The ease of use and perceived usefulness of a selected computer game in expanding vocabulary in English among students at a university of technology

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Declaration

I, Matshafeni Lucas Lingwati, declare that this dissertation is a representation of my own work both in conception and execution.

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ABSTRACT

The need to utilize English in daily International communications within broad settings, such as business and academia, is accelerated by Information and Communications Technologies (ICT) and internationalisation. Internationalisation introduces the increased need (through ICT) to communicate through a common language (global language) and English has evolved into such a 'global language'.

There is evidence in the literature indicating that teachers assume that students have the educated 'guessing skill' in the ability to read and write efficiently in English. Literature further proves that limited ESL proficiency is still a major drawback for the efficient and effective use of English as a medium of instruction both in academe and in other industries. Therefore, the current study postulates that interventions such as perceived educational themed computer game playing could facilitate English vocabulary improvement; an approach believed to be more appealing to the students of this ICT-dominated world than traditional rote learning. As a result, students of the Internet age more receptive towards vocabulary conveyed through ICT tools, as opposed to traditional printed texts. The focus of this study was on the utilization of an ICT tool in the form of a computer game in supplementing teaching and learning of English vocabularies.

This quasi-experimental mixed methods' research used seven research instruments that incorporated both qualitative and quantitative data collection methods. This research attempted to investigate the effectiveness of a selected computer game on English vocabulary improvement using engineering students (participants) that served as either the control or experimental groups. Data analysis tests, such as Wilcoxon Signed Ranks, Chi-Square and Paired Samples T-Test assisted in analysing the data collected for this study. The significant findings of this study indicate that the study's selected computer game was easy to use and useful, because there were improvements in English vocabulary amongst participants resulting from the game. Further lessons learned from this study confirm that ICT relevant tools (such as this study's computer game), do complement teaching and learning. These findings also align with the study's theoretical framework by indicating that

perceived ease of use and usefulness of the study's selected computer game have an influence towards English vocabulary improvement.

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Abbreviations

AWL	Academic Word List
CALL	Computer Assisted Language Learning
CLIL	Content and Language Integrated Learning
CPE	Computer game Playing Experiment
ESL	English as a Second Language
EVT	English Vocabulary Test
HEP	Heuristics Evaluation for Playability
ICT	Information and Communications Technology
IREC	Institutional Research Ethics Committee
ITSS	Information Technology and Support Services
MMORPG	Massively Multiplayer Online Role-Playing Games
MOO	Multiuser Object-Oriented
NBC	Narrative Based Control
PEOU	Perceived Ease of Use
PU	Perceived Usefulness
TAM	Technology Acceptance Model
UID	User Interface Design

Research outputs

Proceedings

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CHAPTER 1

INTRODUCTION TO THIS STUDY

1.1 Introduction

The current study's background focuses on the importance of English vocabulary in day-to-day global educational and or business related communications. The dominance of Information and Communication Technologies (ICT) play an important role in facilitating and making such communications effective amongst societies. As a result, the research field and subject area of this study emanates from this background with a particular focus on ICT and teaching and learning of English vocabularies in classroom environments of tertiary institutions. Therefore, this chapter starts by presenting the background of this study, followed by the research field and subject area, and the problem statement. This chapter further presents the research questions, aim and objectives of this research.

1.2 Background of the study

English communications among the people, corporations and governments of different countries has no boundaries. On the other hand, increased globalization introduces increased need to communicate through a lingua franca (global language) and the role of such a 'global language' has been granted to English (Marsh, 2006). Internationalisation is interestingly described by the Online Oxford English Dictionary, as "the process by which businesses or other organizations develop international influence or start operating on international scale." On the other hand, the Online Oxford English Dictionary, further defines lingua franca as "a language that is adopted as a common language between speakers whose native languages are different", hence, a 'global language'.

The need to utilize a lingua franca such as English in daily broad settings of communication (such as business and academy) is further accelerated by information and communication technology (ICT), in the current age. ICT aids the free flow of

information which needs to be commonly understood (Oulton and Srinivasan, 2005). Through ICT, individuals, businesses and organizations can communicate in harmony.

According to Law (2003), globalization and ICT have made a serious impact on schools' systems worldwide and, as a result, such an impact also has effects on students' global viewpoints. There is, therefore, a need for the development of global competencies, such as the English language communication abilities and ICT usages, amongst the global students' community. Furthermore, according to Matsuda (2003), English is an international language, simply because it is taught and learned in many countries worldwide for the purposes of enhancing verbal and written communications amongst native English speakers and English as a second language (ESL) speakers. This is needed in order to achieve commonalities in global organizational or business communications. Matsuda (2003) further states that, in the teaching and learning processes of English as an international language, ESL teachers or teachings should address common global issues (such as history, nature, health, human rights, world peace, and power inequality) within internationalization and globalization, cultural and national contexts. Marsh (2006) further confirms English and ESL as a medium of instruction even in the classroom context. Therefore, the focus of this study is on the utilization of an ICT tool within a classroom context of universities of technology in facilitating teaching and learning of English vocabulary. It is worth noting that universities of technologies may share common characteristics and vary in some characteristics. However, this study uses a University of Technology both for data collections and experiment because attracts students that have inadequate English vocabulary. As a result, that share this particular set of student populations may greatly benefit from the findings of this study.

1.3 Research field and subject area

The research field and subject areas of this study are ICT and teaching and learning. ICT is described by Elisha (2006) as an umbrella of communication devices and/or applications that are capable of creating access to information and, therefore, facilitate communication. Furthermore, according to Karthikeyan (2013), ICT encompasses tools that could be classified as audio form, visual form, websites, multimedia and software packages, amongst others. On the other hand, teaching and learning is described as professionally developed programs that encompass complex characteristics of ethnic groups that facilitate equitable opportunities for students to learn and construct knowledge in various contexts such as linguistics, sociology, politics and economics (Banks *et al*., 2001). According to Banks *et al*. (2001), learning opportunities for the students must further encompass, amongst others, safe and orderly learning environments through currency of learning resources and information technology, made available to the students. Therefore, information technology-supported learning resources can be pictured as ICT that facilitate teaching and learning. Karthikeyan (2013) further identifies various types of learning that could be achieved through teaching that encompass ICT-aiding resouces. These types of learning include perception, stimulus-response, relational and observational learning. These learning types are amongst the explorations of this current research study.

According to Wojtowicz *et al*. (2009), many teachers (93.1 % of 238 Content and Language Integrated Learning (CLIL) teachers and practitioners from thirty European countries) believe in the benefits of ICT on the effectiveness of their teaching and in the students' involvement in the process of learning. This is because ICT is creating a new trend in the teaching methodology of education (Karthikeyan, 2013). The effectiveness of ICT on the learning environment is also confirmed by Ponnudurai (2011) who adds that the 'Net Generation' students (students born and bred in the Internet age) are more receptive towards learning vocabulary online as opposed to traditional printed texts; this is just an example of an ICT usage towards a teaching and learning process of vocabulary improvement type.

1.4 The problem statement and demarcation of the problem

The foundation of any language is its vocabulary, but many teachers consider the importance of English vocabulary teaching to be secondary (Greenwood, 2004). The inadequate use or emphasis of English vocabulary teaching and learning methods seems to be a problem in the primary to higher education spheres in most parts of the world where English is spoken non-natively. Beck, Mckeown and Kucan (2002:2) confirm that there is slight emphasis on the attainment of vocabulary in school syllabuses. This particularly a case in the South African context (Brock-Utne and Holmarsdottir, 2005; Probyn, 2010). Theorists such as Deaney, Ruthven and Hennessy (2003) and Horst *et al*. (2005) further concur that university students come across unfamiliar text in English academic writings.

Laufer (1981) stated earlier that teachers assume that students have both the educated 'guessing skill' in the ability to read and write efficiently. To assert and extend on this point, Greenwood (2004) further states that teachers simply assign vocabulary learning tasks instead of teaching vocabulary. According to Greenwood (2004), teachers mistake vocabulary teaching for spelling instruction and, therefore, do not know how to teach vocabulary in terms of other aspects such as meaning of words in particular contexts. They, therefore, do not spend time on the teaching of vocabulary (Greenwood, 2004). Greenwood (2004) further states that one needs to acknowledge that, in addition to traditional contextual vocabulary teaching techniques, students can still learn English vocabulary through other informal techniques. These include incidental words' learning and read-aloud and shared reading activities. Incidental words' learning activity is, in particular, the focus of this research study.

Furthermore, Brock-Utne and Holmarsdottir (2005) state that some teachers practise what is referred to as code-mixing and code-switching when teaching vocabulary. This means that both the teachers and students use whatever language they are comfortable with, in English vocabulary teaching and learning activities. Brock-Utne and Holmarsdottir (2005) explain the concept of code-switching as being an 'intersentential' activity whereby the switch in languages (between

native language and English, for example) takes place between sentences. On the other hand, code-mixing is explained by these researchers, as an 'intrasentential' activity whereby the switch in languages (between native language and English, for example) takes place within a particular sentence. Therefore, code-switching and code-mixing activities suggest minor vocabulary teaching and/or learning opportunities (particularly where English, the lingua franca, is concerned), as there is much likelihood of words and contexts losing their meanings if they don't make sense at all to the learners. Hence, most students are not competent enough with English vocabulary to interpret and understand most English-based academic text (Horst, Cobb, and Ioana, 2005). The end results of such incompetence are high academic failure rates and other lifelong consequences such as inability to adequately engage in workplace communications (Bugwadia, 2010; Stephen, Welman and Jordaan, 2004).

According to Andrade (2009), the majority of students hope that their English (especially second language speakers) will improve through some course work in English. There is, therefore, a need to improve English vocabulary teaching methods and one exemplary method to assist in such improvements is to use ICT tool(s). Therefore, the current study postulates that interventions, such as a (the study's selected) computer game, could facilitate English vocabulary improvement if such a game is well incorporated in one of the courses of study; an approach believed to be more appealing to the 'Net Generation' students.

Literature presents evidence of attempts made for the improvement of English vocabulary using ICT; however, only a few research efforts have explored English vocabulary improvement through ICT in South Africa. All the studies conducted in the South African context focused only on perceptions of traditional teaching and learning methods and on how these methods can be improved (Setati, Alder and Bapoo, 2002; Brock-Utne and Holmarsdottir, 2003; Probyn, 2010). However, this study explores the use of a specific type of ICT, namely, a computer game, for English vocabulary improvements. Computer gaming technology usage for English vocabulary improvement is presented in an angle that has been explored only outside of South Africa. It is therefore, inappropriate to adopt the successes of studies that were done outside of South Africa since

South Africa is a multiracial and multicultural country that possesses and attracts the majority of English as a second language speakers; most of which have inadequate English vocabulary. However, this study attempted to investigate the use and measured performance impact of computer gaming technology on the teaching and learning of English vocabulary within the South African context, in order to take advantage of diversity within this country and to strengthen the findings of this study.

As it is stated above, some of the problems that contributes to lack of adequate English vocabulary and competence in English communication therefore, is the lack of commitment from teachers and code-switching in the classrooms amongst others, it is hoped that computer gaming technology will change the teacher-student asymmetry of the conventional classroom García-Carbonell *et al*. (2001). According to Garcia-Carbonell *et al*. (2001), computer games tend to correct this asymmetry by introducing authentic communication, i.e., communication facilitated by informal talk or argumentation in a situation of equality; suggesting a balance between traditional and ICT-based (computer gaming, in particular) teaching and learning techniques. Literature reviews conducted by García-Carbonell *et al*. (2001) and Peterson (2009) share a common conclusion that some computer gaming technologies present valuable opportunities for effective language learning, since they have some amount of exposure to language interactivity. This suggests that foreign language learners, who participate in various computer gaming activities, are likely to receive a lot of comprehensible language input that is a slight step beyond the learners' present level (García-Carbonell *et al*., 2001).

1.5 Purpose and significance of the study

This study extends on the successes (presented in the next chapter on literature review) of international research studies that used computer gaming technology for the improvement of English vocabulary, in the higher education sphere. In particular, this study explores the use of a selected computer game, its usability, and perceived usefulness in an attempt to expand English vocabulary among university of

technology tertiary students. The said computer game is also observed during gamer activities and assessed for its contribution towards English vocabulary improvement.

Therefore, this study conceptualises the use of ICT aided teaching and learning through relevant computer gaming technology in the context of English vocabulary learning and acquisition. In particular, this study is dominated by the use of a selected computer game as an ICT tool that can be utilised in a classroom environment for the purposes of enhancing or supporting teaching and learning. The purpose of this study is further elaborated by the fact English vocabulary improvement is measured through perceptions of participants on the impact of the study's selected computer game by participants and also through English vocabulary based assessments at both pre and post interventions. This means that English vocabulary improvement in the context of this study is the positive significant differences between pre and post interventions English vocabulary assessments results. On the other hand, perceived impact of the study's selected computer game was also investigated, where perceived impact can be defined as effect or influence that the study's selected computer game may have on English vocabulary improvement (Yunus et al., 2009).

The study's selected computer games' usability also contributes as one of the concepts of this study. Computer gaming usability in the context of this study is defined as satisfaction of users on the effectiveness and efficiency of a software product in a particular workplace context or environment (Federoff, 2002). On the other hand, the study's selected computer game's ease of use and usefulness were investigated through gamer perceptions. Perceived ease of use is defined as a determinant factor of the gamers' perception on the extent to which playing a selected computer game will be free of effort (Vanketash and Davis, 2000). The study also gathers perceptions on the usability of the selected computer game, where such usability can be defined as fun that results from a challenging computer game with good goals to be attained by the game player (Barendregt et al., 2003). Moreover, perceived usefulness is defined as the degree to which a person (learner) believes that using a particular system (selected computer game) would enhance his

or her job performance (English vocabulary improvement) (Vanketash and Davis, 2000).

