnaire was a valid and reliable instrument for gathering the required information. Thereafter, the questionnaire was pre-tested in order to observe how participants of the pre-test reacted to it. The pre-test would serve to point out any further points of improvement needed before the questionnaire could be used in the actual experiment. The pre-test involved asking a group of six academic clerks at NWU to play the educational game and then complete the questionnaire. The circumstances under

which the pre-test occurred were similar to the circumstances of the actual experiment. The participants of the pre-test were also asked to write down at the back of the questionnaire any recommendation or points of further improvement regarding the game or the questionnaire and to mark any questions that were confusing or could be interpreted in different ways. The results of this test were considered and discussed with the NWU Statistical Consultation Services. Further improvements were made based on the results of the pre-test. (See Appendices C and D for a copy of both the questionnaires given to the control group and the experimental group.)

6.2.7.1 *Background of the participants*

These questions were included in order to provide additional information to the interpreter of the data. For example, a question about the participant's academic progress in auditing prior to the experience was included, so that some distinction might be made to find out whether students with different levels of commitment experienced the experiment differently.

6.2.7.2 *Educational impact*

The questionnaire included questions that would indicate how the students felt about the experience as being beneficial or not to their studies; for example Question 28, under Section C, states "The case study / educational game helped me to visualise the auditing process" and asked the participants to indicate how they feel about this statement on a Likert scale of 1 to 5. The answers to these questions would indicate whether the participants regarded the experience as adding value to their learning experience at the university.

6.2.7.3 *Motivational impact*

The questions included under this section measured whether the participants felt that the experience had in any way added value to their studies by changing their perceptions about the subject, the background of the subject or their studies; for example Question 36, under Section C, asked the participants to indicate, on a Likert scale of 1 to 5, how they feel regarding the following statement: "Competition motivates me". The answers would indicate whether the experience was extrinsically motivating or not.

6.2.7.4 Joy factor

The questions in this section were included to measure whether or not the experience was particularly straining on the students, for example Question 34, under Section C, asked the students to indicate on a Likert scale of 1 to 5 how they feel about the statement: "This was an enjoyable activity". The answers would indicate whether the experience could add value to their studies by not being as draining as the traditional way of learning.

6.2.7.5 Basic understanding

The questions in this section were included in order to measure whether or not the experience added value to the participants' studies by helping them form a better understanding of what they are studying towards and what the eventual goal of their studies is. An example of these questions is Question 25, which asked the participants to indicate how they feel about the statement: "The case study / educational game helped me understand the role of the auditor in the audit firm". The answers would indicate whether or not the experience increased their basic understanding of the goal that their studies are leading them to.

6.3 REPORTING AND INTERPRETING THE RESULTS

The previous paragraphs discussed in detail the research design of the experiment as well as the design of the questionnaire used to gather the necessary data to interpret the students' perceptions regarding the use of an educational game in the teaching/learning of auditing.

The purpose of the following paragraphs is to discuss and interpret the data collected in this manner. This will be done by firstly analysing the descriptive statistics and frequency analysis and secondly performing and interpreting the results of a factor analysis performed on the data. The results of the control versus the experimental group are compared throughout the interpretation. The total number of students that participated in the final experiment was 104. Of these students, 52 participated in the experimental group and the other 52 students participated in the control group, being 50% of the population.

The statistical analysis for this survey was performed by the Statistical Consultation Services of NWU using the Statistical Package for the Social Sciences (IBM SPSS Statistics 20). Statistical significance was determined at a 50% level,

6.3.1 Descriptive statistics: Answers to Section A of the questionnaire – Background information

Section A of the questionnaire contained questions to establish the background information of the participants. If there were differences between the backgrounds of the experimental and control group, this could possibly have influenced the other answers obtained from them and could have been used to explain possible fluctuations in answers. The results of this section are listed in the tables below.

Table A.1: Gender

Question	Possible answers	Case %	Game %	Total %	Chi-square prob.
What is your gender?	1. Male	48.08	36.54	42.31	0.2337
	2. Female	51.92	63.46	57.69	

There was no statistical difference in the gender composition of the two different groups.

Table A.2: Age

Question	Possible answers	Case %	Game %	Total %	Chi-square prob.
What is your age?	1. 19	0.00	3.85	1.92	0.0175*
	2. 20	53.85	36.54	45.19	
	3. 21	34.62	57.69	46.15	
	4. 22	5.77	0.00	2.88	
	5. 23	5.77	0.00	2.88	
	6. Older than 23	0.00	1.92	0.96	

The control group (students that completed the case study) consisted mainly of participants aged 20 years old, while the rest of the participants were 21 years old. The

experimental group (students who played the game) consisted mainly of participants aged 21, with the rest of the participants aged 20.

The chi-square of 0.0175 (less than 0.05) indicates a significant difference between the two groups. However, if viewed in perspective, this characteristic of the control group being aged slightly younger than the experimental group should not have an effect on the overall picture. The significant difference is mainly caused by the difference in distribution of participants between the ages of 20 and 21. Therefore, this is in fact not a significant difference in age between the two groups, as it is just a matter of having been born earlier or later during the same year.

Table A.3: Historical year of study

Question	Possible answers	Case %	Game %	Total %	Chi-square prob.
What is your current historical year of study?	1. Second year	9.62	1.92	5.77	0.0471*
	2. Third year	78.85	76.92	77.88	
	3. Fourth year	7.69	21.15	14.42	
	4. More than four years	3.85	0.00	1.92	

Both the groups mainly (about 70%) had participants who are in their third year of study (in other words, who have not failed any of the previous audit modules). The remainder of the participants in the experimental group were in their fourth year of study (in other words, have probably failed at least one of their previous modules). The remainder of the participants in the control group were spread out between students in their second, fourth or more than four years of study (in other words, included participants who have probably failed at least one or more of their previous modules as well as students who had a year of their studies exempted for some reason).

The chi-square for this statement is 0.0471, which is less than 0.05 and therefore significant.

This could have had some impact on the way the different groups answered the questions overall and had to be taken into account when interpreting the perceptions of the different groups in the rest of the study.

Table A.4: Qualification

Question	Possible answers	Case %	Game %	Total %	Chi-square prob.
What current qualification are you enrolled for?	1. BCom (CA)	84.62	88.46	86.54	0.4978
	2. BHons (CA)	1.92	00.0	0.96	
	3. Other	13.46	11.54	12.5	

The majority of the students taking third-year auditing as a class at NWU indicated that they were enrolled for their bachelor's degree in chartered accountancy, which was as expected.

Table A.5: Module

Question	Possible answers	Case %	Game %	Total %	Chi-square prob.
Which of these modules are you currently enrolled for?	1. AUDT 371 (third-year auditing)	94.23	88.00	91.18	0.1091
	2. RECP 672 (honours-level auditing)	0.00	0.00	0.00	
	3. Both AUDT 371 (third-year auditing) and AUDT 211 (second-year auditing, first semester)	5.77	4.00	4.90	
	4. Both AUDT 371 (third-year auditing) and RECP 672* (honours-level auditing)	0.00	8.00	3.92	

*This would be possible if a student had only failed Auditing out of all the third-year subjects or transferred from another university and still needed to complete only third-year Auditing before being eligible for honours-level studies and obtained special permission in order to take both subjects.

The majority of the students taking third-year auditing as a class at NWU indicated that they were enrolled for only one auditing course, which was as expected.

Table A.6: Home language

Question	Possible answers	Case %	Game %	Total %	Chi-square prob.
What is your home language?	1. Afrikaans	92.31	92.31	92.31	0.7659
	2. English	3.85	5.77	4.81	
	3. Other	3.85	1.92	2.88	

The majority of the third-year auditing students at NWU were Afrikaans-speaking. This could be expected, as NWU caters mainly for Afrikaans tuition. This Afrikaans background of the students might have affected their perceptions and reactions regarding the game and case study, which were both designed and presented in English; however, as the distribution of Afrikaans and English students per the different groups are more or less the same, this did not affect the comparability of the results and therefore did not affect the reliability and validity of the data gathered in this experiment. The language in which the game was made available for play is, however, an issue requiring further research in future.

Table A.7: Occupation

Question	Possible answers	Case %	Game %	Total %	Chi-square prob.
What is your occupation?	1. Full-time student	100.00	98.08	99.04	0.315
	2. Other	0.00	1.92	0.96	

The majority of the participants of both groups reported being full-time students. This is as expected and links back to the challenges relating to the way chartered accountancy education is currently structured in South Africa (as discussed in Chapter 1). The argument is that, because students start off with four years of theoretical study, only after which they are required to obtain practical experience, they do not have an established frame of reference in which to contextualise the theory of their studies during these first four years of training.

Table A.8: Marks

Question	Possible answers	Case %	Game %	Total %	Chi-square prob.
Which range of marks most accurately depicts your marks for auditing?	1. 0–39%	1.92	1.92	1.92	0.9643
	2. 40–49%	7.69	7.69	7.69	
	3. 50–59%	34.62	40.38	37.50	
	4. 60–74%	42.31	40.38	41.35	
	5. 75–100%	13.46	9.62	11.54	

The majority of the participants of both groups reported that their marks for auditing usually fall between the thresholds of 50 and 74%. This indicates that students are passing, but not achieving distinctions. It has to be taken into account that these marks relate to marks achieved during their second year and the first quarter of their third year of studies. At this stage (when auditing is only introduced to the students), the level of

understanding of the theory demanded in tests and examinations is not as high as the level of understanding demanded at (for example) CTA level, yet the principles taught during these lower-level courses are crucial to them developing the skills and level of knowledge required at CTA level.