It is hoped that the findings and recommendations of this study will provide useful guidance in English vocabulary improvement exercises for South African Higher Education institutions or even lower institutions of teaching and learning.

1.6 The questions, aim and objectives

This study's main research question is:

What is the measured impact and students' perceptions of the ease of use, usefulness and the impact of a selected computer game on the improvement of English vocabulary for ESL tertiary institution students?

The following sub-questions were, therefore, investigated in this study:

I. Which elements or characteristics (e.g., clarity of game instructions, game mechanisms, graphics, etc.) of the selected computer game were useful towards English vocabulary improvement, through perceptions?

II. What are student perceptions on the ease of use, usefulness and the impact of the selected computer game on English vocabulary improvement?

III. How does the performance in English vocabulary assessment gained compare between students who play the selected computer game and students who study English vocabulary the traditional way?

The aim of this research is to assess the perceived ease of use, playability, impact and usefulness, of a selected computer game, namely, ***The Agatha Christie 4:50 from Paddington*** (detective role-based game), on or towards expanding the existing English vocabulary among tertiary institutions' students. Perceived ease of use and usefulness of the selected computer game are factors of TAM 2, as elaborated in Chapter 2 (Section 2.6) below. On the other hand, playability of the study's selected computer game refers to a collection of criteria with which to evaluate the selected computer game's interaction with the game player. The components of playability are also elaborated in Chapter 2 (Section 2.6). Impact of the study's selected computer game can be described in two forms, in the context of this study, as follows:

I. Impact measured through statistical significant improvements (lack of improvements would mean no impact) from the pre to the post-test performances of the study's English vocabulary assessment, attempted by research participants.
II. Impact measured through participants' perceptions on the impact of the study's selected computer game on English vocabulary improvement.

In order to achieve the above aim, this study attempts to address the following objectives:

I. Identifying the perceived mechanisms or characteristics through playability heuristics of the game that could enable students to expand their academic English vocabulary.
II. Investigation of the perceived ease of use, usefulness and impact of the selected computer game towards English vocabulary improvement.
III. Investigation of the impact of the selected computer game on students' English vocabulary competence by ascertaining the level of the students' English vocabulary competence through a designed English vocabulary test, at the pre- and post- intervention period.

1.7 Outline of the study

Chapter 1 – Introduction to this study

This chapter (the current chapter) introduces and accentuates this research study, through the presentation of the research field and subject area, problem statement, aim, research questions and objectives.

Chapter 2 – Literature review

This chapter reviews existing research and literature on:

I. Internationalisation of English and English as a language of instruction;
II. Traditional ways of English vocabulary teaching and learning;
III. The use of ICTs in the teaching of vocabulary;
IV. Computer game design; and
V. The theoretical framework underpinning this study.

Chapter 3 – **Research methodology design**

Chapter 3 of this study presents the research design and methodology used in this research. This chapter describes the design of the research instruments used to collect data that aided in addressing the research objectives, questions and, eventually, the main aim (stated in 1.6 above).

Chapter 4 – **Research methodology implementation**

Chapter 4 presents the administration of research instruments and activities that facilitated data collection, cleaning and capturing. This chapter also elaborates on the data analysis techniques that were employed to deduce results from the gathered data.

Chapter 5 - Data results presentation and interpretation

This chapter presents and discusses the descriptive and detailed inferential statistical and focus group findings of this study. These findings show how or to what extent the research questions of this study were answered and also the extent to which the study's objectives were met.

Chapter 6 - Conclusions and recommendations

This chapter concludes the study with respect to objectives achieved and/or explains why they were not achieved. Recommendations presented in this chapter further address the implications of the findings of this study with regards to computer gaming technology usage towards the improvement of English vocabularies; such as what computer game characteristics to look at, how to administrate future intervention studies or activities and avoid limitations experienced in the current study.

1.8 Summary

English is a global language that facilitates communications around various global aspects, through the aid of ICT. However, it appears that the teaching and learning of English vocabulary in the schooling systems around the world is not practised adequately. Hence, the purpose of this study is explore the use of a selected computer game in an attempt to expand English vocabulary among tertiary students. It was therefore empirical to review the body of knowledge around the scopes of this study in order to get the groundings and research gaps clearly outlined for this study.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

English is a ubiquitous language of instruction in the classroom settings in many countries around the world, inclusive of South African context (Dearden, 2014). Along with this predominance, there is a need for non-English speakers to learn this chief language as a second language (ESL). Due to this predominance, despite the fact that many students' backgrounds are non-English, the need for ESL enables students to understand what is being taught.

This chapter starts by presenting theories around the subsets and predominance of this lingua franca as a classroom language, i.e., medium of instruction in an academic classroom setting. In conjunction with theories on English vocabulary teaching and learning methods, this chapter also explores theories of teaching ESL with ICT and use of computer games. In particular, this chapter presents the successes in incidental learning of ESL vocabulary through computer gaming, the characteristics that are deemed the most important towards enhancing learning through computer games and computer games' design guidelines that enhance playability of computer games. Finally, the chapter ties the Technology Acceptance Model called TAM 2 with Heuristics Evaluation for Playability (HEP) in order to support the incidental learning hypotheses of this current study.

This study was conducted within this framework because of the ICT tool specific competency towards specific incidental teaching and learning activity, namely, English vocabulary improvement through a computer game. In a nutshell, TAM2 is meant to measure the acceptableness of the study's selected computer game as a tool to assist in English vocabulary improvement. Lastly, HEP is used to evaluate the playability of the study's selected computer game in accordance with its player friendliness towards English vocabulary improvement.

2.2 The English language and its subsets

A literature review was conducted by Patil (2006) aimed at presenting a wide view of the nature and role of English in Asia. Patil (2006), Rajadurai (2007) and Mete (2009) explicitly concur that the English language was initially divided into three circles, namely, the inner circle where English is a native language, the outer circle where it is a second language, and the expanding circle where it is a foreign language. However, this three-circle model has not only been criticized by theorists but also been disapproved by the diffusions of the English language.

The above mentioned theorists conducted similar literature reviews (reviewing different linguistic issues) and they all concur that the English language is now cultures-oriented and has earned both global and local (country, culture or norms) status and further earned names such as Indian English, Filipino English, South African English, and so on. This implies that English has borrowed words and often grammar from other languages and as a result, multiplying to other English subsets. Gun (2009) states that none of the English versions is "correct", however, common vernacular is what seems to be important in ESL proficiency. Gun (2009) draws these conclusions from a mixed-methods' study aimed at exploring students' and teachers' level of vocabulary knowledge in two main dialects of English, i.e., British and American English.

One can elaborate on common vernacular in relation to what Le Ha (2007) refers to as Standard English: defined as the natural language that educated native English speakers use. Moreover, the study conducted by Gun (2009) suggests that the so called Standard English is mainly made up of the British and American English. This is because professors interviewed by Gun (2009) indicated that the majority of academic texts used in their academic professions were written in either British or American English. Gun (2009) further confirms the findings of the exploratory survey conducted by Sato and Suzuki (2007); aimed at exploring the possible factors of dialect preferences by Anglophone (a set of English-speaking nationals with a similar cultural heritage, based on populations originating from England, Wales, Scotland and Ireland) speakers. Sato and Suzuki (2007) found that some non-native

speakers of English tend to consider the centre variants of British or American English as their model of English usage.

2.3 English as an International Language and Medium of Instruction

English is an international language for communication purposes in a large number of organizations across the world. It is, therefore, important for non-native English speakers to, at least, know English as a second language (ESL) (Llurda, 2004). In consequence, English has become a dominant medium of instruction in the majority of academic institutions in South Africa and around the world (Andrade, 2009; Nel and Muller, 2010). Literature proves that limited ESL proficiency is still a major drawback for the efficient and effective use of English as a medium of instruction for both teachers and learners (Probyn, 2010; Setati *et al*., 2002; Stephen, Welman and Jordan, 2004; Setati, 2008; Andrade, 2009; Nel and Muller, 2010).

According to Probyn (2010), videotaped lessons and interviews of five township schools' teachers in South Africa revealed that students' English proficiency was generally poor. Probyn (2010) further states that this poor proficiency is due to the practice of code-switching (change between two or more languages in the context of one conversation) of English and their (teachers' and students') mother tongue during English-based lessons. Similarly, data collected in a form of transcribed interviews, teacher narratives, lessons' videotapes and questionnaires from ten urban and rural primary and secondary schools in South Africa revealed that code-switching is an intentional practice by both teachers and learners of mathematics, science and English (Setati *et al*., 2002). Brock-Utne and Holmarsdottir (2005) explain the concept of code-switching as being an 'intersentential' activity whereby the switch in languages (between native and English, for example) takes place between sentences. On the other hand, code-mixing is explained by these researchers, as an 'intrasentential' activity whereby the switch in languages (between native and English, for example) takes place within a particular sentence.

However, interviews conducted by Setati (2008) on five grade 11 students found that even though both teachers and learners practised code-switching and multilingualism, learners still preferred English to their home language as a language of learning and teaching, despite lack of ESL proficiency. According to Setati (2008), the students' preferences were due to the social advantages that come with the ability to communicate in English. This implies that the students see the importance of being equipped with English vocabulary, for the purposes of effective global communications, where English is used as a common language. However, practices such as code-switching are putting them at a disadvantage of English vocabulary inadequacy.

A comparative study conducted by Stephen *et al*. (2004), in South Africa, used groups of African and Indian students, enrolled between 1996 and 2002 for a National Diploma in Human Resources Management, to determine the impact of English language proficiency on academic success for first year students. Stephen *et al*. (2004) found that students' low English marks, obtained in high school, contributed to high academic failure rates and "drop outs" (unexpected school leaving, sometimes due to failure rates). Furthermore, Andrade (2009) collected data from interviews, focus groups and surveys of 36 non-native English speakers (who were university undergraduates) to examine how English language proficiency affects academic and social adjustments, amongst other factors. The data collected by Andrade (2009) confirms, after analysis, that limited English language proficiency affects students' experiences at tertiary institutions in a variety of ways; one of which is interactions in classroom academic settings. Another study, conducted by Nel and Muller (2010), examined portfolios and analysed questionnaire data submitted by final year ESL student teachers enrolled at a distance teaching university for the Advanced Certificate in Education: inclusive Education. The results from the qualitative component of the research conducted by Nel and Muller (2010) indicate that various forms of English language errors such as writing errors were transferred to learners. In terms of tertiary level students' English proficiency improvement, Boroujeni and Ketabi (2012) suggest that undergraduate students need English classes that will help them to improve their technical vocabulary, reading, and

translation skills. There is, therefore, a need for the emphasis on the teaching and learning of English vocabulary in the academic sphere.

2.4 English vocabulary teaching and learning methods

2.4.1 Traditional English vocabulary teaching and learning strategies

According to Kinsella, Stump and Feldman (2002), successful language comprehension depends on the reader's knowledge of word meanings in a particular reading context. They conducted a literature review that presents strategies for vocabulary development. In their review, they criticize the following traditional teaching practices for their weakness in lack of active student involvement in learning new concepts or meaning in vocabulary:

I. Looking words up in dictionaries, especially during writing, with the act of just looking and copying the word definition;
II. Using words in a sentence, particularly without understanding the meaning of the word first; it's pointless;
III. Learning from context that is used in mere advice to do the reading, i.e., context learning becomes effective if it is coupled with instructional guidance; and
IV. Memorization of definitions.

A mixed-methods' study, conducted by Pichard (2008), focused on examining the use of a dictionary by Japanese university students to determine how selective these students are when reading nonfiction English texts for general comprehension. The findings of their study suggest (and concur with those presented above from Kinsella, Stump and Feldman (2002) that communicative language instruction may improve the efficiency of students' dictionary usage. This conclusion was informed by facts found in literature reviewed by Pichard (2008), in that, more often, using a dictionary, while reading, can lead to inefficient learning of new words. This is because the learner would merely memorize word definitions without relating the new words to the other words in the entire sentence. It is during such rote learning activity that instructional guidance intervention from educators is required in order to

promote selective dictionary usage in order to promote efficient retention of new words.

Huang and Eslami (2013) concur with Pichard (2008) and indicate, through their survey, that learners, who consult a dictionary for vocabulary learning, most often learn pronunciation rather than the meaning and appropriate usage of the (new) word. Their study's aim was to provide insight into the use of dictionaries and contextual guessing by advanced English-language learners, from the South Western University in the United States of America. They further found that, in terms of contextual vocabulary learning, learners used the main idea and background information to formulate their guesses; meaning they developed their own relationship between new words and other words in a sentence, and/or a relationship between a sentence's word and a conjunction. Their study also further confirms the findings of the study conducted by Kinsella, Stump and Feldman (2002) in terms of their criticism towards inappropriate usage of dictionaries and contextual vocabulary learning and also the inappropriate usage of words in a sentence.

The efficiency of any traditional vocabulary teaching and learning strategy appears to merely depend on its thorough usage (Kinsella, Stump and Feldman, 2002). However, for the interests and nature of this study, the following sections review the few significant (popularly known and practised) strategies, namely, contextual and non-contextual, incidental and ICT-based vocabulary teaching and learning strategies.