Table A.9: Vacation work experience

Question	Possible answers	Case %	Game %	Total %	Chi-square prob.
Have you done any vacation work at an auditing firm?	1. Yes	55.77	34.62	45.19	0.0302*
	2. No	44.23	65.38	54.81	

The majority of the students reported that they had no vacation work experience. This again confirmed that one of the challenges relating to the way chartered accountancy education is currently structured in South Africa is the lack of contextualisation of the theory, because students have no way of establishing a frame of reference. This is consistent with the literature review, as discussed in Chapter 1.

The chi-square for Statement 9 is 0.0302, which is less than 0.05 and therefore significant. This is because, of the participants who reported that they had done some vacation work, the majority formed part of the control group who completed the written case study. The effect of this might be that these students understand auditing better within a practical frame of reference.

Table A.10: Full-time work experience

Question	Possible answers	Case %	Game %	Total %	Chi-square prob.
Have you worked as a full-time article clerk?	1. Yes	0.00	3.85	1.92	0.2447
	2. No	100.00	96.15	98.08	

The majority of the students reported that they have no full-time work experience, which links to the confirmation of the lack of contextualisation of the theory due to the absence of a frame of reference, as already discussed.

There was no significant statistical difference between the two groups in this regard.

The three questions below were interpreted to establish whether the fact that some students stated that they had work experience had a significant effect on the way the two groups responded to the rest of the questionnaire.

Table A.11: Perceived effect of work experience on studies

Question	Possible answers	Case %	Game %	Total %	Chi-square prob.
Indicate how you feel about the following statements:					
My work experience in the auditing sector has helped me to better understand the concepts of auditing.	1. Strongly disagree	0.00	4.17	2.02	0.1251
	2. Disagree	0.00	8.33	4.04	
	3. Neutral	41.18	45.83	43.43	
	4. Agree	29.41	18.75	24.24	
	5. Strongly agree	5.88	2.08	4.04	
	6. Not applicable	23.53	20.83	22.22	
I am better able to visualise the auditing process because of my work experience.	1. Strongly disagree	0.00	4.17	2.02	0.0632
	2. Disagree	0.00	4.17	2.02	
	3. Neutral	19.61	35.42	27.27	
	4. Agree	27.45	20.83	24.24	
	5. Strongly agree	19.61	6.25	13.13	
	6. Not applicable	33.33	29.17	31.31	

Question	Possible answers	Case %	Game %	Total %	Chi-square prob.
My work experience helps me to achieve higher marks in auditing.	1. Strongly disagree	0.00	4.17	2.02	0.7195
	2. Disagree	3.92	6.25	5.05	
	3. Neutral	35.29	35.42	35.35	
	4. Agree	21.57	22.92	22.22	
	5. Strongly agree	5.88	4.17	5.05	
	6. Not applicable	33.33	27.08	30.30	

These questions indicate that all the participants who had some form of work experience felt neutral to mildly positive about the effect that this has had on their studies. In general, the students felt that work experience could aid in developing a better understanding of auditing principles and theory, help in achieving higher marks and help them to visualise the auditing process. There was no significant difference between the answers of the control and the experimental groups. This response, if considered together with the responses to statements 9 and 10, indicates that the participants of the control group might have had a better understanding of how the theory of auditing leads back to the real work environment; however, as only about a fifth of the students felt that this was the case, the effect of this could be mitigated. Therefore, this does not constitute a significant difference between the control and experimental group.

Table A.12: Reason for chosen Profession

Question	Possible answers	Case %	Game %	Total %	Chi-square prob.
Please choose the most applicable answer to complete the following sentence: I decided to study chartered accountancy because ...	1. Of the money	5.77	5.77	5.77	0.2597
	2. I love accounting	34.62	19.23	26.92	
	3. I am good at accounting	7.69	17.31	12.5	
	4. It opens up a lot of work opportunities	51.92	57.69	53.85	

As the chi-square is more than 0.05, this difference is not significant. The answers to the above question reflect that the majority of the participants decided to study chartered accountancy because of the work opportunities available in this chosen career path. This confirms what was revealed by the literature review in Chapter 1, namely that students of chartered accountancy tend to study this course not because of some inherent love of the subject, but because of the extrinsic rewards related to the career. This poses a challenge to auditing education, as it eliminates the self-motivation that goes along with studying something you love and therefore indicates that an educational method that would re-introduce some motivation factors to these students (such as those researched in this study) might be appropriate.

6.3.1.1 Conclusion on answers to Section A of the questionnaire

The background information data show that the control group and experimental group basically had the same characteristics and represent each other as well as the population fairly. The chi-square test was used in order to establish whether there are significant differences between the two groups. If the probability factor of the chi-square test is less than 0.05, it means that there are significant differences between the two groups (Babbie, 2007). This was only true for three of the questions, which indicate that the control group and experimental groups represent each other fairly, except for three differing characteristics. These are discussed below.

6.3.1.1.1 Corresponding characteristics of the participants

According to the data gathered, the population can be described as being predominantly female and enrolled in the BCom (CA) qualification and AUDT 371 (Auditing at third-year level) subject. Almost all of the participants were Afrikaans-speaking (noteworthy, as the game and case were designed in English only, which may have influenced the users' experience of the game). The majority of participants were full-time students who achieved marks between 50 and 74% for the subject of Auditing. Only 7.69% of the participants indicated they were failing Auditing, while 11.54% reported that they were achieving distinctions in this subject.

When asked whether they feel that work experience could help them understand the auditing concepts, visualise the content and achieve higher marks, most participants either agreed or felt neutral about the statement. It has to be noted that nearly a third of the participants replied that this statement was not applicable to them. When taking into account that more than half of the group have never done any vacation work in the auditing sector and that nearly none of them have ever worked in the sector full time, this could indicate that even if work experience could help them in the above prescribed ways, they would not have known this, as they have not had the experience. This is consistent with the literature review in Chapter 2, which highlights that one of the main shortcomings of the way the chartered accountancy qualification programme is currently structured is the fact that all theoretical knowledge is deemed to be obtained during the first four years of study, only after which the prospective chartered accountants are introduced to the work they actually need to do from day to day and the world in which they need to learn to function.

The participants' response to Question 23 ("I decided to study chartered accountancy because ...") supported what was found in the literature review, namely that students do not study chartered accountancy because of some inherent love of accounting, but because of the inherent perks linked to the profession, such as multiple work opportunities, a good salary and so forth, and this obviously influenced their approach towards studying for the subjects included in the syllabus.

6.3.1.1.2 Diverse characteristics of the participants

The control group and experimental group differed significantly from each other in terms of the following three characteristics:

- a) Age
- b) Historical year of study
- c) Vacation work experience.

a) Age

The control group (students that completed the case study) consisted mainly of participants aged 20 years old, while the rest of the participants were 21 years old. The experimental group (students who played the game) consisted mainly of participants aged 21, with the rest of the participants aged 20.

This characteristic of the control group being aged slightly younger than the experimental group should not have had an effect on the overall picture that the data present, as it is just a matter of having been born earlier or later during the same year.

b) Historical year of study

Although both the control and experimental group consisted largely of participants who are in their third year of study, there was a significant difference in the historical year of study of the remaining participants. While the remainder of the participants in the experimental group were in their fourth historical year of study, the remainder of the participants in the control group were spread out between students in their second, fourth or more than four years of study.

This significant difference could have had an impact on the way the different groups answered the questions. However, it is argued that, since these same students mostly reported that their current marks for auditing are between 50 and 74%, the students (regardless of which historical year they are) are probably on the same academic level, and therefore the influence of this differing characteristic could be negated.

c) **Vacation work experience**

The participants of the control group (case study) reported that more than half of them have had some vacation work experience, while the participants of the experimental group (game) reported that less than half of them have had some vacation work experience.

This could well have an impact on the way the groups perceive the concepts and environment of the auditing subject. It could also have an impact on the way in which they perceive the case study or game. A student who has worked before will most probably react differently to a case study or game that simulates this work reality than a student who have not experienced this reality before. This is a material difference between the two groups and had to be taken into account during the interpretation of the responses of the two groups to the rest of the questionnaire.

6.3.2 Descriptive statistics: Answers to Section B of the questionnaire – Perceptions regarding auditing education

Section B of the questionnaire contained questions to establish what the general perceptions of third-year chartered accountancy students were of auditing education. The results of the t-tests on data obtained for the experimental and control groups are summarised in the tables below.

Table B.1: Understanding the role of the auditor in public practice

Question	Mean game	Mean case	Std dev. game	Std dev. case	P
I understand the role of the auditor in public practice.	4.000000	4.211538	0.740959	0.935918	0.204193

The participants of both the control and the experimental groups felt positive that they understand the role of the auditor in public practice.

Table B.2: Understanding of the work environment

Question	Mean game	Mean case	Std dev. game	Std dev. case	P
I can picture the work environment in which I will one day be working.	3.884615	3.865385	0.832050	1.029541	0.916771

The participants of both groups felt more positive than neutral regarding being able to picture the environment in which they will be working one day.

Table B.3: Understanding of the auditing process

Question	Mean game	Mean case	Std dev. game	Std dev. case	P
I understand the auditing process.	3.596154	3.903846	0.773574	0.721100	0.038370*
Question	Mean game	Mean case	Std dev. game	Std dev. case	P
I understand how the different concepts in auditing link together to form the auditing process.	3.634615	3.942308	0.741722	0.669019	0.028540*

The students in the control group felt significantly more confident about their understanding of the auditing process than the students of the experimental group. Both groups, however, started off with the same level of education concerning the auditing principles taught during the sessions. As these questions were completed after the game was played (or the case study written), it could be that the students were actually made aware of the gap in their education up to this point. However, this could only be confirmed by future research through a pre- and post-test experiment.

Table B.4: Assessment of the difficulty of the subject

Question	Mean game	Mean case	Std dev. game	Std dev. case	P
Generally I feel that auditing is a difficult subject.	3.673077	3.865385	0.943942	0.950312	0.302970

Both groups of participants feel slightly more positive than neutral that auditing is a difficult subject.

Table B.5: Interest in the subject

Question	Mean game	Mean case	Std dev. game	Std dev. case	P
Generally I feel that auditing is a boring subject.	3.173077	3.480769	1.132776	1.128775	0.168320

Both groups felt more or less neutral about auditing being a boring subject; however, it is interesting to note that, although this is not a significant difference, the participants of the control group did feel slightly more positive about auditing being a boring subject.

Table B.6: Assessment of the workload of the course

Question	Mean game	Mean case	Std dev. game	Std dev. case	P
I feel the chartered accountancy course has a substantial course load compared to other courses.	3.980392	4.038462	0.989751	1.154047	0.784735

All participants indicated that they felt that the chartered accountancy course has a substantial course load compared to other courses. This is as expected in terms of the literature review and is a significant challenge facing auditing students and lecturers (see Chapter 1).

Table B.7: Learning approach preference

Question	Mean game	Mean case	Std dev. game	Std dev. case	P
When I am studying auditing for a test, I focus on learning theory by heart.	3.826923	3.865385	0.856833	0.950312	0.828832

The participants also confirmed another challenge associated with auditing education (see Chapter 1), which relates to the learning approach of the students. This confirms that students of auditing tend to approach examinations and tests by studying the theory by heart. The reason might be that because the students have no frame of reference to relate the theory to (see Chapter 1), learning the theory by heart seems to them the easiest or possibly the only approach to their studies of auditing.

Table B.8: Perception of lectures

Question	Mean game	Mean case	Std dev. game	Std dev. case	P
Too much lecturing is done during auditing classes.	3.076923	2.942308	0.925587	0.751820	0.417509

The participants felt neutral regarding whether too much lecturing was done during auditing classes. According to the literature review (see Chapter 1), this is one of the challenges facing auditing education; however, it is possible that the students who participated in this study were not fully aware of all alternative teaching methods and therefore would not know that too much lecturing is done during classes. This could be the reason for participants responding to this statement in a neutral sense.

6.3.2.1 Conclusion on answers to Section B of the questionnaire

It seems that the participants' general feeling regarding the subject of auditing was that it is a fairly difficult subject that they deal with by learning the theory by heart. In contrast to this, the overall feeling of the participants was that they understand what an auditor does, can picture the work environment, and understand the auditing process and how the

different concepts link together to form the auditing process. The question is then, as interpreted by the researcher: If these students feel that they understand the logic behind the subject, why is it then necessary for them to study the theory by heart? This data indicate that there could be a gap in the students' minds between understanding the logic of the subject and applying this logic to comprehend the concepts taught in theory. Students therefore seem to be able to think logically about the subject, but are unable to link this logic to the theory that they are taught in class. This notion is consistent with what was found in the literature review in Chapter 2.

The participants in both groups feel neutral about whether auditing is a boring subject and whether too much lecturing is done in the process of getting the concepts across to the students. This could possibly indicate that the participants do not particularly enjoy the lectures on auditing, but (coming from a background where knowledge is traditionally transferred via lectures) are unable to comprehend any alternative.

The p-value indicates that there were only two questions for which there were any meaningful differences between the answers of the control and experimental groups. Both these questions (16 and 19) attempt to explore the perceptions of the participants regarding their understanding of the auditing process and how the different auditing concepts link together to form this process. For both questions, the control group felt slightly more positive about their understanding of above-mentioned process. When taken at face value, this data suggest that the case study better re-enforced the concept of the auditing process than did the educational game; however, it could also be that the participants who played the educational game were challenged more to move away from memorising theory and towards thinking critically and logically about the concepts in such a way that they actually realised that there was more to the auditing process than what they had been reading about in books and told about in class. This would then explain why they rated their knowledge level in terms of this concept lower than did their peers who were not similarly challenged. However, it could also be that, as the participants of the control group reported having more practical experience in the form of vacation work, they understand the concepts and processes of auditing better than do the participants of the experimental group.

6.3.3 Descriptive statistics and frequency analysis: Answers to Section C of the questionnaire – Perceptions regarding the case study and educational game as an educational tool

Section C of the questionnaire contained questions to establish what the different groups thought about their different educational experiences. The control group received a list of questions focusing on the perceptions of the participants regarding the written case study as an educational tool. The experimental group received exactly the same list of questions, but focusing on the participants' perceptions regarding the computerised educational game as an educational tool. The results of the data obtained for the experimental and control groups are summarised in the tables below.

Table C.1: Interest in the game/case study

Question	Mean game	Mean case	Std dev. game	Std dev. case	P
The experience was interesting.	3.557692	3.038462	1.055582	0.928028	0.008978

The group that played the game found the experience significantly more interesting than the group that completed the written case study. This result is as expected and is one of the engaging factors of the gaming teaching tool (see Chapter 4).

Table C.2: Game/case study as an aid to understanding the role of the auditor in the audit firm

Question	Mean game	Mean case	Std dev. game	Std dev. case	P
The case study / educational game helped me understand the role of the auditor in the audit firm.	3.557692	3.076923	0.937528	0.836570	0.006871

The students that completed the case study felt significantly more positive regarding the aid that the teaching tool provided in helping them understand the auditor's role in the audit firm. This result is as expected, as the educational game was designed with the objective of providing a simulated universe in which students can learn through experience.

Table C.3: Game/case study as an aid to develop problem-solving skills

Question	Mean game	Mean case	Std dev. game	Std dev. case	P
The case study / educational game improved my problem-solving skills.	3.134615	2.865385	0.950312	0.840841	0.129105

There was no statistical significant difference regarding the perception of the participants of both groups in relation to the use of the various teaching aids in promoting problem-solving skills; however, in hindsight, this could also be because the students did not understand / had varying definitions regarding the term 'problem-solving skills'. This is an area to address in future questionnaires developed in this area of study.

Table C.4: Game/case study as an aid to developing judgement skills

Question	Mean game	Mean case	Std dev. game	Std dev. case	P
The case study / educational game improved my judgement skills.	3.000000	2.961538	0.792118	0.791165	0.804839

There was no significant statistical difference in the perceptions of the students relating to the use of the various teaching aids in improving their judgement skills.

Table C.5: Game/case study as an aid to understanding the audit process

Question	Mean game	Mean case	Std dev. game	Std dev. case	P
The case study / educational game helped me to understand the auditing process.	3.442308	2.980769	0.849763	0.896406	0.008244

The students who played the game felt significantly more positive regarding the use of the educational game in promoting their understanding of the auditing process than did the students who completed the written case study. This could be because the game assisted in communicating this process through visualisation and animation, a method that has been particularly effective in engineering education (see Chapter 3).

Table C.6: Game/case study as an aid to visualising the audit process

Question	Mean game	Mean case	Std dev. game	Std dev. case	P
The case study / educational game helped me to visualise the auditing process.	3.788462	3.134615	0.824539	0.840841	0.000119

The students who played the game felt significantly more positive regarding the use of the educational game in acting as a visualisation aid when studying the auditing process than did their peers who completed the written case study.

Table C.7: How the game/case study addresses the challenge of limited time

Question	Mean game	Mean case	Std dev. game	Std dev. case	P
The case study / educational game was time-consuming.	3.288462	3.673077	1.054152	1.115333	0.073674

Neither the gaming nor the case study group felt particularly positive or negative about the teaching aid being time-consuming.

Table C.8: The link between theory and the game/case study

Question	Mean game	Mean case	Std dev. game	Std dev. case	P
I could link the theory to the practical experience.	3.788462	3.576923	0.775521	0.695818	0.146255

In both instances, the students felt positive about being able to link the theory of auditing to the practical experience thereof.

Table C.9: The Level Of Difficulty Of The Game/Case Study

Question	Mean game	Mean case	Std dev. game	Std dev. case	P
Examination questions are more difficult than the case study / educational game.	4.442308	3.346154	0.697712	1.135602	0.000000

There was a significant difference in the perceptions of students regarding this statement. The students who completed the case study perceived it as being more or less on par with examination questions. The students who played the game in turn felt very positive that the game was easier than their examination questions. This is interesting to note, as the game and the case study are based on exactly the same theoretical framework (see Chapter 5). What did differ between the two teaching aids was that firstly, the game conveyed the theoretical scenario through animations, pictures and sound, while the case study conveyed the scenario in written form. Secondly, the way in which questions were presented to students also differed between the two teaching aids: Questions in the written format were open-ended (as they were marked afterwards by a human marker who could apply judgement), while questions in the game were presented with pre-set answers in mind being forced upon the student (as this was reviewed by the computer program in order to provide immediate feedback to the students). This answer therefore highlights one of the main constraints of computerisation (see Chapter 3), but could also indicate that students more easily understand certain aspects of auditing when conveyed to them in a visual, animated manner (see Chapter 2). Determining the exact influence of

both of these factors on the perceived difficulty of a teaching aid is however an area for further research.