2.4.2 Contextual and non-contextual English vocabulary teaching and learning strategies

Of the various vocabulary teaching strategies available, Nielsen (2003) states that, according to recent literature, teaching of words out of context is advisable but a more context-based vocabulary teaching should take place at later stages of language development. Thus, words taught in context are, at a later stage of language development, retained better than when taught through incidental (out of context) vocabulary learning. Koren (1999) asserts further that teachers need to play a vital role in intentional teaching of English vocabulary and these teachers must be

lexically knowledgeable (knowledgeable in vocabulary, words and morphemes (speech elements having a meaning or grammatical function that cannot be subdivided into further such elements) of a language. Teachers are also expected to be aware of various vocabulary teaching practices in order to help in delivering vocabulary education to the learners; thus making good instructional decisions (Newton, 2001).

As a consequence, so far, literature shows that there is a need for great teacher intervention in ESL teaching and learning developments. A study conducted by Newton (2001), examined data from classroom tasks where learners had to learn new words without teacher intervention or dictionary consultation. He found that learners were ill-equipped to carry out tasks and needed teacher intervention; suggesting that an additional teaching and learning technique is necessary.

A literature review, conducted by Nielsen (2006), differentiates, among others, between contextualized and decontextualized English vocabulary teaching and learning. This comparative literature review confirms that many English language professionals concur that a contextualized approach to English vocabulary teaching and learning is the most effective, especially when coupled with instructional guidance (Kinsella, Stump and Feldman, 2002). In support of the current research study, Neilsen (2006) further shows that mnemonic decontextualized English teaching techniques are superior in sentence construction and facilitation of recalling of words. Mnemonic English vocabulary teaching and learning can be described as technique(s) that involve the use of both visual and verbal mental imagery in attempts to relate a word to be learned, with some previously (or recently) learned language. Furthermore, Gülseçen and Kubat (2006) state that associating a vocabulary term with an image (presenting the learner with non-linguistic representation of the new word) is one of the most effective means to learn a new word. Hence, this current study utilizes a research tool (a computer game, in particular) that incorporates images that need to be identified through given words, throughout the game.

2.4.3 Incidental versus intentional English vocabulary learning

Shokouhi and Maniati (2009) argue that readers' incidental English vocabulary learning depends on the type of a text, different complexities of various texts and varying degrees of reasoning elaboration for the task of comprehension. They concluded, after conducting an experimental study made up of two groups, namely, the Narrative Group (participants who read a narrative) and the so called Expository Group (participants who read expository text (texts that are less cohesively organized by temporal and causal connections, thus demanding more explicit logical inference)). The participants in this study were 40 Iranian English Foreign Language students, split into equal halves for the aforementioned groups. Their study found a relative superiority of expository texts over narratives in terms of enhancing readers' incidental acquisition of unknown words. Similarly, research participants in the current study were expected to practise logical inference of the computer game's storyline, through the printed computer game guide and the computer game playing activity.

On the other hand, a study conducted by Xu (2010), concludes and confirms that a better comprehension of texts leads to a higher rate of incidental vocabulary acquisition of word knowledge. The study conducted by Xu (2010) aimed at finding out if the three different types of glossing (interpreting) in both Chinese and English, glossing in Chinese, and glossing in English, exert effects on the incidental vocabulary acquisition through reading. Their study's research activities are different from code-switching in that, instead of deliberately constructing a sentences that contains both the native language's words and English words, the whole sentence is being interpreted from one language to another. The study further found that glossing in both Chinese and English is the most effective in enhancing the word knowledge in both the immediate retention and in the delayed retention. In this current study, participants were, therefore, expected to interpret the computer game storyline in conjunction with the printed computer game guide to, at least, incidentally gain immediate retention of any new words they may come across and also words that they happen to have never known their meaning.

Another comparative and experimental study, conducted by Ahmad (2011) on 20 Saudi ESL learners' ability to understand, retain and use new words actively in different situations, aimed to achieve a comparison of intentional and incidental vocabulary learning. Two types of tests (one intentional and the other incidental) were administered to two halves of the research participants. In particular, the intentional vocabulary test was made up of synonyms, antonyms, crossword puzzles and word substitutions, while the incidental vocabulary test was attributed to reading passages and contextual sentences. The statistical results of the study, conducted by Ahmad (2011), demonstrated that the incidental test type performed significantly better than the intentional test type. Furthermore, Ahmad (2011) concludes that the incidental vocabulary technique would be a better method for teaching and learning vocabulary items to students, as compared to the intentional vocabulary technique. Ahmad (2011) further criticizes intentional vocabulary items as being prone to cramming rather than involving the learners' cognitive process of learning. This current study, however, hopes to assess intentional vocabulary learning through an English Vocabulary Test that entails fill in the blanks, synonyms and images to words' mapping. This assessment takes place after, hopefully, successful incidental learning activities (reading of the printed computer game guide and computer game playing activity); a somewhat balanced usage of the two approaches.

Li (2013) advocates a balanced usage of both intentional and incidental English vocabulary learning modes. Li (2013) used 225 Mandarin Chinese native speakers from TG University (in China) to investigate and compare word-learning methods in two modes of learning, i.e., incidental and intentional learning. The findings of the study, conducted by Li (2013), report, amongst others, a significant superiority of intentional learning to incidental learning of vocabulary. However, Li (2013) further argues that there is a peripheral degree of conscious attention in incidental learning as compared to focal attention in intentional learning and this compels Li (2013) to advocate the balanced usage of the two modes of vocabulary learning.

2.4.4 Use of ICT in ESL teaching and learning

Literature shows evidence of many studies that were conducted on the use of ICT in education, in general, and in specific educational aspects, such as ESL teaching and learning. According to Andrews *et al*. (2006), information and communications technology (ICT) is best seen as another tool in the range of learning assistive techniques available to learners and teachers, for expression and communication. Furthermore, according to Yunus *et al*. (2009), the rapid growth of ICT introduced some degree of diffusion of technology in education. They further state that it is believed that ICT would bring more learning advantages to students, if used under the right circumstances.

In a study conducted by Deaney *et al*. (2003), interviews of students from six high schools in the United Kingdom revealed that these learners perceived computer-based tools and resources as being helpful and motivational towards their vocabulary learning. Another survey conducted by Bakar *et al*. (2010) used 197 students, who were registered for a compulsory English for Social Sciences course, to determine the usefulness of the activities embedded in a blogging (a Web-based form of communication) course. The results of the study conducted by Bakar *et al*. (2010) show that students perceived the blogging activities to be a great contribution to their English second language skills such as writing and reading.

A study conducted by Yunus *et al*. (2013) aimed at identifying both advantages and disadvantages of using ICT in teaching ESL reading and writing; using 23 secondary school English teachers as interview research participants. As per teachers' opinions, attracting students' attention, facilitating students' learning process, helping to improve students' vocabulary knowledge and promoting meaningful learning were regarded as the most important advantages of using ICT in teaching ESL reading and writing (Yunus *et al*., 2013). It is, therefore, believed that an ICT tool, in the form of a computer game in this current study, can assist in confirming the aforementioned opinions. However, disadvantages stated by these teachers included the difficulties in classroom control and students' distraction as well as their tendency to use short forms in writing tasks. In another study, Yunus *et al*. (2013) investigate the use of ICT in the teaching of ESL writing skills in Malaysian secondary schools. Similarly,

they interviewed 33 English secondary school teachers from five different areas in Malaysia. The findings of their study revealed that the integration of ICT in the teaching of writing encouraged independence and self-discovered skills such as searching for educational-related materials online; as per teachers' opinions. On the other hand, they also discovered that classroom control (from teachers), distraction from learners and the improper use of short forms in writing tasks were disadvantages that came with the said integration of ICT in teaching activities.

Wang, Teng and Chen (2013) used a specific type of ICT, namely, an iPad App, to assist Taiwanese natives in English vocabulary acquisition. A total of 74 students from a private university in Taiwan participated in their study, through an 18-week lecture; in which participants were split into two groups (experiment and control). The experiment group used the iPad "Learn British English WordPower" App; an application meant to teach them British-based English vocabulary. According to Wang *et al*. (2013), the said application has about 2 000 words and phrases meant to facilitate English vocabulary learning through spelling, pronunciation, and images. On the other hand, the instructor used a traditional semantic-map method (a visual approach to vocabulary improvement that displays categories of words that are related to one another) to teach English vocabulary to the control group. Results of their study showed that the experiment group performed better in the post-test. Moreover, a literature review, conducted by Sharndama (2013), confirms that ICT encompasses several devices, such as iPads/tablets, and educators can manipulate such devices and their relevant software applications to facilitate and deliver learning activities and evaluation; particularly in the teaching and learning of English vocabulary. Furthermore, according to Ma and Kelly (2006), any computer-assisted teaching and learning method, such as an online computer program and computer games with teaching and learning essence, can assist in English vocabulary acquisition. Hence, the motive of this study is to assess the usefulness and ease of use of a selected computer game for the improvement of vocabulary in English.

2.4.5 English vocabulary teaching and learning through computer games

The use of computer games for language teaching and learning found some ground in the body of knowledge for more than a decade ago. According to García-Carbonell *et al*. (2001), simulations and computer games, in particular, change the teacher-student asymmetry of the conventional classroom (a classroom within which the teacher decides who will talk, when, and about what they will talk). According to Garcia-Carbonell *et al*. (2001), computer games tend to correct this asymmetry by introducing authentic communication, i.e., communication facilitated by informal talk or argumentation in a situation of equality; suggesting a balance between traditional and ICT-based (computer gaming, in particular) teaching and learning techniques. Literature reviews conducted by García-Carbonell *et al*. (2001) and Peterson (2009) share a common conclusion that some computer gaming technologies present valuable opportunities for effective language learning, since they have some amount of exposure to language interactivity. This suggests that foreign language learners, who participate in various computer gaming activities, are likely to receive a lot of comprehensible language input that is a slight step beyond the learners' present level (García-Carbonell *et al*. (2001). García-Carbonell *et al*. (2001) specifically elaborate on simulation types of games in their research, while Peterson (2009) expounds that target language is embedded in network-based computer games and simulation. Furthermore, the study conducted by Peterson (2009), reveals that current multiuser object-oriented (MOO) domains or web-based simulated virtual worlds and stand-alone commercial simulation-based games serve as computer-assisted language learning (CALL) platforms. Peterson (2009) further highlights the following as CALL characteristics that are advantageous:

I. Realistic virtual environments;
II. Game scenario (provision of simultaneous feedback that raises awareness of the target language); and
III. Target language interface and commands which must facilitate the understanding of scenarios and feedbacks.

Furthermore, a study conducted by Rosasa *et al*. (2003) acknowledges computer-gaming characteristics that enhance learning amongst students. Their study was aimed at evaluating the effects of the introduction of educational videogames into the classroom, on learning, motivation, and classroom dynamics. They utilized a sample of 1 274 students from economically disadvantaged schools in Chile; a sample divided into experimental groups (EG), internal control groups (IC) and external control groups (EC). The experimental group played the experimental video game for 30 hours on average before participating in a post-test that assessed comprehension, amongst others. All research participants for the study, conducted by Rosas *et al*. (2003), were assessed on silent reading comprehension, reading level and writing of dictations, at both pre- and post-test. Study experimental participants were further evaluated on their acquisition of reading comprehension, spelling, and mathematical skills, and on their motivation to use video games. Results confirm an improvement in motivation to learn, and a positive technological transfer in the educational elements of video games.

Furthermore, computer gaming characteristics, highlighted by Rosas *et al*. (2003), include the following:

I. Demonstrative and practice-based gaming (enhances motivation);
II. Drill-and-practice gaming (improve achievement in performance);
III. Exploratory environment-based gaming (allows control over learning);
IV. Adequate and adaptive feedback in gaming;
V. Embedded cognitive strategies (to enhance thinking and problem-solving abilities); and
VI. Animated graphics (increased achievement and or reduced task time (faster way to get a task done)).

Therefore, the majority of the computer game characteristics, as outlined above, informed the choice of this study's selected computer game, as described in the methodology chapter (Chapter 3).

The literature presented, thus far, suggests that computer gaming alone cannot facilitate English language teaching and learning. However, computer gaming needs to be blended with some form of traditional methods of teaching and learning; such as the printed computer gaming guide that was provided to computer gaming

research participants for the current study. A study, conducted by Conati and Zhao (2004) on 20 grade 7 learners, found that computer games, on their own, cannot provide a valuable learning environment, but that such an environment can be made possible by including or introducing assistive components or materials, alongside playing computer games. According to Conati and Zhao (2004), this limitation is due to the fact that learning how to play the game does not necessarily imply learning the target instructional domain. As such, Conati and Zhao (2004) developed an assistive agent for an educational computer game called Prime Climb. Conati and Zhao (2004) describe the agent as a tool that gives (target instructional domain-based) hints on demand or unsolicited type of hints to the player, so as to assist the player in progressing in their game play. Similarly, this study's selected computer game provides hints to assist the gamers in progressing in their gameplay. In their study, they split the participants into experimental (played the game with the pedagogical agent) and control groups (played the game without the pedagogical agent). They administered a pre-test involving 7 multiple choice questions on finding common factors between two numbers. They then allowed the groups to play the game versions for 20 minutes, then administered the post-test. Results from their study show that the experiment group gained more than the control group (by a mean of 2.4, compared to 0.3 for the control group), where "gain" is defined as the difference between the players pre- and post-tests results. In a similar manner, this study will assess the effectiveness of the selected computer game (with built-in hints, as Conati and Zhao (2004) suggest) through pre- and post-tests and experimental and control groups. Moreover, a printed computer game guide, that incorporates targeted English vocabulary words, was given to the study's research participants.

It is further worth noting that Engenfeldt-Nielsen (2007), through an examination of various educational media and non-electronic games for educational purposes, suggests that computer games meant to enhance learning (in school curricular, in particular), should not have their fun meant part compromised by the learning activities, such as too much text and speech within the computer game. As a result, the choice of this study's selected computer game was guided by motivational factors that are identified and mentioned by Engenfeldt-Nielsen (2007); this study's selected computer game contains integral learning in a form of gathering investigation clues

that would lead to the identification of the murderer, i.e., a perceived desirable achievement for the players. Furthermore, the current study's selected computer game's hardcopy computer game guide was aimed at assisting the research participants with English vocabulary improvement, through game progression images that were accompanied by a short narrative of the computer game's storyline.

2.4.5.1 Use of computer games for English vocabulary teaching and learning in high schools and tertiary institutions

A literature review, conducted by Purushotma (2005), examined how content originally designed for entertainment purposes can be utilized for language learning environments, without sacrificing its entertainment value. An examination of *The Sims* (English version) computer game, for the learning of English claims that *The Sims* exposes learners to abundant second language vocabulary while still providing enough English as a first language content. *The Sims* (English version) computer game was one of the reviewed computer games for the purposes of this study. However, it was discovered that, even though the aforementioned computer game contained English language content (sufficient to facilitate English vocabulary improvement), it is not an easy computer game to learn to play; given the time constraints aimed at by the current study.

A limited participants' investigative study, conducted by Ranalli (2008) using a sample of nine intermediate-level English Second Language (ESL) learners enrolled at a major Midwestern research university, inspected whether *The Sims* computer game could be rendered pedagogically beneficial to these university-level ESL learners (included Mandarian Chinese, Korean, Arabic, Japanese, Spanish and Vietnamese natives). The study, conducted by Ranalli (2008), shows that there is evidence that commercially produced computer simulation games can, with theoretical guidance, be adapted for use by ESL students. Furthermore, Ranalli (2008) states that supplementary ESL materials (such as online dictionaries, vocabulary lists, [game] culture notes and instructions) used to support such play (all of which were used in their study) can contribute to vocabulary acquisition. Results of the study, conducted by Ranalli (2008), specifically indicate a 14% increase in the

average score from pre- to post-tests that were used to evaluate existing knowledge of the target words amongst participants.

Kam *et al*. (2008) re-designed a cellphone mobile-based game called the Frogger and Floored (aimed to develop animals' avatars' vocabulary in spoken English for learners) with user interface control facilitators. They tested the game using 47 students between grades 2 to 5 from a primary school in India. According to Kam *et al*. (2008), the study shows that the 47 learners scored an average of 1.96 out of 5 on the pre-test and 3.85 out of 5 on the post-test. Both the pre- and post-tests were based on identifying and naming pictures from the game; similar to one section of the current study's pre- and post-tests, but using tertiary students. Furthermore, Turguta and Irgin (2009) found that young learners who play online games improve their language learning and especially vocabulary skills. These young learners were in the 10 to 14 years' age group (studying at different schools in Mersin, Turkey) who were observed (three times lasting two hours per participant) while playing (in an internet café) *Knight Online World version*, *Counter-Strike*, *Grand Theft Auto: Vice City*, *Warcraft III*: *Reign of Chaos*, and *FIFA 08.* They later participated in semi-structured interviews. However, the qualitative study, conducted by Turgut and Irgin (2009), further reveals that very little is known about the instructional effectiveness of the computer games which the youngsters (participants) played. Their study further recommends the importance of attention to social context in computer games that are chosen for instructional purposes or perhaps the length of play required for a given vocabulary improvement milestone.

deHaan (2005) investigates and demonstrates how one intermediate Japanese-as-a-foreign-language (JFL) student improved his listening comprehension and kanji (Japanese characters) character recognition by playing a Japanese baseball video game. The participant, who took part in deHaan's (2005) study, was a 27-year-old American male who worked in a factory and went to college part-time. According to deHaan (2005), this participant claimed to have played video games for about 15 years, and enjoyed sports video games. For the purposes of the study, conducted by deHaan (2005), the subject played Nintendo 64 video game called *Powerful Pro Baseball 6* because of its popularity, rich authentic language, and the fact that the subject had never played it. This one-month study used interviews, observation, self-

reporting, and reading and listening to test data from the participant in order to assess his ability to learn some Japanese from a baseball video game. deHaan (2005) states that one of the limitations of the study was the use of one participant.

Reinders and Wattana (2011) also state that careful pedagogic planning of the use of computer games on language teaching and learning activity is of utmost importance.

On the other hand, Reinders and Wattana (2011) investigate the effects of playing a modified (translated from Thai to English) online multiplayer game (called *Ragnarok Online*), on the quantity and quality of second language interaction in the game and on participants' willingness to communicate in the target language (English, in this case). The participants were 16 fourth-year undergraduate Information Technology students, between 21-26 years of age, at a university in Thailand. All of them indicated that they had played MMORPGs (massively multiplayer online role-playing games) before and played digital games on an average of 27 hours per week. *Ragnarok Online* was integrated into a regular language course for three (90 minutes each) lessons, where approximately 40 minutes were devoted to computer game playing. The game was modified to purposefully contain scenarios, language and lexical items related to what students previously studied in class. Two types of data were collected: (a) transcripts of students' produced discourse were recorded using Skype Chat Recording or Skype Call Recording for evidence of their interaction and language use as they worked on computer game activities; and (b) students' responses to a questionnaire for evidence of their willingness to communicate. Reinders and Wattana (2011) conclude that digital games can indeed affect second language interaction patterns and contribute to second language acquisition and research participants were willing to communicate in English. However, the study conducted by Reinders and Wattana (2011) does not highlight other external factors (within the 27 hours per week of game play) that may have also contributed to second language acquisition.

None of the studies presented above mention or identify some level of boredom in relation to the use of computer gaming technology to assist in language teaching and learning. A pilot study, conducted by Dedeaux and Hartsell (2011), confirms that students prefer computer games that can be a merger to a teaching and learning environment, especially when learning new content compared to traditional modes

such as written text. Dedeaux and Hartsell (2011) explored differences in engagement, satisfaction, and Spanish language content learning among participants playing one of two different educational computer games, namely, *Shoot 'Em* and *Match 'Em*. Participants for this study included four college students who completed pre-tests, post-tests, and satisfaction/engagement questionnaires. These participants were not conversant or fluent in Spanish; however, they had some previous training in the Spanish language, having taken courses in high school. Furthermore, Dedeaux and Hartsell (2011) state that the rationale behind choosing the two games mentioned above for their study resides in the fact that the two games fall under the same software suite named *Buensoft Spanish 2004*; hence, the motive of their study was to improve students' Spanish vocabulary through the games. Their pilot study did not yield further significant statistical results due to the small number of participants.

The literature presented above adds to the body of knowledge on the computer games' pedagogical uses for language teaching and learning in contexts that are outside South Africa. The results yielded by the above mentioned studies are mostly quite positive and give a sound reasoning behind the use of some computer games for the teaching and learning or improvement of English vocabulary proficiency. However, very few studies have explored the use of computer games on English proficiency improvement in the culturally diverse (multiracial and multilingual) South African context. One of the few recent studies that aimed at exploring the extent at which the ESL syllabus can be supported by computer games was conducted by Herselman (2010).

Herselman (2010) used fifteen grade six learners from six primary schools as study participants to investigate how educational computer games can benefit resource-advantaged (RA) and resource-deprived (RD) learners in English Second Language (ESL) teaching. Herselman (2010) identified five most suitable computer games (*Sniper, Cover up, Word Fit, Librarian* and *Cheers*) to support the grade six ESL syllabus. The computer games that were used in the study conducted by Herselman (2010) were regarded as suitable because they contained the following requirements in line with the ESL syllabus: forming of words; spelling, punctuation; adjectives; nouns; adverbs; use of tenses; concord (alphabetical indexing of all words in a text); and word order. Two controls groups (RA and RD) were subjected to a pre-test and a

post-test to establish whether their language proficiency improved after the games were played. Findings of this study suggest that each game played motivated resource-advantaged (RA) as well as resource-deprived (RD) learners to continue playing through the challenges it presented to them. Finally, the results of their study show a significant improvement in all the learners' language proficiency after the computer games were played. While the study conducted by Herselman (2010) used high school learners who spoke isiXhosa as a native language and various perceived suitable computer games, the current study focuses on the use of a selected computer game for English improvement among multiracial, multilingual and, possibly, multinational university students.

2.4.6 Factors affecting the adoption of ICT in teaching and learning of language

A questionnaire based survey conducted by Albirini (2006) on a sample of 326 Syrian English teachers found that the majority of teachers have a positive attitude towards using ICT in education, in general, and for the teaching of English, in particular. The study conducted by Albirini (2006) particularly investigates the relationship between teachers' attitudes towards computers for teaching and learning and five independent variables: computer attributes; cultural perceptions; computer competence; computer access; and personal characteristics (including computer training background). According to Albirini (2006), positive attitude is influenced by factors such as teachers' perceptions of the appropriateness of the use of computers in their daily teaching routines, teachers' perceptions on the impact of computers on society, in general, and on their culture, and teachers' aptitude to use a computer.

An interpretive study, conducted by Chigona and Chigona (2010), aimed at analysing the factors which are preventing the high school educators from using ICT in their work. Fourteen randomly sampled high schools' teachers from four schools in the Western Cape of South Africa were interviewed on abilities and/or well-being that educators generate from technology available and on factors that impact educators' utilisation of ICT in the curriculum delivery in the schools. Results of their study

show that the following factors are not in place or not right for teachers to realise the capabilities in the adoption of ICT in their work:

I. Insufficient ICT training to enable the educators to access and use the laboratories;
II. Lack of freedom for some educators to access the laboratories;
III. Inadequate technical support for the educators who are using the ICT for teaching and learning; and
IV. Insufficient equipment (computers) in the laboratories which leads to the learners crowding in front of few machines; resulting in an environment unfavourable to learning.

However, another study conducted by Cassim and Eyono Obono (2011), particularly aimed at examining factors that affect the adoption of ICT for the teaching of word problems; using a sample of 102 teachers from primary schools in the KwaZulu-Natal province of South Africa, (teaching grades 2, 3 and 4) showed, through questionnaire survey data results, that their positive attitude towards ICT adoption (as indicated by Albirini (2006)), and their awareness of a successful and effective ICT integration in teaching, contributed to higher levels of ICT adoption for the teaching of mathematical word problems. Furthermore, their study confirms positive perceptions on the usefulness and ease-of-use of ICT, as other contributing factors towards the successful adoption of ICT in the teachers' daily working routines.

Factors around the adoption of ICT, particularly at tertiary levels of education, were also studied. A study conducted in Ghana, Africa, by Obiri-Yeboah, Fosu and Kyere-Djan (2013), attempted to examine the trend and use of ICT amongst students and lecturers at the Kwame Nkrumah University of Science and Technology (KNUST), in teaching, research and learning processes. Their mixed-methods' (using questionnaires and semi-structured interviews) study claims, through data results, that ICT infrastructure, particularly at KNUST, is not sufficiently developed. Their study further acknowledges that most African countries' tertiary institutions, with the exception of those in South Africa and some North African countries, are seriously constrained in the use of ICT (by a lack of computer stations and lack of access to affordable high-speed Internet). Thus, there's no doubt that the South African tertiary institution (Durban University of Technology), where the current study was

conducted (and possibly many other South African tertiary institutions), is (are) better equipped in ICT infrastructure, as this study's data collection processes (believed to mimic adoption and integration of ICT in teaching and learning) experienced no hurdles with regards to ICT infrastructure.

In another study, Khalili and Eskandari (2014) aimed to predict factors that influence students to adopt ICT, using a survey of 400 students from Panjab University, India; prediction was conducted through the technology acceptance model (TAM, described below). Khalili and Eskandari (2014) found that perceived usefulness of e-learning (in particular), attitude towards e-learning, and ease of use directly influence intention to adopt new technology. Similarly, the current study used the TAM model's attributes, namely, perceived usefulness and ease-of-use of the selected computer game towards English vocabulary improvement; these two attributes are among the many other characteristics that were used to measure the effectiveness of the said selected computer game.

2.5 Computer game design

2.5.1 Computer game elements

Computer games' players often make sense of the game played by interacting with the computer games' internal systems (Hunicke and Chapman (2004)). Interactions with these computer games can be personal or social. A large-scale survey (of approximately 900 participants), conducted by Choi and Kim (2004) to examine the efficiency of the model aimed at explaining why people continue to play online network games, reveals that customer or player loyalty, flow, personal interaction, and social interaction motivate people to play games and help them to eventually attain an optimal game playing experience.

Personal interactions can be facilitated by providing appropriate goals, operators and feedback while social interaction can be facilitated through appropriate communication places and tools (Choi and Kim (2004). Furthermore, a well-designed game should introduce or facilitate a gaming challenge, intrigue fantasy, allow player control, and facilitate curiosity to create fundamentally motivating gaming environments (Squire, 2005; Jørgensen, 2004; Dickey, 2005; Gros, 2007).