Table C.10: The game/case study as an aid when studying alone

Question	Mean game	Mean case	Std dev. game	Std dev. case	P
I would use the case study / educational game when studying on my own.	2.750000	3.442308	1.281467	1.073997	0.003541

There was a significant difference between the perceptions of the two groups regarding the use of the teaching aid when studying on their own. The students who completed the written case study felt positive about using the case study when studying on their own. The students who played the game felt negative regarding using the game when studying on their own. This could be because the students perceived the game as not being on par with the difficulty level of their examination questions.

Table C.11: Joy factor

Question	Mean game	Mean case	Std dev. game	Std dev. case	P
This was an enjoyable activity.	3.461538	2.673077	1.056475	1.023664	0.000196

There was a significant difference in the perceptions of the two groups regarding the enjoyability of the experience with the various teaching aids. The students who played the game regarded the experience as being enjoyable, while the students who completed the case study did not. These answers are as expected, as one of the engaging factors of an educational game is its enjoyability (see Chapter 5).

Table C.12: Level of competition

Question	Mean game	Mean case	Std dev. game	Std dev. case	P
There was a sense of competition.	2.923077	2.173077	1.117528	1.023664	0.000549

There was a significant difference in the perceptions of the two groups regarding the level of competition experienced. While all students felt negative regarding there being a sense of competition present in the experience, the students who played the game felt slightly less negative. This is as expected, as one of the engaging factors of an educational game is the sense of competition that could be incorporated (see Chapter 5).

Table C.13: Competition as a motivating factor

Question	Mean game	Mean case	Std dev. game	Std dev. case	P
Competition motivates me.	3.692308	4.019231	0.919046	1.057010	0.095416

There was no significant difference in the way the students in the two groups answered this question. Most students agreed that competition is a motivating factor, which is consistent with the literature review in Chapter 5.

Table C.14: Perceived value of the game/case study

Question	Mean game	Mean case	Std dev. game	Std dev. case	P
It was a waste of time.	2.519231	2.750000	1.093481	1.186112	0.304735

In both instances, the students did not feel that either experience was a waste of time.

Table C.15: Effectiveness of the guidance provided with the game/case study

Question	Mean game	Mean case	Std dev. game	Std dev. case	P
The experience confused me.	2.153846	2.557692	0.849097	0.872532	0.018590

There was a significant difference in the way the students from the different groups responded to this question. The students who played the educational game felt that the game was less confusing than did the students who completed the case study. However, in both instances the students did not rate the experience as being positively confusing.

Table C.16: Successfulness of the guidance provided with the game/case study

Question	Mean game	Mean case	Std dev. game	Std dev. case	P
I required more guidance than was provided.	2.480769	3.192308	1.196242	1.188812	0.002984

There was a significant difference in the way the students responded to this question. The students who completed the written case study felt more positive that they needed more guidance than was provided, while the students who played the game felt that they did not require more guidance than was provided. This result is as expected, as guidance was specifically programmed into the educational computer game for precisely this reason (see Chapter 5).

Table C.17: The game/case study as an aid in achieving better marks

Question	Mean game	Mean case	Std dev. game	Std dev. case	P
The experience will improve my marks in auditing.	2.615385	2.576923	1.012739	0.936120	0.841015

Neither group's students felt positive about the experience improving their future marks in auditing. Linking experiential teaching experience such as this to showing the students how it will/is able to improve their marks is an area for future research.

Table C.18: Feedback regarding the learning process in the game/case study

Question	Mean game	Mean case	Std dev. game	Std dev. case	P
I received immediate feedback.	3.615385	2.980392	1.105314	1.086098	0.004065

There was a significant difference in the way the students responded to this question. The students who played the game felt more positive about receiving immediate feedback on their actions than did the students who completed the written case study. This result is as expected, as guidance was specifically programmed into the educational computer game for precisely this reason (see Chapter 5).

Table C.19: Success of the game/case study in changing the learning approach of the students

Question	Mean game	Mean case	Std dev. game	Std dev. case	P
The experience has caused me to move away from memorising auditing.	2.961538	2.634615	0.928028	0.970725	0.082188

There was no significant difference in the way the students responded to this question. This is not as expected, as the game was designed in order to promote the principle of understanding auditing and not memorising the theory by heart (see Chapter 5).

Table C.20: Success of the game/case study in increasing the motivation of the student

Question	Mean game	Mean case	Std dev. game	Std dev. case	P
The experience increased my motivation to study.	2.903846	3.115386	1.014785	1.041376	0.296616

There was no significant difference in the way the students responded to this question. This is not as expected, as the educational game was designed to be both engaging and intrinsically motivating (see Chapter 5).

Table C.21: Ability of the game/case study to substitute work experience

Question	Mean game	Mean case	Std dev. game	Std dev. case	P
The experience would be a viable substitute for work experience.	2.730769	2.711538	1.122242	0.996790	0.926571

There was no significant difference in the way the students responded to this question. This is not as expected, as the educational game was designed to provide some form of practical experience, even if it is only simulated (see Chapter 5).

Table C.22: Ability of the game/case study to be used repeatedly to enable the student to achieve higher marks

Question	Mean game	Mean case	Std dev. game	Std dev. case	P
I believe that practising with the case study / educational game could improve my marks.	3.076923	3.653846	1.117528	0.837471	0.003614

There was a significant difference in the way the students responded to this question. The students who completed the case study felt more positive regarding using the teaching aid to improve their marks than did the students who played the game.

Table C.23: Level of difficulty of the game/case study

Question	Mean game	Mean case	Std dev. game	Std dev. case	P
The case study / educational game was difficult.	2.538462	3.461538	0.999246	0.938533	0.000004

There was a significant difference in the way the students responded to this question. The students felt that the case study was difficult and that the game was not difficult. This is interesting to note, as the game and the case study were based on exactly the same theoretical framework (see Chapter 5). What did differ between the two teaching aids was that firstly, the game conveyed the theoretical scenario through animations, pictures and sound, while the case study conveyed the scenario in written form. Secondly, the way in which questions were presented to students also differed between the two teaching aids: Questions in the written format were open-ended (as they were marked afterwards by a human marker who could apply judgement), while questions in the game were presented with pre-set answers in mind being forced upon the student (as this was reviewed by the computer program in order to provide immediate feedback to the students). This answer therefore highlights one of the main constraints of computerisation (see Chapter 3), but could also indicate that students more easily understand certain aspect of auditing when conveyed to them in a visual, animated manner (see Chapter 2). Determining the exact influence of both of these factors on the perceived difficulty of a teaching aid is an area for further research.

Table C.24: Level of intrigue of the game/case study

Question	Mean game	Mean case	Std dev. game	Std dev. case	P
I am intrigued to find out more about the concepts taught.	3.230769	3.365385	0.807207	0.908108	0.426178

There was no significant difference in the way the students responded to this question.

Table C.25: Transferral of application skills in a test scenario

Question	Mean game	Mean case	Std dev. game	Std dev. case	P
I will be better able to apply knowledge during examinations and tests.	3.000000	3.153846	0.970143	0.957624	0.417632

There was no significant difference in the way the students responded to this question. This is not as expected, as the game was designed with the principle in mind that understanding the theory (as opposed to learning it by heart) would promote application of the theory in examination and test scenarios (see Chapter 5). Determining whether students who play the game do actually achieve better results in tests (as opposed to their perceptions) is an area of future research.

Table C.26: Transferral of application skills in a work environment

Question	Mean game	Mean case	Std dev. game	Std dev. case	P
I will be better able to apply knowledge when I start working.	3.250000	3.576923	1.045532	0.936120	0.096044

There was no significant difference in the way the students responded to this question. This is not as expected, as the game was designed with the principle in mind that

understanding the theory (versus learning it by heart) would promote application of the theory in general (see Chapter 5). Determining whether students who play the game do actually perform better in a work environment (as opposed to their perceptions) is an area of future research.

Table C.27: Motivational aspect: emotional involvement

Question	Mean game	Mean case	Std dev. game	Std dev. case	P
I was involved emotionally in the story of the case study / educational game.	2.230769	2.173077	1.198289	1.183566	0.805399

There was no significant difference in the way the students responded to this question. This is an engaging factor that should have been present in the game design (see Chapter 5); however, choosing a storyline that is emotionally appealing to students of auditing in their third year is an area of future research.

Table C.28: Critical thinking skills utilised to complete the game/case study

Question	Mean game	Mean case	Std dev. game	Std dev. case	P
I had to think critically in order to complete the case study / educational game.	3.615385	3.769231	0.889015	0.920686	0.388074

There was no significant difference in the way the students responded to this question.

Table C.29: Success of story in relating to student

Question	Mean game	Mean case	Std dev. game	Std dev. case	P
I could relate to the story of the case study / educational game.	2.961538	2.461538	1.154047	1.056475	0.023224

There was a significant difference in the way the students responded to this question. The students who played the game noted that they could relate to the story more than could the students who completed the written case study. This is possibly because the game conveyed the story through animations and sound, while the case study provided students only with the story in written form.