According to Jørgensen (2004), **challenge** (in a form of intended difficulty such as time pressure and opponent play (Hunicke *et al*. (2004), is the most important aspect of computer gaming. This is further confirmed by Hunicke and Chapman (2004) after exploring the computational and design requirements for a dynamic computer game (extreme) difficulty adjustment system. This difficulty adjustment system provides guidance on the adjustment of uncertain (extreme) difficulty that may occur during computer game play; so as to ensure that the computer game remains sufficiently difficult and fun to play. Hunicke and Chapman (2004), therefore, claim that, for game designers to achieve a sufficient level of game difficulty, the "supply and demand of game inventory" (e.g., the store of items that a player collects and carries throughout the game world or achieving another level), need to be analysed and adjusted in order to control overall game difficulty. Another confirmation arises from a case study conducted by Denis and Jouvelot (2005); which confirms that desire to play games even more results from **challenge** and is by far the most important aspect to provide players with real game interaction (Dickey, 2005). This case study's overall pedagogical goal was to motivate the players' curiosity and creativity by enabling them to easily play a musical education dedicated computer game, using gamepads as musical instruments. According to Dickey (2005), the following strategies are some of the attributions of game player engagement:

I. Player positioning; "the shift from an outside orthographic perspective to a first-person agent embedded in the game space marks a shift in moving the player from outside of the game into becoming part of the gaming environment";

II. Narrative arc; means of reasoning and a means of representation; and

III. Interactive choice; various dimensions of a setting, the roles and characters within a gaming environment, and actions' affordability (through play) and feedback to the players.

Fantasy, as another element of computer gaming, is, according to Squire (2005), one of the aspects of computer gaming that creates intrinsically motivating real world task-based environments (Garris *et al*. (2002). Furthermore, Garris *et al*. (2002), emphasize that fantasy should be incorporated in the design of computer games,

because, according to Denis and Jouvelot (2005), fantasy gives more pleasure (feeling of game enjoyment) to players. In an explorative literature review conducted by Asgari and Kaufman (2004), computer game fantasy is described as an environment that evokes mental or imaginary images of physical or social situations and imaginary characters that are not part of the real life (Baranowski *et al*. (2008); with fantasy comes some level of curiosity. Curiosity is, according to Dickey (2005), one of the aspects that are contextual in some individual games. A literature review, conducted by Asgar and Kaufman (2005), explored the relationships among computer games, fantasy, and learning, and states that curiosity is the result of a knowledge gap evoked by mystery (Garris *et al*., 2002). Garris *et al*. (2002) further distinguish curiosity from mystery by stating that mystery is an external feature of the game itself while curiosity resides in the individual. Therefore, according to Asgari and Kaufman (2005), curiosity in games can be stimulated by making individuals think that their existing knowledge lacks one or more of these three characteristics: completeness, consistency (Garris *et al*., 2002) and parsimony (meanness).

Garris *et al*. (2002) and Rosas *et al*. (2002) further state that curiosity comes in two types, namely;

I. Sensory curiosity, which is the interest evoked by novel sensations or sensory stimuli. These sensations are evoked by audio and visual effects in games; and
II. Cognitive curiosity, which is a desire for knowledge. This type of curiosity is evoked by surprises and constructive feedback in games.

Lastly, according to Dickey (2005), a good game storyline (narrative) is a device that enables and supports fantasy and gives the game some level of control over the gaming environment.

Squire (2005) states that computer game player control serves as one of the fundamental aspects of motivating the player to achieve high levels in the gaming environment; much better if such a gaming environment has educational elements. A study, conducted by King and Delfabbro (2009), aimed at investigating the psychological and social context of video game playing in order to understand the phenomenon of excessive video game play. This study used a group interview of 38 participants and revealed that, amongst others, player control (while playing the

game) is a very significant computer game theme towards player empowerment and/ or motivation.

It is hoped that this study's selected computer game will attract or feature the elements (used to evaluate various computer games before choosing the study's computer game) mentioned above so as to assist in achieving the educational goals hoped, through the said computer game. Computer gaming theory that aligns with these elements further advocates adherence to some heuristics (rules) during the design of computer games.

2.5.2 Computer game heuristics

In the productivity software sphere, usability is one of the most important aspects. Usability is defined as satisfaction of users on the effectiveness and efficiency of a software product in a particular workplace context or environment (Federoff, 2002). One may then question the relationship between games and usability, if usability has a lot to do with productivity software. According to Jørgensen (2004), there is a range of cohesions between productivity software and computer games (and, more broadly, entertainment software). These commonalities include learning, motivation, mental models (fantasy included), control, interaction, feedback, spatial navigation, linguistic and visual expressions (Jørgensen, 2004). However, differences between usability in productivity software and usability of computer games are not clearly outlined in the body of knowledge. Nonetheless, according to Barendregt *et al*. (2003), as much as satisfaction is a main user-oriented attribute of usability in productivity software, the usability of a good computer game is the fun attribute of it. This implies that satisfaction results from efficiency and effectiveness of productivity software on easily achieving tasks and fun result from a challenging game with good goals to be attained by the game player (Barendregt *et al*., 2003). However, Barendregt *et al*. (2003) warn that difficulty of 'challenge' in computer games introduces frustration while too little 'challenge' leads to boredom; a computer game with such attrubutes will, therefore, be deemed 'unusable', hence, less fun to play. Hence, some of the objectives of this study will investigate the ease-of-use and the usefulness of the study's selected computer game; through the TAM.

Usability in productivity software is measured through heuristics evaluation, amongst others. Usability heuristics are a set of identified usability principles that can assist in creating or evaluating a design. Usability heuristics, which were established by Nielsen (1994), can clearly relate each one of their heuristics (10 in number) to the usability of games (Federoff, 2002). However, Federoff (2002) derives only six games-related usability heuristics from those of Nielsen (1994) and presents them as follows:

I. Game Interface Controls should be intuitive and mapped in a natural way;
II. Game Interface and Play art should speak to its function;
III. Game Mechanics should feel natural and have correct weight and push (towards motivation);
IV. Game Play [should] include a lot of interactive props for the player to interact with;
V. [During] Game Play every puzzle should relate to the story; and
VI. Game Play [should] teach computer gaming (playing) skills early; skills that the players are expected to use later.

Another study, conducted by Pinelle *et al*. (2008), developed game heuristics by analyzing personal computer game reviews from a popular gaming website, and the review set covered 108 different games and included 18 from each of 6 major game genres. The set of game heuristics, developed by Pinelle *et al*. (2008), includes the following:

I. Provide consistent responses to the user's actions;
II. Allow users to customize video and audio settings, difficulty and game speed;
III. Provide predictable and reasonable behavior for computer controlled units;
IV. Provide unobstructed views that are appropriate for the user's current actions;
V. Allow users to skip non-playable and frequently repeated content;
VI. Provide intuitive and customizable input mappings;
VII. Provide controls that are easy to manage, and that have an appropriate level of sensitivity and responsiveness;
VIII. Provide users with information on game status;
IX. Provide instructions, training, and help; and

X. Provide visual representations that are easy to interpret and that minimize the need for micromanagement momentum.

In relation to the heuristics presented by Federof (2002) and Pinelle *et al*. (2008), it was hoped that the studies selected computer game features in the majority of these heuristics and, as a result, incidental English vocabulary improvement would be achieved, through game play.

2.5.3 Identifying effective learning factors through game heuristics

In educational information flow, the reactions to new technologies, including digital gaming technologies, are emerging in the recent body of knowledge. According to Squire (2005), the use of digital game-based learning suggests that developing educational games is a moral imperative, as the "videogame generation" does not respond satisfactorily to traditional instruction in the academic sphere. Digital games are, according to Gros (2007), user-centered as they can promote challenges, co-operation, engagement (Dickey, 2005), and the development of problem-solving strategies. Therefore, the design of a learning environment built on the educational properties of games can be an appropriate way to improve learning (Gros (2007)). Therefore, the literature presented below incorporates various notions of the design aspects presented above.

Garris *et al*. (2002), Rosasa *et al*. (2003) and Tuzun (2004) agree that motivational elements of games include identity presentation, social interaction, playing, learning, ownership and control, fantasy, immersive context, curiosity, creativity, achievement, rewards, uniqueness, and context of support. In addition to stimulating motivation, De Aguilera and Mendiz (2003) state that video games are considered very beneficial in acquiring practical skills, as well as increasing perception and stimulation and developing skills in problem-solving, strategy assessment, media and tools organization and obtaining intelligent answers. De Aguilera and Mendiz (2003) further point out procedural objectives that video games can help to fulfil:

I. Reading. It is essential to use video games to promote book reading related to the game in some way (e.g., The Lord of the Rings or even the current study's selected computer game);

II. Logical thinking. Video games help in thinking about how to solve problems by proposing strategies, organizing elements in anticipation of objectives, towards reaching a set or expected goal;

III. Observation. Due to the number of elements on screen, and, hence, the need for visual and spatial (three dimensional) refinement, this ability is used the most during video game playing; and

IV. Spatiality, geography. The development of cartography and spatial representations: maps, plans, and so on, help to mimic real life objects and surroundings.

Likewise, the selected computer game for the current study inherits the above mentioned assistive features and hopes to enhance English vocabulary incidental learning.

A study, conducted by Garris *et al*. (2002), presents an input-process-output model of instructional games and learning that elaborates the key features of games that are of interest from an instructional perspective. This input-process-output model elaborates that those instructional games that have game characteristics (in a form of cooperative motivation) should, when coupled with instructional elements, affect a cycle of events such as user judgment (in terms of enjoyment or interest), user behavior (such as greater persistence or time on task) and system feedback. This cycle will, according to Garris *et al*. (2002), result in recurring and self-motivated game play and will play lead to the achievement of training objectives and specific learning outcomes. Learning outcomes come in broad categories of, namely, skill-based, cognitive (rational), and affective (attitude).

Rosas *et al*. (2002) further state that motivational elements of games specifically designed for educational purposes result in high levels of attention and concentration while playing computer games in classrooms. This conclusion followed an attempt to evaluate the effects of the introduction of educational videogames (specifically designed to address the educational goals of the first and second years of school, for basic mathematics and reading comprehension) into the classroom, on learning,

motivation, and classroom dynamics. Results from study conducted by Rosas *et al*. (2002) show that students showed improvements in mathematics, reading comprehension and spelling. Rosas *et al*. (2002) clearly point out the following as elements that distinguish a particular computer game as an "instructional tool":

I. Challenge: clear, meaningful and multiple goals, uncertain outcomes, variable difficulty levels, randomness, and constant feedback;
II. Fantasy: a character with whom players can identify, use of an emotionally appealing fantasy directly linked to the activity, and use of metaphors; and
III. Two types of curiosity: sensory curiosity (audio and visual effects) and cognitive curiosity (surprises and constructive feedback)

In terms of the current study's selected computer game, challenge, fantasy (emotionally appealing, in particular), sensory curiosity (excluding audio) and cognitive curiosity are prevalent features.

Denis and Jouvelot (2005) assert (and highly concur with theories presented above) that the best practices rooted in psychology and motivation theory are also useful when designing educational games. These suggestions came through a case study that was aimed at looking at the design of the ongoing Cha-Luva Swing Festival project, a video game dedicated to music education. Denis and Jouvelot (2005) suggest that an organization of the fun factors that should be considered when designing games, include pleasure from fantasy, desires from challenge and curiosity and lucid tensions from discovery, learning, surprise or narration, amongst others.

2.6 Framework to explain ICT adoption in ESL learning: TAM and HEP

The theoretical framework underpinning this study is guided by the revised and critiqued Technology Acceptance Model (TAM), originally developed by Davis (1989) and heuristic evaluation for playability (HEP), as presented by Desurvire, Caplan and Toth (2004).

According to Davis and Venkatesh (1996), TAM is used by researchers and practitioners to predict and explain user acceptance of information technologies. In TAM, external variables (such as objective system design characteristics, training,

computer self-efficacy, user involvement in design, and the nature of the implementation process) have an impact on perceived usefulness (PU) and perceived ease of use (PEOU). Both PU and PEOU determine the user attitude towards behavioural intention to use the actual computer system (Davis and Venkatesh, 1996).

A study conducted by Cho and Hung (2009) aimed at examining the effects of the common backgrounds of PEOU and PU on their relationship. Their study reviewed extensive literature around the said construct and also entailed a survey of users' acceptance of some common e-learning forums (such as ICQ, WebCT, and MSN). Their study revealed that user-interface design (UID) explains 43% of the relationship between PEOU and PU, and that learners consider UID very important in deciding whether to accept an e-learning forum for their learning and communication or not. This suggests that the UID of the current study's selected computer game will hopefully influence PEOU and PU as these two TAM constructs are measured in the current study, through a survey of selected computer gaming research participants. Furthermore, Cho and Hung (2009) highlight that earlier theories on the original TAM suggest a direct significant linkage between PEOU and PU, i.e., the easier it is to use a particular technological system, the more the system is perceived to be usable. However, Cho and Hung (2009) argue that the relationship between these constructs depends on the type of technology being studied for acceptance amongst potential users. Figure 2.1 below shows the original TAM model.