Table C.30: Success of game/case study in utilising thinking skills

Question	Mean game	Mean case	Std dev. game	Std dev. case	P
The experience forced me to think through the auditing concepts.	3.500000	3.730769	1.019419	0.931273	0.230911

There was no significant difference in the way the students responded to the question. Both groups indicated that the experience required of them to think about the theoretical auditing concepts.

From the above tables it is evident that there were meaningful differences between the way the control group and experimental groups responded to more than half of the questions in the section.

6.3.3.1 Factor analysis

In order to extract more meaningful groups of information from the data, it was decided to perform a factor analysis to group the findings. Principal axis factoring was used as extraction method. The rotation method used was Oblimin with Kaiser normalisation. The rotation converged in 36 iterations. In order to determine the internal consistency reliability

of the factors, Cronbach's alpha coefficients were calculated for each factor (component). The Cronbach's alpha should preferably be above 0.7 (Field, 2009).

The results of the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy, p-value of Bartlett's test of sphericity and the determinant of correlation matrix are reported in Table 6.1 below.

Table 6.1: Important statistical values

KMO, Bartlett's test and determinant of correlation matrix: Strategy formulation	Value
KMO	0.735
Bartlett's test of sphericity	$p < 0.001$
Approximate chi-square test	1498.830
Df	435
Factor analysis significance test	< 0.000

The KMO measures the adequacy of the sample size that has been obtained in the study. KMO values between 0.5 and 0.7 are mediocre, between 0.7 and 0.8 good, between 0.8 and 0.9 great and above 0.9 superb (Field, 2009). In this case, the KMO value was measured at 0.735, which is 'good' according to above reference.

The p-value of Bartlett's test of sphericity returned a value smaller than 0.05 ($p < 0.001$), indicating that correlations between statements were sufficiently large for factor analysis.

With respect to the correlation matrix, two things are important: The variables have to be intercorrelated, but they should not correlate too highly, as this would cause difficulties in determining the unique contribution of the variables to a factor.

Table 6.2: Pattern matrix

The result of the factor analysis is given by a pattern matrix. In this study, the pattern matrix was used to interpret the factors.

Question no.	FACTOR							
	Educational value	Examination preparation	Discomfort level	Engagement and joy	Critical thinking	Motivation	Fascination	Skills and workplace application
v42	0.699							
v49	0.544	0.331						
v43	0.418	0.238					-0.258	
v33		0.717						0.216
v45		0.674						
v46		0.567						
v32		-0.539		0.280				
v48	0.467	0.477						
v40	0.376	0.412				-0.281	-0.224	
v44		0.409		0.355	-0.214			
v39		0.300	0.616					
v38			0.567				0.201	
v30			0.416				0.263	0.288
v41				0.656				
v35	0.338			0.635				
v34				0.521			-0.461	
v52	-0.328			0.470		0.316		0.266
v51					0.833			
v36						0.446		
v53				-0.258		0.411		0.221

Question no.	FACTOR							
	Educational value	Examination preparation	Discomfort level	Engagement and joy	Critical thinking	Motivation	Fascination	Skills and workplace application
v50		0.254		0.242	-0.224	0.268		
v37							0.737	
v47	0.246		0.216			0.279	-0.561	
v31							-0.356	0.208
v26								0.832
v27			0.259					0.799
v28								0.735
v25			-0.264					0.647
v29	0.296			0.213				0.450
v24				0.229		-0.238	-0.320	0.341
Cronbach's alpha	0.71	0.67	0.53	0.72	0.39	-0.93	0.66	0.84
Mean inter-item correlations	0.444	0.232	0.289	0.337	0.241	-0.162	0.397	0.453

RELIABILITY

Reliability was discussed in detail in Section 6.2.3. Cronbach's alpha, which is the most common measure of scale reliability (Field, 2009), was used as a measure of the reliability of the factors. Factors that return a Cronbach's alpha of higher than 0.7 can be viewed as reliable factors.

The following factors had a Cronbach's alpha coefficient higher than 0.7, which indicates that the factors are reliable:

Table 6.3: Factors with a cronbach's alpha higer than 0.7

FACTOR	CRONBACH'S ALPHA
Educational value	0.71
Engagement and joy	0.72
Skills and workplace application	0.84

The following factors had a Cronbach's alpha coefficient that approximates 0.7, but could still be regarded as a relatively low reliability factor (Field, 2009). However, this was most probably caused by the low number of statements in the factor, as maintained by Cortina (1993, as cited in Field, 2009, p. 675) and therefore can still be reliably interpreted.

Table 6.4: Factors with a cronbach's alpha between 0.5 and 0.7

FACTOR	CRONBACH'S ALPHA	NUMBER OF STATEMENTS IN THE FACTOR
Examination preparation	0.67	7
Discomfort level	0.53	3
Fascination	0.66	3

The following factors had a Cronbach's alpha coefficient remarkably lower than 0.7, which is regarded as a relatively low reliability factor (Field, 2009). Reliability on these factors measured too low en therefore the statements contained in the factor were rather interpreted individually.

Table 6.5: Factors with a cronbach's alpha lower than 0.5

FACTOR	CRONBACH'S ALPHA
Critical thinking	0.39*
Motivation	-0.93*

The tables listed below (C.31 to C.36) discuss the interpretation of the factors identified in Section C of the questionnaire, through the process as discussed above in paragraph 6.3.3.1. Factors that were deemed not reliable are not discussed.

Table C.31: Factor: Educational value

Factor description	Mean game	Mean case	Std dev. game	Std dev. case	P
Educational value	3.038462	3.108974	0.812897	0.774656	0.651636

There was no significant statistical difference between the amount of educational value obtained from participating by either playing the educational game or writing the case study. This observation is of value, as it provides at least an indication that the 'gamification' of the theory did not subtract from the educational value of the experience.

Table C.32: Factor: Examination preparation

Factor description	Mean game	Mean case	Std dev. game	Std dev. case	P
Examination preparation	3.021978	3.192308	0.721468	0.472437	0.157423

Both groups reported an equal perception regarding the value of the various educational teaching methods in preparing for examinations. Again, this indicates that adding an element of 'play' and 'joy' in the educational game experience did not negatively affect the educational value of the teaching tool.

Table C.33: Factor: Level of discomfort

Factor description	Mean game	Mean case	Std dev. game	Std dev. case	P
Discomfort level	2.641026	3.141026	0.722638	0.750733	0.786375

There was a significant difference between the levels of discomfort perceived by the case study group versus that perceived by the group that played the educational game. This factor deals with the negative factors associated with experimental teaching methodologies (see Chapter 3) and includes whether the participants felt that the experience was time-consuming and confusing and whether they needed more guidance. The participants who played the game experienced noticeably lower levels of discomfort than did the participants who completed the case study. It can therefore be argued that the game achieved its goals and design objectives of including sufficient guidance in the form of tutorials, tips, hints and other integrated educational material (refer to sections 4.3 and 4.4 in Chapter 4) and that this had a significantly positive effect on how the participants perceived the gaming experience.

Table C.34: Factor: engagement and joy

Factor description	Mean game	Mean case	Std dev. game	Std dev. case	P
Engagement and joy	3.038462	2.488462	0.833644	0.611541	0.028917

There was a significant difference between the amount of engagement and joy that was experienced by the participants who played the game versus the participants who took part in completing the case study. The participants who played the game experienced significantly more joy and engagement than did the participants who completed the case study. This result is as expected, as the joy factor is one of the most significant advantages of using a game as an experiential teaching method (refer to Section 2.3.7.1 in Chapter 2).

Table C.35: Fascination

Factor description	Mean game	Mean case	Std dev. game	Std dev. case	P
Fascination	3.423077	3.217949	0.797915	0.758064	0.181934

In terms of fascination with the experience, there were no significant differences between the answers of the control group versus the answers of the experimental group. This could

be because the material used as basis for each educational experience did not differ, but still consisted of auditing theory. However, one would expect that the ‘gamification’ of the theory would have added some fascination factors to the educational experience (as discussed in Chapter 4).

Table C.36: Skills and workplace application

Factor description	Mean game	Mean case	Std dev. game	Std dev. case	P
Skills and workplace application	3.451923	3.099359	0.626517	0.605224	0.004327

There was a significant difference between the answers of the experimental and control group with regard to the skills and workplace application factor. Overall, the participants who played the educational game felt more positive about having developed real life skills and obtaining knowledge, which they understand as being applicable to the workplace environment of an auditor. It was expected that, as the game provides a vehicle to bring simulated reality to the lecture room, students would be able to better understand the real-life application of the theory and would develop skills in critical thinking, judgement and knowledge application (see Chapter 4). This result is therefore as could be expected.

6.3.3.2 Conclusion on answers to Section C of the questionnaire

By examining the p-value of the different factors analysed in the factor analysis, it is evident that there were three factors for which the control and experimental group reported meaningful differences. These factors are the following:

- Discomfort level
- Engagement and joy
- Skills and workplace application.

The experimental group that played the educational game experienced a higher level of joy and engagement. They also reported their development of practical skills and future workplace application ability as higher than did the control group that completed the

written case study. This is in line with the findings of the literature review (see Section 4.2.2 in Chapter 4), in which it was reported that much of the power of gaming as an educational tool lies in the ability to engage the student in the educational experience, while introducing a joy factor to the learning process that is not present in traditional educational methods. Previous studies on experiential teaching methodologies also report that these methods could aid in the development of workplace-related skills and act as a bridge between the practical and theoretical world in order to cultivate students who are more likely to adapt more quickly to the workplace after studies (see Chapter 3).

The experimental group also reported a higher level of comfort, which could be attributed to the success of the design objectives and goals (refer to sections 4.3 and 4.4 in Chapter 4) of the game to include guidance in the form of tutorials, hints, tips and other integrated educational material.

Factors that did not report meaningful differences between the experimental and control groups but still had to be taken into account to analyse the bigger picture of the experimental results were the following:

- Educational value
- Examination preparation
- Fascination.

The fact that there were no meaningful differences reported between the educational and examination preparation value of the educational game and the written case study suggests that the educational game equals the case study in educational value. As substantiated by the literature review (see Chapter 3), students taking part in experiential learning may be overwhelmed by the new experience in such a way that the educational value of the method is mitigated. However, in this study, the experimental group did not report meaningful differences in this area. This is very important, as the first and foremost goal of any educational method is still to educate students adequately.

The experimental group reported a slightly higher mean in terms of the fascination factor than did the control group, but not in such a way that it could be viewed as meaningful. It would be expected that because of the higher rating of the experimental group in the joy and engagement factor, there would also be a meaningful difference in the fascination factor; however, this was not the case.

6.3.4 Descriptive statistics: Answers to Section D of the questionnaire – Self-assessment with regard to learning outcomes achievement

Section D of the questionnaire included questions to measure whether students felt they achieved the specific learning outcomes that should have been achieved by them in this exercise. Both the written case question and the educational game were designed to help students achieve these learning outcomes (see Chapter 5). The responses of the participants of both the experimental and the control groups are listed in the tables below.

Table D.1: Learning outcomes: understand how inventory should be audited

Question	Game mean	Case mean	Game std dev.	Case std dev.	P-value
I have a general understanding of how an audit of the inventory balance should work.	3.634615	3.692308	0.657650	0.672673	0.872487

There was no significant statistical difference in the way the two different groups responded to this question. Both the students who played the game and the students who completed the written case study felt positive about having a general understanding of how an audit of the inventory balance should work.

Table D.2: Learning outcomes: Understand the audit process

Question	Game mean	Case mean	Game std dev.	Case std dev.	P-value
I have a general understanding of the auditing process.	3.769231	3.673077	0.546482	0.584813	0.630111

There was no significant statistical difference in the way the two different groups responded to this question. Both the students who played the game and the students who

completed the written case study felt positive about having a general understanding of the auditing process.

Table D.3: Learning outcomes: Able to identify risks at assertion level for the inventory balance

Question	Game mean	Case mean	Game std dev.	Case std dev.	P-value
I am able to identify risks at assertion level for the inventory balance.	3.442308	3.288462	0.826366	0.749811	0.489989

There was no significant statistical difference in the way the two different groups responded to this question. Both the students who played the game and the students who completed the written case study felt positive about being able to identify risks at assertion level for the inventory balance.

Table D.4: Learning outcomes: understand assertions relating OT Inventory

Question	Game mean	Case mean	Game std dev.	Case std dev.	P-value
I have a general understanding of what the different assertions for inventory means.	3.442308	3.403846	0.894722	0.891344	0.978555

There was no significant statistical difference in the way the two different groups responded to this question. Both the students who played the game and the students who completed the written case study felt positive about having a general understanding of what the different assertions for inventory means.

Table D.5: Learning outcomes: able to link risks to assertions

Question	Game mean	Case mean	Game std dev.	Case std dev.	P-value
I am able to link the risks identified to assertions pertaining to inventory.	3.423077	3.230769	0.695818	0.782539	0.404422

There was no significant statistical difference in the way the two different groups responded to this question. Both the students who played the game and the students who completed the written case study felt positive about being able to link the risks identified to assertions pertaining to inventory.

Table D.6: Learning outcomes: understand the principles of audit planning

Question	Game mean	Case mean	Game std dev.	Case std dev.	P-value
I have a general understanding of what the principles of audit planning are.	3.711538	3.500000	0.723188	0.641689	0.396052

There was no significant statistical difference in the way the two different groups responded to this question. Both the students who played the game and the students who completed the written case study felt positive about having a general understanding of what the principles of audit planning are.

Table D.7: Learning outcomes: understand the role of professional judgement in audit planning

Question	Game mean	Case mean	Game std dev.	Case std dev.	P-value
I understand how professional judgement should be used in order to plan an audit.	3.921569	3.942308	0.688277	0.725271	0.712047

There was no significant statistical difference in the way the two different groups responded to this question. Both the students who played the game and the students who completed the written case study felt positive about understanding how professional judgement should be used in order to plan an audit.

Table D.8: Learning outcomes: understand the concepts of nature, timing and extent of audit procedures

Question	Game mean	Case mean	Game std dev.	Case std dev.	P-value
I understand what the nature, timing and extent of audit procedures mean,	3.711538	3.634615	0.893035	0.886253	0.956799

There was no significant statistical difference in the way the two different groups responded to this question. Both the students who played the game and the students who completed the written case study felt positive about understanding what the nature, timing and extent of audit procedures mean.

Table D.9: Learning outcomes: understand the concepts of risk versus effectiveness as it applies to audit planning

Question	Game mean	Case mean	Game std dev.	Case std dev.	P-value
I understand that the nature, timing and extent of audit procedures are planned in order to lower risk to an acceptable level while performing the most cost-effective audit possible.	3.596154	3.884615	0.891344	0.704435	0.095949

There was no significant statistical difference in the way the two different groups responded to this question. Both the students who played the game and the students who completed the written case study felt positive about understanding that the nature, timing and extent of audit procedures are planned in order to lower risk to an acceptable level while performing the most cost-effective audit possible.

Table D.10: Learning outcomes: understand the concept of how and why audit procedures are performed

Question	Game mean	Case mean	Game std dev.	Case std dev.	P-value
I have a general understanding of how audit procedures are used to obtain evidence pertaining to specific assertions in performing an audit.	3.576923	3.750000	0.824767	0.737643	0.428034

There was no significant statistical difference in the way the two different groups responded to this question. Both the students who played the game and the students who completed the written case study felt positive about having a general understanding of how audit procedures are used to obtain evidence pertaining to specific assertions in performing an audit.

Table D.11: Learning outcomes: understand the examination technique of formulating an audit procedure

Question	Game mean	Case mean	Game std dev.	Case std dev.	P-value
I understand how audit procedures are formulated (examination technique).	3.038462	3.294118	0.969365	0.900980	0.605849

There was no significant statistical difference in the way the two different groups responded to this question. Both the students who played the game and the students who completed the written case study felt positive about understanding how audit procedures are formulated in an examination situation.

6.3.4.1 Conclusion on answers to Section D of the questionnaire

No meaningful differences arose between the responses of the experimental and the control groups. Both groups felt slightly more positive than neutral that they had achieved all the specific learning outcomes. Both groups felt the same about all the learning outcomes and there was not one about which they felt particularly negative or positive. The data therefore suggest that students gained the same educational value from either completing the written case question or completing the computerised educational game. This finding supports the above interpretation of the factor analysis for which the data also suggested that the educational value of the educational game and the case study was the same. Therefore, it can again be concluded that no educational value was lost in the computerisation and 'gamification' of the case study.

6.3.5 Descriptive statistics: Answers to Section E of the questionnaire – Perceptions regarding the computer game design

Section E was only included in the questionnaire given to the experimental group and aimed to gather information about the perceptions of the students regarding the effectiveness of the design of the computer game itself. The statements and responses are discussed below per individual statement.

Table E: **Answers to Section E of the questionnaire: Perceptions regarding the computer game design**

Table E.1: **Computer literacy**

Question	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean	Std dev.
I am computer literate.	3.85	3.85	21.15	30.77	40.38	4.0000000	1.0664215

The majority of the participants in the experimental group regarded themselves as being computer literate, in other words they know how to work with a computer to achieve certain goals. In addition, it was noted that while the experiment took place, all participants succeeded in completing the game. This supports the viability of using a computer-based game as a teaching tool.

Table E.2: **Like/dislike of recreational gaming**

Question	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean	Std dev.
I like recreational gaming.	7.69	15.38	25.00	40.38	11.54	3.3269231	1.1153326

The majority of the students (51.92%) indicated that they like engaging in recreational gaming activities. During the literature review it was considered that, because of the changing nature of our world, students nowadays grow up with computerisation (see Section 2.3.10.1 in Chapter 2, paragraph on computerisation) as a natural part of their existence, and they would respond more readily to a graphically engaging and computerised teaching method. This finding again supports the viability of using a computer-based game as a teaching aid.

Table E.3: Visual appeal

Question	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean	Std dev.
The game was visually appealing.	25.00	13.46	28.85	26.92	5.77	2.7500000	1.2660731

About a third of the participants felt that the game was visually appealing, while another third was of the opinion that the game was not visually appealing and another third remained neutral on the matter. During the literature review (in Section 4.4 of Chapter 4) it was established that graphics are one of the engaging factors integrated in an educational game. It is also what is used to visually communicate the story of the game and serves as guidance to the gamer that is playing the game. This finding indicates that, although the graphics of this game succeeded in their purpose (conveying the story, etc.), more detailed and better programmed graphics would increase the engaging factor of the game. In other words, in the graphics department there was room for improvement.