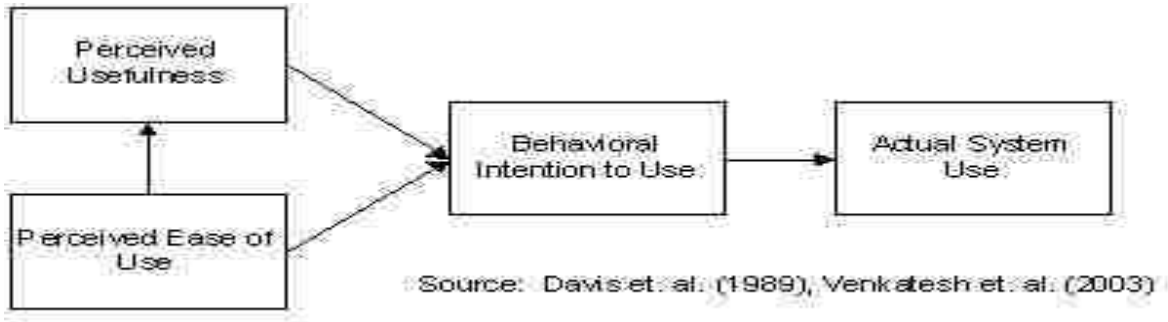

Figure 2-1 Original TAM

According to Bagozzi (2007), TAM has, since its inception, been used as a model of preference to determine technology acceptance for various types of systems in the information systems sphere, with over 700 citations. This is evident in prior studies that further present extensions of TAM that were suitably tested for various implementations of technology of both problem solving and entertainment sorts (Hsu and Lu, 2003), etc. The study conducted by Hsu and Lu (2003) sought to explore so called predictors of entertainment-oriented technology acceptance, namely, social influences and flow experience (defined as the whole experience that people feel when they act with total involvement); incorporated into TAM (in their study) as belief-related constructs to predict users' acceptance of on-line games using a survey of 233 on-line gamers. The study revealed that social norms and flow of experience have a direct impact on the adoption of on-line games. Furthermore, Hsu and Lu (2003) stress that these two additional constructs to TAM decrease the importance of perceived usefulness if on-line games are played merely for fun. Moreover, the study, conducted by Ha *et al*. (2007), concurs with Hsu and Lu's (2003) results by showing that there is no significant effect of perceived usefulness towards user attitude when playing computer games, merely for fun (where fun could be interpreted as the "seeking" of mere pleasure or "remedy" for boredom in game playing). This online survey study (Ha *et al*., 2007) of 1 011 mobile gamers, sought to extend the TAM model with perceived enjoyment and further examine the effects of prior experience amongst other factors on gaming intentions. Results from their study show that perceived enjoyment has the greatest effect on intention to play computer games.

Bagozzi (2007) goes on to critique the original TAM (as developed by Davis, 1989)) as being over used to determine user technology acceptance despite the ever evolving technology or rather technological systems. Similarly, Chuttur (2009) further highlights criticism of the original TAM from other researchers as a model that may have attracted more easy and quick research such that less attention has been given to the real problem of technology acceptance. Nonetheless, Chuttur (2009) further gives credit to Venkatesh and Davis (2000) for their effort in extending the original TAM to TAM 2.

Venkatesh and Davis (2000) present the extended model (TAM 2) as a model that explains perceived usefulness and usage intentions in terms of social influence and cognitive instrumental processes. According to Vanketash and Davis (2000), both social influence processes (subjective norm, voluntariness, and image; "the degree to which use of an innovation is perceived to enhance one's status in one's social system.") and cognitive instrumental processes (job relevance, output quality, result demonstrability, and perceived ease of use) significantly influence technology user acceptance. Figure 2-2 below shows TAM 2. The current study therefore, examines, in particular:

I. 'Job relevance' of the selected computer game in terms of English vocabulary improvement; through a pre- and post-English vocabulary test and eventually 'result demonstrability';
II. Perceived ease of use of the selected computer game; and
III. Perceived usefulness of the selected computer game (perceived usefulness being a construct from the original TAM).

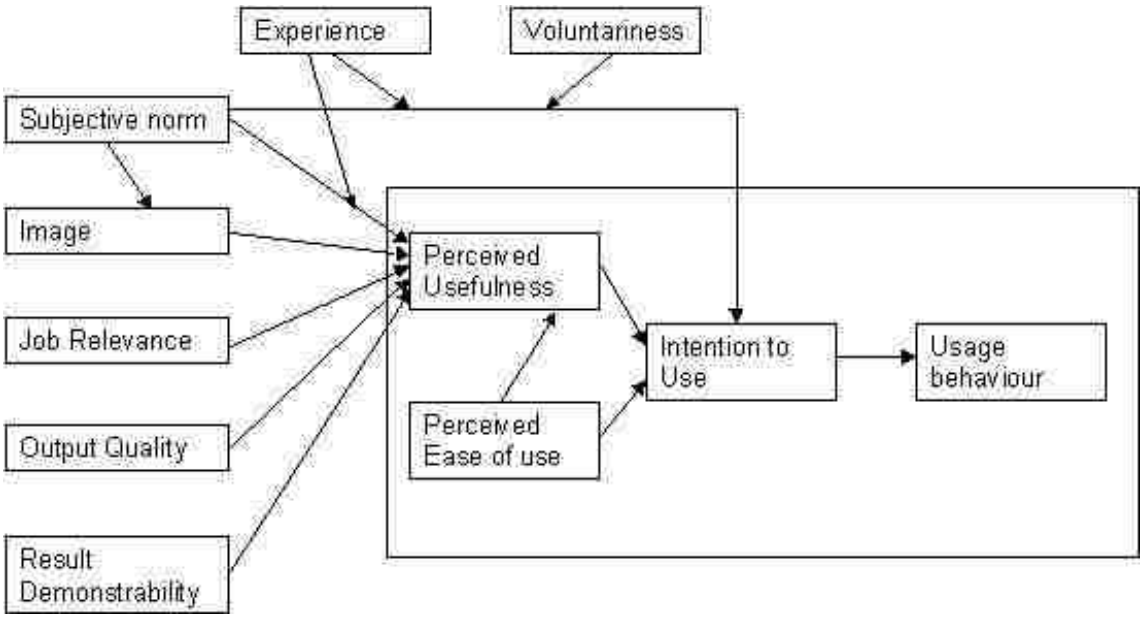

Figure 2-2 TAM 2 Model (Venkatesh and Davis, 2000)

Furthermore, computer design theories, presented above, acknowledge effective consideration of computer game design heuristics as recipes of fun, gamer control and motivation amongst other computer gaming appealing features. Therefore, the current study also acknowledges certain computer game design heuristics as perceivably available in the off-shelf selected computer game that attempted to facilitate incidental English vocabulary learning.

A case study, conducted by Desurvire, Caplan and Toth (2004), identifies heuristic evaluation for playability (HEP). Heuristics are design guidelines which serve as a useful evaluation tool for both product designers and usability professionals. Playability is, on the other hand, described in Nacke (2009) as "a collection of criteria with which to evaluate a product's gameplay or interaction". Nacke (2009) further states that there are four components of playability, namely;

I. Functional; the learning curve of a game's input/output based on gamers expressions (relates to efficiency in terms usability);
II. Structural; evaluation of game rules, structures and patterns as well as player evaluation of skill, experience, and actions;
III. Audio-visual; naturally tied to functional playability as interface aspects can directly relate to input controls and feedback of the game; and
IV. Social playability; estimates the suitability of digital games for different contexts of use.

These components are, according to Nacke (2009), measured or analysed in terms of formal aspects such as game functionality components (e.g., game rules) and also informally in a form of gamer experience assessment. The current study, through a survey questionnaire, measures or investigates the study's computer game's playability in terms of functional, structural and visuals, as follows:

I. Ease of use and usefulness of the selected computer game (efficiency related and functional);
II. Past and present gamer experience, game rules clarity and computer gamers being observed as they play, equate to assess the structural playability of the study's computer game; and

III. In particular, feedback through qualitative data (interviews) and some of the functional factors mentioned above would informally or indirectly measure the visual playability of the study's selected computer game.

Gameplay is defined or described as the pattern defined through the game rules, connection between player and the game, challenges and overcoming them, plot and player's connection with the game (Engenfeldt-Nielsen, 2007). HEP is a comprehensive set of heuristics for playability, based on the literature on productivity and play testing heuristics that were specifically tailored to evaluate video, computer, and board games. Desurvire, Caplan and Toth (2004) in Nacke (2009) present four game heuristic categories and are in line with functional and audio-visual playability. The four game heuristic categories, as presented by Desurvire, Caplan and Toth (2004), are as follows:

I. Game play; a set of problems and challenges a user must face to win a game;
II. Game story; includes all plot and character or narrative development;
III. Game mechanics; involve the programming that provides the structure by which units interact with the environment; and
IV. Game usability; addresses the interface and encompasses the elements the user utilizes to interact with the game (e.g., mouse, keyboard, controller, game shell, heads-up display).

In conclusion, the current study, therefore, used some of the constructs from TAM 2 and some of the computer game heuristics, as presented in HEP theories above. Constructs from TAM 2 were used to determine the perceived usefulness of the selected computer game; where perceived usefulness is defined by Vanketash and Davis (2000) as the degree to which a person (learner) believes that using a particular system (selected computer game) would enhance his or her job performance (English vocabulary improvement). In the context of this research study, TAM 2 is used to determine the ease of use or ease of playability experienced or expressed by tertiary students (research participants) in determining the perceived usefulness of this study's selected computer game towards English vocabulary improvement in the classroom.

As a result, the following TAM 2 constructs were used, as illustrated in Figure 2-3 (Vanketash and Davis, 2000):

Perceived ease of use; defined in the context of this study as a determinant factor of the gamers' perception on the extent to which playing a selected computer game will be free of effort;

Experience (of participating gamer in computer gaming); described as an enabling factor (in its increased level) towards overcoming hurdles with gaming and, as a result, enhancing the incidental learning experience, due to familiarity with gaming or prior learned elements; i.e., resulting in less time wasted learning how to play the computer game and more time on English vocabulary improvement through the computer as such;

Job relevance (incidental learning task relevance in the context of the current study or perceived impact of the selected computer game on the improvement of English vocabulary); defined as an individual's perception regarding the degree to which the target (system) selected computer game is applicable to his or her English vocabulary improvement in the context of the current study; and

Results demonstrability (simple differences in the performances of experimental participants'/learners' in pre- and post- English vocabulary test); described as the tangibility of the results of using the innovation as a direct effect on English vocabulary improvement.

2.6.1 The resulting theoretical framework

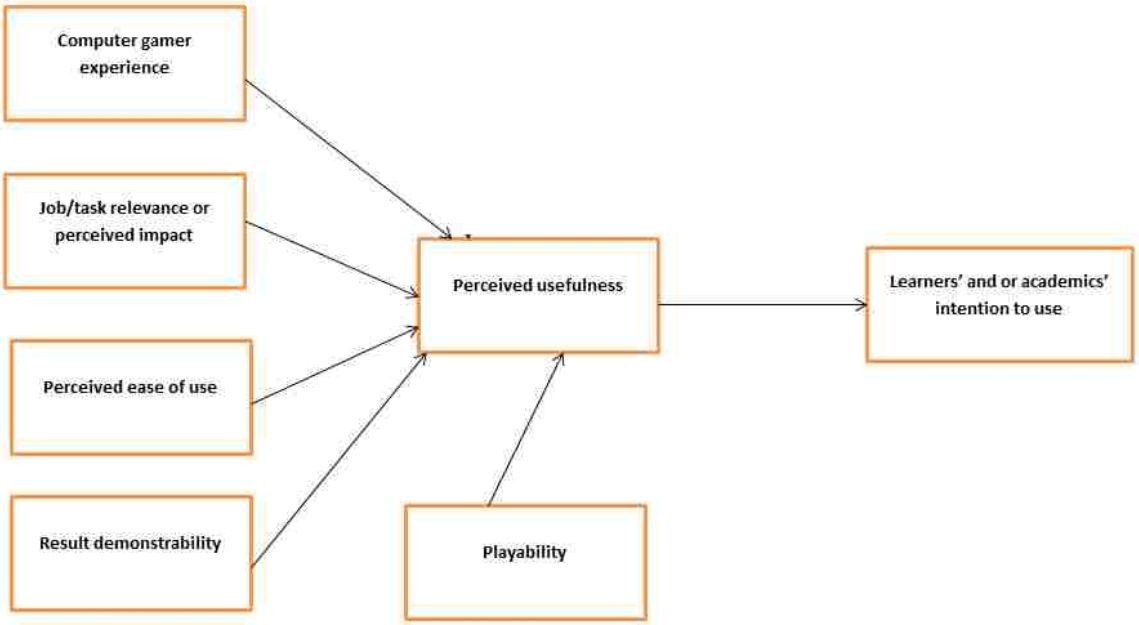

Figure 2-3 This study's theoretical framework (Vanketash and Davis, 2000)

2.7 Summary

Literature reviewed and presented in this chapter starts off by acknowledging some background in the English language by highlighting the various types of this internationally acclaimed language. It is clearly evident that the English language subsets that come in various names, such as Indian English, Filipino English, South African English, exist and such subsets clearly inform, give rise to or further distinguish English into first native language or second (additional) language. Literature further shows that it is important for English speakers, as second language speakers, learners in particular, to be equipped with English vocabulary; since English is recognized as an international language and medium of instruction in the classroom and academic texts in most parts of the world. In order to achieve efficient English vocabulary, it is clear that, amongst other factors, emphasis needs to be on the application, improvement and adoption of English vocabulary teaching and methods. Hence, the aim of this study is to promote, as an English vocabulary teaching and learning improvement method, the usage of relevant computing

technology. In particular, the current study focuses on the improvement of English vocabulary through incidental interactions with a selected computer game by gaming participants. Furthermore, a theoretical framework, derived from TAM2 and HEP theories that will assist in achieving various objectives of this study, is outlined in detail in the next chapter.

CHAPTER 3

RESEARCH METHODOLOGY DESIGN

3.1 Introduction

This study endeavoured to examine the perceived usefulness, ease of use, playability (from usability point of view) and the perceived impact of a selected computer game, for the purposes of English vocabulary improvement. This chapter outlines, in detail, the research methods that were implemented to address this study's research questions, aims and objectives and, eventually, the research gaps identified in the literature as outlined in chapter 2.

A quasi-experimental mixed methods' research design was implemented to investigate and explore the assumptions of this study. This chapter further presents seven research instruments (2 questionnaires, English Vocabulary Tests (EVTs), a detective computer game, a computer game guide, a computer game playability checklist, a computer game-based narrative, and computer game-based post-play questionnaire) that incorporated both qualitative and quantitative data collection methods, for data that were used to answer the study's research questions. This chapter further presents the administration of a pilot study that was conducted to affirm the research instruments' design feasibility and the feasibility of the projected main study data collection procedures.

3.2 Research Design

Scientific and systematic types of research usually utilize two types of research methods, namely, quantitative and qualitative methods, in their endeavours to answer or address research questions and/or hypotheses. Furthermore, Creswell (2014) states that quantitative and qualitative research can also take one of the various paradigms (patterns) available, and they include, positivism, anti-positivism, post-positivism, interpretive and critical theory. Positivism research pattern suggests the goal of knowledge is to describe the phenomena that the researcher experiences/d (Trochim, 2006). On the other hand, anti-positivism includes the high involvement of the

researcher and low involvement from the respondents (Creswell, 2014) and post-positivism rejects positivism and advocates critical realism (independent of one's thinking) through scientific reasoning and common sense (Trochim, 2006).

Interpretive paradigm, according to Trochim (2006) involves researcher interpretation of the elements of the study through the integration of participants' interests or opinions. On the other hand, critical theory paradigm postulates technical interest (concerned with the control of the physical environment), practical interest (concerned with understanding of situations) and an emancipating interest (concerned with the provision of growth and advancement) (Cresswell, 2014). As a result, this research study takes a positivist paradigm as a quantitative approach and the interpretive paradigm as a qualitative approach using scientific methods, observations, focus groups and experimental procedures to gather data.

Qualitative research methods include unstructured interviews, observations and content analysis. The qualitative form of this research study produced subjective participants' data perceptions around research variables through open-ended questions (asked during interviews and or through questionnaires); allowing participants to supply answers or opinions in their own words (Creswell, 2014; Salkind, 2009: 209).

On the other hand, quantitative research is, in nature, identified in a form of three primary types, namely (Creswell, 2014):

I. Exploratory; where the researcher explores and understands a concept, people, or a particular situation that he/she does not know much about;
II. Descriptive; where the researcher investigates a concept, people, or a particular situation that he/she knows something about, however, the intention is just to describe the observations or findings; and
III. Explanatory; where the researcher tests a hypothesis and derives the hypothesis from available theories.

Therefore, the quantitative nature of this study sought to investigate quantitative statistical interpretations of answers that were obtained from quantitative data; taking an exploratory post-positivist quantitative research paradigm approach. This data was collected in a form of closed-ended questions on research variables; specifically control variables (Creswell, 2014; Salkind, 2009: 209). According to Creswell

(2014), control variables are used to measure the extent at which they influence dependent variables. The control (independent) variables for this study were, therefore, participants':

I. Biographical information;
II. Computer gaming experience;
III. Autonomous (out of classroom) English vocabulary learning activities;
IV. Perceptions on the playability of the study's selected computer game;
V. Perceptions on the impact and the usefulness of the study's computer game towards English vocabulary improvement; and
VI. Perceptions on the ease of use of the study's computer game.

The dependent variable for this study was the English vocabulary improvement, measured through the EVT.

3.2.1 Mixed methods approach

According to Creswell (2014), the combination of qualitative and quantitative research approaches yields a mixed methods' approach to research; enabling researchers to present a better understanding of the research problem. Creswell (2014) further describes mixed methods' research as a research design with logical assumptions as well as methods of inquiry that guide the direction of the collection or production and analysis of data; taking a mixture of qualitative and quantitative approaches in many phases in the research process.

The quantitative nature of this research employed research methods and data collection instruments that served the purpose of quantifying the relationships among the abovementioned variables, based on a sample of respondents. On the other hand, the qualitative side of this study explored participants' opinions captured in research questionnaires on the perceived usefulness of the computer game on English vocabulary improvement. Furthermore, computer game playability (equivalent to ease of use) opinions were also captured on game playability checklists that were completed by observers; researcher assistants that were observing the research experimental group participants as they played the computer game. It is further worth mentioning that there was also a need to conduct a follow-up discussion (qualitative

way of obtaining clarity on some of the research factors) with the research participants, due to the nature of results that were obtained from the quantitative data. The purpose of the follow-up discussion was to establish factors that may have influenced participants' performance in terms of this study's English vocabulary assessment, in relation to the selected computer game. The fact that this study sought to examine perceptions on the effectiveness of a selected computer game for the improvement of English vocabulary made this mixed methods study, an experimental type of study, i.e., a quasi-experimental type of study, to be precise.

3.2.2 Quasi-experimental research design

This study implemented two intervention groups' (of research participants) design, namely, a narrative-based control (referred to as the NBC group from here onwards) and a computer game playing experiment (CPE) groups. This design allowed for the two groups' participants to complete the same English vocabulary pre-test. The CPE group played the selected computer game, namely, ***The Agatha Christie 4:50 from Paddington,*** while the NBC group studied a printed narrative (see the instruments design section below for details on the narrative and the computer game). The two groups then finally completed the same English vocabulary post-test. Moreover, the CPE group completed a post-gaming questionnaire that attempted to investigate, in particular, the playability, perceived usefulness, perceived ease of use, and perceived impact of the computer game on English vocabulary improvement. Data were also collected on the playability of the computer game through an observer checklists, while the CPE group participants were playing the abovementioned computer game. This research approach design is somewhat aligned to or validated by studies such as those conducted by Ahmad (2011) (see section 2.4.3 in the chapter above)

3.2.1.1 Research participants' assignments

The research participants for this experimental design were assigned to the groups based on the "first available-assign to CPE" principle until 71 participants were reached, then the other 71 participants were assigned to the NBC group, i.e., the researcher collected data using the CPE group first, due to complexities of the

group's data collection administration. Therefore, a convenient type of non-probability (non-randomized) sampling and assignments of participants to CPE and NBC groups was used (See section 3.4 (Sampling) for more elaborations on non-probability convenient sampling); making this study a quasi-experimental type of a study (Trochim, 2006).

In simple terms, a quasi-experimental design is a research design where research participants are assigned to non-randomized experimental groups. According to Trochim (2006), the non-randomization in participants' assignment to groups, makes the design to be non-equivalent probabilistically. This means that, even though the researcher may have assumed that the group participants are equivalent (e.g., all from second semester group level), the fact that each and every participant was not given equal chances to choose the group they want to participate in, leaves little chances that the performance between the two groups' pre- and post-tests will be statistically different. Performance, in this instance, means the differences between the pre- and post-tests' results of the two groups and for each group. This further implies that the researcher has no control over mystifying factors that may affect the results of this study (Shadish, Cook and Campbell, 2002; Hopkins, 2000). However, according to Trochim (2006), quasi-experimental study statistical data analysis techniques were designed to compensate for the non-equivalence among the groups (see data analysis section).

3.2.3 Design and purpose of data collection instruments

Survey studies are, according to Trochim (2006), any measurement procedures that involve posing research questions to research participants. Precisely, these procedures may range from questionnaires (in both qualitative and quantitative manners) to an intensive one-on-one in-depth interview (qualitative manner). Therefore, this mixed methods' survey quasi-experimental study utilized research instruments that were completed by both the NBC and CPE groups, for data collection.

The instruments used in this study were mainly printed questionnaires as these instruments proved feasible (in their printed format) for the data collection of this study. This feasibility was possible due to the accessibility and cooperation of respondents and their time to complete the questionnaire (Trochim, 2006).

The design of these questionnaires strived to conform to the following design rules, as outlined by Trochim (2006) and emphasized by Creswell (2014):

I. Determining the question content, scope and purpose of a questionnaire item, in order to ensure the necessity of each item in terms of getting to the data, that the researcher wishes to obtain from the respondents (Cohen *et al*., 2011);
II. Choosing the response format that was used for collecting information from the respondent, i.e., two types of response formats exist, namely, structured and unstructured formats and the research instruments used in this study utilized both formats;
III. Structured formats helped the respondent to respond more easily and helped the researcher to accumulate and summarize responses more efficiently; these included question formats that required filling in the blanks and placing a tick or a cross on the most appropriate answers, perceptions or opinions; and
IV. The satisfactory way of wording the question to get at the issue of interest; this assisted in ensuring clarity in terms of communicating the question items' ideas or prompting of answers from the respondents (Cohen *et al*., 2011).

In terms of questionnaire instruments, questionnaire items included close-ended questions (answered through some scale or logical options), dichotomous questions (yes/no questions) and open-ended questions (where the participants had to write answers or opinions for particular questions) (Cohen *et al*., 2011; Trochim, 2006). Questions based on level of measurement were also used in some of the research questionnaires of this study. These types of questions include nominal questions such as those that asked respondents about the mark range obtained in their matriculation English, for instance.

Interval or scaling types of questions were also used in constructing some research instruments used in this study. Trochim (2006) and Creswell (2014) describe scaling questions as questionnaire items that use a scale of measurement and various types of scaling methods exist.

The most commonly used scaling method is the Likert-scale. Likert-scale helps the researcher to ask opinion questions on a 1-to-5 or sometimes 1-to-3 bipolar scale (bipolar means there is a neutral point and the two ends of the scale are at opposite positions of the opinion) (Creswell, 2014). In this study, research instruments used the 1-to-3 bipolar scale, where applicable, and none used a 1-to-5 bipolar scale. According to Dolnicar *et al*. (2011), questionnaire item responses that are based on a 1-to-5 (and even a 1-to-7) bipolar scales are subject to biasness, i.e., a systematic tendency to respond to a range of questionnaire items on some basis such as boredom or responding to the questionnaire items for the sake of finishing, by going for the easy response; yielding lower reliability of information in responses (Krosnick and Presser, 2010). Hence the use of 1-to-3 bipolar scale in this research study.

The subsections below briefly outline the design and purpose details of the questionnaire instruments in terms of the type of questions or data collection items that the study instruments intended to use.

3.2.4 Background or biographical, prior computer gaming experience and autonomous English language learning questionnaire

Each research participant from both groups of this study had to complete a questionnaire that surveyed their background information so as to gain an understanding of the research participants' characteristics. This questionnaire also surveyed information about participants' computer gaming experience with particular reference to role playing computer games and/or adventurous crime detective computer games. Information on game computing history was gathered for the purposes of:

I. Gaining an understanding of the extent at which research participants were exposed to computer gaming; and

II. Investigating any correlation between computer gaming experience and participants' English vocabulary (at pre and post-test).

This questionnaire further sought to find out the frequency at which research participants engaged in daily autonomous English vocabulary learning activities such as reading a newspaper or magazine, watching English television shows, listening to English songs, etc. The information on these activities was collected for the purposes of understanding any correlation between these activities and participants' English vocabulary (at pre- and post-test). The following sub-sections describe the design details of each of this questionnaire items:

3.2.4.1 Question items 1-11

This research instrument starts off with a section on the biographical details of the research participant. Biographical details are also known as demographic details and these are participants' personal details such as gender, age, mother tongue and high school exit level of English that would assist in categorizing the target population into various groups and variables for correlations (Creswell, 2014).

3.2.4.2 Question items 12-19

After the biographical details section, the questionnaire queried the participants' computer gaming experience, starting with dichotomous (yes or no) questionnaire items that asked about whether the respondents played any computer game, the selected computer game for this study or any other detective computer game. Questions on whether participants' experience with playing specific most popular detective computer games were also asked. These computer games were rated for popularity by Cook (2011) and they include, ***Batman: Arkham Asylum, Sam and Max hit the road, L.A. Noire, Gillian seed snatcher.*** Questions were also posed to participants' experience in terms of participants still playing (frequency or how often they play) or had quit (how long since they had quit) any of the mentioned games. Questions on frequency of play or history of play on other general computer gaming categories, such as board, strategic, adventure, role and simulation games, were also posed to respondents in this questionnaire. Detective computer games, therefore, satisfy or fall in role playing and/or strategic computer game categories. These categories of computer gaming technology are considered by available literature to

be educational (Rockwell, 2002; Klabbers, 2003; Lindley 2003; Teixeira, Sa, and Fernandes, 2008). In particular, computer games that allow for learning object (graphical object that is instructionally contextualised) environments and can be linked to planned learning activities are considered to be educational (Teixeira, Sa, and Fernandes, 2008).

The purpose of all questions on computer gaming experience (particularly detective computer games) was to investigate any correlations between:

I. Computer gamers' gaming experience and English vocabulary improvement (improvement measured through the English Vocabulary pre and post-tests); and

II. Playability of the selected computer game with the experience in gaming, amongst gamers.

3.2.4.3 Question item 20

The last section of the first questionnaire gathered information on autonomous English learning activities of research participants, i.e., out-of-classroom independent English vocabulary learning. Autonomous English learning activities include reading a newspaper or magazine, watching English TV and reading academic books and articles (Hyland, 2004). The purpose of this section was to establish if there is any correlation between autonomous English learning and English vocabulary improvement.