Table E.4: Links with theoretical knowledge

Question	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean	Std dev.
The main determining factor of the player's success is his/her level of theoretical knowledge.	0.00	7.69	25.00	57.69	9.62	3.6923077	0.7550733

Prior research suggests that the effective design of a computer game should have, as one of its goals, that the main determining factor of the player's success should be his/her skill level. In other words, the educational game should test the student on what it is trying to teach in order to pass students who have attained the pre-set learning outcomes. Whether or not this goal is achieved will rely on the effective design of the case study as well as on how the underlying case study is turned into a game. In this instance, the data indicate that the educational game was fairly effective in achieving this goal, as the majority of the

participants agreed that the goal was achieved, while only 7.69% of the participants did not agree that the goal was achieved.

Table E.5: The gradebook feature is helpful

Question	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean	Std dev.
The gradebook feature is helpful in directing my learning progress.	0.00	7.69	34.62	48.08	9.62	3.5961538	0.7735737

During the literature review it was discovered that guided teaching methods are generally more effective than unguided teaching methods. In addition, it was discussed that an educational game needs to have maximum usability in order to avoid decreasing the educational value derived from it. Usability is also one of the key principles of good game design (see Chapter 5). The gradebook (a scorekeeping feature was built in to provide extra guidance in terms of focused learning) was programmed into this particular educational game in order to help achieve these goals. In this case, it seems that students perceived this feature as helpful and therefore having achieved its goal.

Table E.6: Progress properly planned

Question	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean	Std dev.
The progress through the game was properly planned.	1.92	3.85	28.85	46.15	19.23	3.7692308	0.8770580

As mentioned above (and discussed in Chapter 5), one of the key principles of a good game and good educational game design is usability. Good usability adds to the gaming and educational value of the game. This statement aimed to assess whether students perceived the game as being properly planned and therefore user-friendly. The majority of the students perceived the game as being properly planned and therefore it can be interpreted that this goal of game design had been reached.

Table E.7: Desire to use the game as a study aid when studying out of class

Question	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean	Std dev.
I would like to have the game made available to me on a disc/flash drive.	15.38	17.31	28.85	26.92	11.54	3.0192308	1.2444447
Question	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean	Std dev.
Having the game to study with in my own time would be convenient.	15.38	19.23	15.38	44.23	5.77	3.0576923	1.2273591
I would like to be able to access the game online.	11.54	13.46	32.69	34.62	7.69	3.1346154	1.1207289

It was necessary to assess whether the game has potential use as a teaching tool or supplementary aid to the education of auditing students. The rationale behind including the above-listed questions in the questionnaire was that students who perceive the game as being potentially useful or beneficial to their studies would find it desirable. Therefore, these questions were included in order to establish whether the students perceive the educational game as holding educational value for them. Three varieties of the question

were included. This was done in order to explore whether (if the game is perceived as desirable) different ways of distribution would add to or subtract from the desirability of the game.

Fifty per cent of the students indicated that they would like to have the game to help them study at home in their own time, 15.38% of the students felt neutral about this statement and the rest of them felt negative about having the game made available to them to study with online. To both the other above-listed questions, more than a third of the participants responded in a positive manner to having the game made available to them, while another third felt neutral about the notion and the other third of the students disagreed. The participants do not specifically prefer the game to be made available on a disc/flash drive or online; however, this is a point for future research.

Approximately a third of the students responded that they would like to have the game made available to them, while another third of the students responded that they would not like the game made available to them; the other third of the students felt neutral about the statement. Therefore, there is some room for improvement in the area of developing the educational game so that students will perceive it as being a useful study aid. Possible areas of future research might compare the perceived usefulness of this educational game to the perceived usefulness of other known educational aids (such as textbooks and practice questions).

Table E.8: Usability

Question	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean	Std dev.
The game is easy to use.	1.92	5.77	21.15	51.92	19.23	3.8076923	0.8864660

This question was again included in order to establish whether the game design reaches the goal of usability, as discussed above and in Chapter 5. The majority of the group responded positively to the game being easy to use. The data therefore indicate that the game design does attain the standard of usability.

Table E.9: Aptitude for interaction with others

Question	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean	Std dev.
I would like a LAN option included in the game.	25.00	23.08	32.69	17.31	1.92	2.4807692	1.1112682
I would like a chat function included in the game.	13.46	21.15	23.08	26.92	15.38	3.0961538	1.2873383

In Chapter 4 it was discussed that a key design principle of experiential teaching methods includes giving consideration to socialisation and interaction. It was decided that this educational game would aim to give the player a somewhat simulated interaction socialisation experience with simulated characters built into the game engaging the player in the story behind the game. The above-listed two questions were included in order to determine whether the amount of interaction integrated into the prototype game design was sufficient or whether there was a need to include more interactive socialisation features. The overall response of the participants leaned towards the negative side (48.08% negative; 32.69% neutral) with regard to being enabled to play the game with other students, while 41% of the participants responded positively to having a chat function integrated into the game. Therefore, it can be interpreted that the design of this educational game is adequate in terms of interaction and socialisation, but the possibilities of including more social functions into the game is a point for further research.

Table E.10: Success of information technology integration

Question	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean	Std dev.
I liked the integration of information technology.	5.77	7.69	30.77	48.08	7.69	3.4423077	0.9582145

Information technology is one of the changing and challenging factors in the work environment as well as educational environment of chartered accountants today (as discussed in Chapter 1). The integration of information technology exposure in the curriculum would therefore be a positive attribute that could possibly produce added benefits. The students also perceived the integration of information technology into the educational experience as a positive attribute.

Table E.11: Clarity of communication

Question	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean	Std dev.
I understood what was expected of me during each stage of the game.	3.85	11.54	38.46	36.54	9.62	3.3653846	0.9503115

The storyline of the computer game needed to be clear in order to ensure maximum usability of the game. Students need to be engaged and yet derive educational value from the game. Approximately 40% of the students felt that the game conveyed clearly to them what was expected in terms of learning and progressing through the game. However, the rest of the students felt neutral to negative about this statement. Ways to improve the storyline and guidance given to students is a point for further research.

Table E.12: Authenticity

Question	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean	Std dev.
The game felt authentic.	7.69	9.62	55.77	23.08	3.85	3.0576923	0.8947222

In Chapter 4 it was established that one of the key design principles of a case study is that it has to have a feeling of authenticity to the student – especially so in auditing, as the whole subject of auditing focuses on teaching students the theory behind what will be expected of them one day in the workplace. More students agreed than felt negative about this statement; however, most students were neutral on the matter. This could however be because the background of this group includes little to no previous workplace experience. Improving the authenticity of the game could be a point for further research.

Table E.13 Interest in the story

Question	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean	Std dev.
The story was interesting.	13.46	15.38	28.85	36.54	5.77	3.0576923	1.1446973

One of the potential benefits of games as teaching tools is that it has the ability to engage the gamer in the learning process (see Chapter 4). One of the ways that students are engaged is by providing the educational material within the context of an engaging storyline; however, there is a challenge in designing a story/scenario that is engaging and interesting as well as authentic and educational. In this case, approximately 40% of the students rated the story as being interesting and approximately 28% of the students disagreed that the story was interesting, while (as indicated above in Table E.12) approximately 16% of students viewed the scenario as being authentic. The data therefore indicate that students perceived that the design goal of creating an engaging and interesting scenario was met.

Table E.14: Joy factor introduced through animations

Question	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean	Std dev.
I enjoyed the animations.	19.23	7.69	32.69	30.77	9.62	3.0384615	1.2518463

This statement has to do with the way in which the story is offered to the gamers. Once an interesting and engaging scenario has been designed, it has to be animated and programmed in such a way as to successfully convey this story to the game player. Fifty per cent of the participants indicated that they do engage in and enjoy recreational gaming and that, when compared to commercially available non-educational games, the animations utilised in this game are fairly simple. Having said that, approximately 40% of the participants indicated that they enjoyed the animations of the game (approximately the same number of participants who indicated that they thought the story was interesting). It can be interpreted that the animations utilised in this game were fairly successful in accomplishing the task of engaging the students in the story of the game.

Table E.15: Educational value of tutorials

Question	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean	Std dev.
The tutorials held educational value.	0.00	7.69	23.08	53.85	15.38	3.7692308	0.8072074

Educational tutorials explaining applicable theoretical principles were included in the game in order to provide guidance to the students and to further add educational value to the game. These tutorials could serve as a means of revision or as a supplementary aid to scheduled theoretical lectures. This question was included in order to establish whether these tutorials did indeed add educational value to the game. The majority of the students agreed that these tutorials do hold educational value, while only 7.69% of the participants

disagreed and 23.08% felt neutral about the matter. This result indicates that the tutorials were successful in adding value to the game and should be regarded as a good design feature to include in future educational games.

Table E.16: Joy factor introduced through fantasy

Question	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean	Std dev.
I enjoyed the fantasy of the game.	9.62	17.31	42.31	23.08	7.69	3.0192308	1.0570099

Approximately a third of the students indicated that they enjoyed the element of fantasy included in the storyline and animations of the game, while 42.31% remained neutral on the matter. Future research may be conducted in order to establish a design principle relating to how much fantasy and how much authenticity should be included in an educational game in order to achieve the optimal mix of engagement and educational value.

Table E.17: Motivational factor: challenge

Question	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean	Std dev.
I enjoyed the challenge of the game.	1.92	7.69	34.62	48.08	7.69	3.5192308	0.8281893

Challenges in a game have to be designed in such a way that all players who have reached the desired skill level and/or understanding of theoretical principles will succeed in completing and passing the challenge (see Chapter 4). If the challenge is too difficult, players may be demotivated; if it is too easy, the educational value and motivational factor of competition are diminished. In this experiment, the majority of the students indicated

that they enjoyed the challenges incorporated in this game. It seems therefore that the challenges included in the game were not too difficult or too easy.

Table E.18: Tempo

Question	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean	Std dev.
The playing tempo of the game was too slow.	1.92	19.23	40.38	26.92	11.54	3.2692308	0.9724718
The playing tempo of the game was too fast.	19.23	40.38	34.62	5.77	0.00	2.2692308	0.8428566

The tempo of a game is largely influenced by the way in which non-story elements are interlinked with the story-elements of the game (see Chapter 4). If the game tempo is too slow, players might get irritated or demotivated. If the playing tempo of the game is too fast, players may be confused and in this way the value of guidance as well as the educational value of the game might be diminished. It also has to be taken into account that different students will prefer and be able to adapt to different speeds of gaming. The challenge is therefore to design the game at a speed that will be acceptable to the majority of the target population. In this experiment, a third of the participants indicated that they felt the speed of the game was too slow, while only 20% of students disagreed. The majority of the participants indicated that the playing tempo of the game was too fast, while only 5.77% disagreed. This result indicates that the playing tempo of this game might have been a little too slow and future endeavours and research in this field might attempt to include less story elements in the game in order to increase the speed at which the game progresses.

6.3.5.1 Conclusion on answers to Section E of the questionnaire

All of the students, except for four, reported that they are computer literate. Of these students, only approximately a fifth reported that they do not enjoy recreational gaming. The population of the experimental group could therefore be described as a computer

literate group, susceptible to information technology integration into the syllabus. This would add to the group's experience of the joy factor when introduced to the 'gamification' of the educational content of their studies. This is substantiated by the findings of the factor analysis (see Section C). This is also confirmed by the responses of the participants to Question 77 ("I liked the integration of information technology"), to which only approximately a sixth of the participants responded negatively.

The participants reported positively that:

- the main determining factor of the player's success is his/her level of theoretical knowledge;
- the progress through the game was properly planned;
- the game is easy to use; and
- they understood what was expected of them during each stage of the game.

Therefore, it seems that the overall feeling of the students who participated in the experimental group was that the game was properly designed and planned. This means that the usability factor was successfully integrated into the game to such an extent that the students could focus on the story, gameplay and problem solving rather than on how to operate and navigate the game.

The results are discussed under the following headings:

- a) Tutorials
- b) Joy factor
- c) Storyline
- d) Social features
- e) Accessibility

a) TUTORIALS

The participants were very positive about the add-on functions of the animated tutorials and the gradebook. These integrations were originally added to the game in order to

increase the educational value and guidance provided by the game (see Chapter 5). The data indicate that this has been achieved.

b) JOY FACTOR

Questions regarding the joy factor of the game were included in an attempt to confirm which component of the game mostly influenced the gamers' enhanced enjoyment of the game as substantiated by the factor analysis (see Section C); however, the majority of the participants reported feeling neutral about all of the following components that could be the cause of the joy factor:

- The game felt authentic.
- The story was interesting.
- I enjoyed the animations.
- I enjoyed the fantasy of the game.

The only question in this regard that they felt slightly more positive about was Question 84 ("I enjoyed the challenge of the game"). A possible explanation for this could be that the participants are comparing these elements of the game to commercially available recreational games that include cutting-edge technology in terms of programming and animations, because the only goal of these games is to entertain. Compared to these games, the technology incorporated in designing and producing the game used in this experiment is very simple.

c) STORYLINE

The story and fantasy of the game had to be built on the educational theory that will lead the students to accomplish the pre-determined learning outcomes. Therefore, it might not have been perceived as being as interesting as any other story that they might have encountered in other recreational games. This is one of the intrinsic limitations of the educational game, which should be challenged in any game design, but will nevertheless always be present (see Chapter 5).

Many of the participants reported that they enjoy recreational gaming. This would make the participants prone to comparing this prototype educational game with the commercial recreational games available in the market today. In comparison, the game content and

animations of the educational prototype game will most probably not be as enjoyable as that of more commercially inclined counterparts.

The participants reported experiencing a level of joy factor (see Section C) and these data had to be reconciled to the responses of the participants to these questions. Therefore, the data can be interpreted to indicate that no individual component gave rise to the reported joy factor of the gamer, but that it must be the integration of these components as a whole that form the gameplay process that gave an experience of joy to the gamer. This is in line with the participants' more positive responses to the statement "I enjoyed the challenge of the game".

d) SOCIAL FEATURES

The majority of the participants reported that they would not like a LAN option or chat function included in the game. The data indicate that they enjoyed the isolated personalised experience of the game while interacting with the characters in it. It might be that the integration of options to share these experiences with their peers would cause the personalised educational experience to lose some of its value.

e) ACCESSIBILITY

When asked questions about whether they would like to have the game made accessible to them after the experiment, the responses varied greatly, but do not seem to indicate that they would like to be able to access the game in their own time. In hindsight, it was realised that this could be because they feel that they have completed the game and experienced everything it has to offer, much like practising with written questions. A point for future research would be how to incorporate greater variability into the game itself in order to increase the number of educational experiences it offers and therefore prolong its lifetime of usability. In this case, a better question might have been "I would like to have access to games like this one on other topics in the syllabus".

6.4 SUMMARY

This chapter discussed the research method and design that were followed in order to gather data regarding the perceptions of students of the educational game designed as part of this study to be used in auditing education. It discussed the way in which the study was performed as well as the way in which the questionnaire was developed.

The results of this data were also reported and interpreted as follows:

Section A of the questionnaire was completed by both the control and the experimental groups and set out to measure the background information of the two different groups of participants. It was found that there were no significant differences between the experimental and control groups and that both groups were representative of the total population.

Section B of the questionnaire was completed by both the control and the experimental groups and set out to measure the students' perceptions of auditing education. It was confirmed that the students generally felt that auditing is a difficult subject, which they deal with by learning the content by heart. There were only two instances of significant differences in answers between the two groups and this related to the participants' understanding of the auditing process. The control group felt more confident regarding their understanding of the auditing process than did their experimental group 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.

Section C of the questionnaire was completed by both the control and the experimental groups and attempted to measure the perceptions of the case study (for the control group) or the educational game (for the experimental group) as a teaching aid. A factor analysis was performed in order to interpret these data more reliably. The participants of the experimental group reported significantly higher levels of comfort, engagement, joy and development of workplace and application skills, while they reported the same levels of educational value, examination preparation and fascination. The educational game was therefore perceived to have the same educational value and value in examination preparation, but the participants enjoyed the experience more, reported developing more skills and felt a higher level of comfort than did their control group peers.

Section D of the questionnaire was completed by both the control and the experimental groups and set out to encourage the participants to record their self-assessment in terms of learning outcomes achievement. The control and experimental groups reported perceiving equal achievement of the learning outcomes. This is consistent with their answer in Section C, which reports that they perceived the two teaching aids to be of equal educational value.

Section E of the questionnaire was answered by only the experimental group and set out to measure the perceptions of the appropriateness of the computer game design. All

participants reported being computer literate and nearly all participants reported engaging in recreational gaming. The participants felt positive regarding the guidance, ease of use, tempo and integration of theory into the game. The aspect of the game they were most positive about was the educational tutorials, while they felt neutral about the aspects that should give rise to the joy reported in answers to Section C (for example competition). It therefore seems that it was the integration of all of these aspects that gave rise to joy and engagement when playing the game and not a specific joy aspect that can be pinpointed. The participants reported that they would not like any more social features integrated into the game, which could indicate that the social aspect that was chosen to be included (refer to goals and design considerations of the game in sections 4.3 and 4.4 in Chapter 4), namely animated and pre-programmed characters, was sufficient. They also reported that they would not want to have the game made available to them for use in their own time.

It was found that the students perceived the game to have the same learning value as the written case study, but that the 'gamification' of the theory added some enjoyment to the experience. In essence, the key findings of this experiment can be summarised as follows:

- It was confirmed that the participants' general feeling regarding the subject Auditing is that it is a fairly difficult subject that they deal with by learning the theory by heart (as supported by the literature review in Chapter 1).
- The experimental group that played the educational game experienced a higher level of joy and engagement.
- 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 did.
- Student perceptions indicate that the educational value and ability to support examination preparation are equal between the game and the case study method.
- The learning outcomes of the experiment were equally reached by the students who played the game and the students who completed the written case study.
- Therefore, it can again be concluded that no educational value was lost in the computerisation and 'gamification' of the case study.
- The overall feeling of the students who participated in the experimental group was that the game was properly designed and planned.

This chapter addressed Specific objective 7: Test the students' perceptions of the computer game as a learning tool by developing and administering a questionnaire (see Section 1.5.2 in Chapter 1).

The next chapter concludes on the findings of this study.