3.2.5 English vocabulary pre- and post-tests

The pre-and post-tests that served as English vocabulary assessment instruments were guided in their design by both literature and the contents or storyline of the **Agatha Christie 4:50 from Paddington** crime detective computer game. Furthermore, it is worth mentioning that, even though only the CPE group of this study played the selected computer game, the English vocabulary pre- and post-tests were carefully designed for attempts by participants from both groups, i.e., the researcher made sure that even the NBC group could attempt these assessment tools, without having played the computer game.

These test instruments also incorporated sub-list 1 of the Academic Word List (AWL). AWL is a list (with sub-lists 1-7) made up of most popular words in the academic English vocabulary, as identified by Coxhead (2000). Sub-list 1 of the AWL contains 70 most frequently used academic words. This research instrument, therefore, incorporated at least 20 words from AWL sub-list 1.

Furthermore, studies in literature show that the most recommended ways of assessing English vocabulary is through (amongst others), cloze (fill in the blanks), synonyms, concordance (alphabetical index of all the words in a text), and using images to word mapping as some of the vocabulary teaching and learning strategies (Nielsen, 2006; Horst *et al*., 2005; Nation and Waring 2010). Three techniques, namely, fill in the blanks, synonyms and image to word mapping were chosen to design the English vocabulary pre- and post-tests. There is, however, no particular rationale behind the choice of these strategies. Thus, the aim of these research instruments was to assess participants from both groups of this study, for their English vocabulary; using an English Vocabulary pre-test, on a selected computer game's context, before;

I. The CPE group could play this study's selected computer game; and
II. The NBC group could attempt the selected computer game based narrative comprehension (described below).

Research participants, from both groups, were subsequently tested on their English vocabulary after participating in the abovementioned intervention activities (narrative attempt and game playing), using an English Vocabulary post-test. This test was the same as the English Vocabulary pre-test. The context of these tests was on the computer game storyline and is independent of game playing. The tests were also suitable for the NBC group.

The main aim of these instruments was to investigate the impact (improvement or none) of the selected computer game, in particular (or both interventions thereof), on participants' English vocabulary improvement. This hypothesised impact was investigated by a comparison in performances of the pre- and post-tests (see section 4.4 for data analysis details).

These test instruments have, therefore, the following sections in their design and the structure of these instruments can be seen in Appendices D and E:

3.2.5.1 Question 1

The purpose of this section was to assess English vocabulary using the cloze assessment method (fill in the blanks). This question item was constructed with incomplete sentences that were based on the computer game's storyline. As a result, research participants were expected to complete the sentences, using words that were provided. The number of given words were more than the number of empty sentences' spaces.

3.2.5.2 Question 2

This section of the test assessed English vocabulary using the synonyms' technique, i.e., respondents were prompted to provide words that have the same meaning as those provided, so as to preserve the same sentence meaning. Words to use as synonyms were also given to the research participants.

3.2.5.3 Question 3

This last section of the English vocabulary assessment instrument aimed at assessing respondents' English vocabulary through the use of images. Images were provided and the respondents had to provide or write the image name.

3.2.6 The Agatha Christie 4:50 from Paddington computer game

This research made use of a pre-designed (off-shelf) detective computer game called **Agatha Christie 4:50 from Paddington** as a research intervention tool for the purposes of English improvement amongst the research participants in the CPE group. Extensive reading and scrutiny on various types of games led to selecting the abovementioned computer game, as a relevant type of a game for this study. According to Ranalli (2008), off-shelf computer simulation games are generally realistic in their animations, impressive in their interactivity and also, generally, known to be popular amongst the youth.

3.2.6.1 The rationale for choosing the Agatha Christie 4:50 from Paddington computer game

The computer game search began with a consideration of various computer games in the mystery or detective, adventure and simulation genres. The main aim of the search was to locate a computer game that has English vocabulary improvement essence through images and English text (not too much text and mainly text that form part of the game instructions) suitable for most, if not all, age groups and genders.

In all the search cases, computer games were reviewed through their demo or trial versions. Computer games that were reviewed included (to mention a few), The Sims 3, Second Life, Civilization IV, Indiana Jones and the Fountain of Life, Nancy Drew, Warnings at Waverly Academy, CSI: New York, Mrs Marples/Hercules Poirot Endhouse, Mystery in London; and Sherlock Holmes versus Jack the Ripper. All of the reviewed games did not meet the expectations or purposes of this study due to playability, ethical and other related reasons, because some games:

I. Require large amount of personal computer resources;
II. Have good narratives and graphics but are complex (they would not be easy to map in terms of their content);
III. Have good graphics and some dialogue but were too simplistic to hold a gamer's attention;
IV. Require more gaming time and are difficult;
V. Are not suitable for a South African context in terms of the language used, the setting of the game (e.g., Medieval (old-fashioned context), war, genre, etc., and
VI. Require gaming experience to play, particularly civilization-based games, where the time required to master developing one's civilization was also an opportunity for a neighbouring civilisation to attack and destroy the player.

Finally, the **Agatha Christie 4: 50 from Paddington** computer game was chosen amongst all due to the following justifications, to mention the relevant few:

I. A nice narrative, broken into chapters, where the gamer gathers clues related to a storyline that is logical (meaning the game players would understand why

they are/were looking for objects and clues). It is different from other games where you gather clues in a much more random fashion;

II. It is suitable for gamers of different experience levels and age groups;

III. There is variety in the game so that players would not be bored if they play it several times; and

IV. A choice to play a timed or unrestricted time (carefree) modes.

This computer game was, therefore, chosen also for its ease of play (no need to read long manuals and play for hours to learn how to play it properly), as reviewed by Cater (2010) and its suitability for all ages and genders. Gamers in the context of this study were also given a printed computer game guide, which provided details and instructions to help them to understand and play the game.

Moreover, this computer game has a logical storyline (made up of English instructions and objects) comprising of chapters as game scenes. This means the game players will understand why they look for objects and clues; different from other computer games where gamers gather clues in a much more random fashion. This selected computer game has a total of 11 chapters, where the computer game player is expected to play a crime detective role, to investigate a murder that occurred on a train that was going in an opposite direction to the train that came from Paddington. Therefore, as detective, the game player investigates a murder crime at various sites, such as a train station and the police station, and gathers clues that eventually help to solve the crime mystery.

However, due to time limitations, the research's CPE group gamers were allowed to play only up to chapter 5 of the computer game, in pairs; playable in one hour thirty minutes, on average. The motive for allowing the participants to play in pairs was to enhance motivation and/or learning or English vocabulary improvement. At the end of the fifth chapter of the computer game, players are given the first opportunity to guess or rather identify their suspected murderer from a set of characters presented from the game's built in gallery. Furthermore, by the fifth chapter of the selected computer game, all of the participants would have been exposed to the target words (AWL words and other words in the assessment instruments). The guessing or the identifying of the suspected murderer depends on glues gathered and the storyline constructed or understood by the gamers up to chapter 5.

The details of this computer game's storyline can be followed in both the CPE group's computer game guide (Appendix F) and the NBC group's narrative (Appendix H).

3.2.7 The Agatha Christie 4:50 from Paddington printed game guide

A game guide on how to play the above mentioned computer game was designed for the CPE group. This game guide incorporated a few graphics or pictures that showed what the selected computer game looked like in play mode. The game guide also provided a computer game overview in a narrative format that incorporated 22 AWL words from sub-list 1; enhancing exposure to the AWL targeted words for the participants. The purpose of the computer game overview was to ensure that research participants (as experienced or amateur gamers) get a fair introduction to the computer game and to also aid understanding the game storyline and goals.

3.2.8 The Agatha Christie 4:50 from Paddington computer gamers' observer checklist

Researcher assistants, known as observers, used a checklist of observational items to capture the game play of the CPE group players (participants) as they played this study's computer game. This checklist allowed the observers to capture the game play activities through both quantitative (where data was quantified in terms of the observed playability of the game) and qualitative (where observer opinions were also captured) manners. The main purpose of this checklist was to allow the researcher (assisted by observers) to further gain understanding of the playability or rather the ease of use of the selected computer game, as CPE group participants progressed through computer game, during their game play.

This observer checklist queried playability from chapter to chapter in terms of how often did the computer gamers:

I. Consult the computer game guide (printed and or in game), and if they did consult the game guide, for how long did they seem to do that?
II. Consult the in-game gallery (meant for constructing the storyline and believed to enhance English vocabulary in the context of this study)?
III. Locate "crime investigation" locations within the computer game through the aid of in-game (English) instructions, and how long did it take the players (CPE participants) to locate such locations?

3.2.9 The Agatha Christie 4:50 from Paddington narrative

The CPE group played the abovementioned computer game; while, on the other hand, the NBC group studied a printed narrative that was based on the mentioned computer game storyline. This narrative also included comprehension questions for the purposes of ensuring that participants do read the narrative in order to gain exposure to the target English words (AWL, in particular).

This hard copy intervention instrument translated the storyline of the intervention computer game for this study into a narrative that incorporated the AWL words. This instrument also had a family tree (diagram) to assist research participants (NBC group) in understanding the relationships of characters (role players) within the narrative. Research participants were also encouraged to answer open-ended questions in a tutorial at the end of the narrative.

3.2.10 Post-test questionnaire

The post-test questionnaire instrument that was applicable to the CPE group contained questions that were only relevant to this study's computer game. The aim of this questionnaire was to attain the following study objectives:

I. To determine the playability of the selected computer game in the classroom environment;
II. To determine the perceived ease of use of the selected computer game in the classroom environment;
III. To determine the perceived usefulness of the selected computer game in expanding English vocabulary; and

IV. To determine the impact of the selected computer game in expanding English vocabulary.

The design of this research instrument was guided by heuristics (design guidelines that serve as useful evaluation aspects for software products, inclusive of computer games) designed to evaluate the playability of computer games (Desurvire, Caplan and Toth, 2004). As a result of the selected computer game review, it is, therefore, assumed that the said heuristics are incorporated or featured in the game. Table 3-1 shows computer game playability heuristics that guided the ten questionnaire items on computer game playability:

Table 3-1 Playability Heuristics: Adapted from Desurvire, Caplan and Toth (2004)

Game play	Heuristic and Description	Number of questionnaire items yielded
1	Provide clear goals, present overriding goal early as well as short-term goals throughout play.	2
2	There is an interesting and absorbing tutorial that mimics game play.	2
Mechanics		
1	A player should always be able to identify his/her score/status and goal in the game.	1
Usability		
1	The player experiences the user interface as consistent (in controls, colour, typography, and dialog design) but the game play is varied.	1
2	The player should experience the menu as a part of the game.	1
3	Upon initially turning the game on, the player has enough information to get started to play.	1
4	Players should be given context sensitive help while playing so that they do not get stuck or have to rely on a manual.	1
5	Players do not need to use a manual to play game.	1

Furthermore, this questionnaire was also guided by the TAM 2 (TAM 2, as explained in Chapter 2; Bagozzi, 2007) and further adapted questionnaire items designed to measure two TAM 2 constructs, namely, **Perceived Ease of Use** and **Perceived Usefulness** (Davis, 1989; Venkatesh, 2000; Saade´and Bahli, 2005; Bourgonjon, Valcke, Soetaert, and Schellens, 2010).

As a result, the questionnaire items for this research instrument were as follows:

3.2.10.1 Question item 1

This dichotomous question aimed in establishing whether the computer gamers understood the game instructions in terms of assisting them in progressing with the gameplay. A "Yes" answer led the respondent to question item 2, otherwise respondents were urged to answer question item 3.

3.2.10.2 Question items 2 and 3

Question item 2 is labelled **"positive playability"** by the researcher because the respondent would have answered with a "Yes" to question item 1 (described above), suggesting that the respondents agreed to have understood the computer game instructions to progress with the game play. This question item/section incorporated 10 (2.1-2.10) Likert-scale (1-to-3 bipolar scale) questions that assessed playability based on the playability heuristics, presented in Table 3-1, in a positive way.

Otherwise, if the respondents answered with a "No" to question item 1 described above, they were urged to answer to question item 3. Question item 3 (labelled **"negative playability"**) incorporated 10 (3.1-3.10) Likert-scale (1-to-3 bipolar scale) questions that assessed playability based on the playability heuristics presented in Table 3-1, in an opposite or rather, negative way.

3.2.10.3 Question item 4

Likert-scale (1-to-3 bipolar) questions were adapted from Yunus, Lubis, Lin and Wekke (2009) to measure the perceived impact of the study's computer game towards English vocabulary improvement.

3.2.10.4 Question item 5

This question item/section incorporated 1-to-3 bipolar Likert-scale questions, to measure the perceived ease of use (adapted from TAM 2; Bagozzi, 2007) of the

study's computer game, as gamers played the computer game. The purpose of this questionnaire construct was to supplement the playability constructs described above, i.e. if the computer game is perceived to be easy to use; it is then playable (Desurvire, Caplan and Toth, 2004).

3.2.10.5 Question items 6

This question item/section attempted to measure the perceived usefulness (adapted from TAM 2), through 1-to-3 bipolar Likert-scale questions. Furthermore, respondents were also prompted to explain their Likert-scale choices (agree, somewhat and disagree) in their own words, as the researcher needed to enhance the measurement of this construct through respondents' opinions on the selected computer game's perceived usefulness, towards English vocabulary improvement.

All the above described research instruments and material were coded or numbered for ease of tracking of material related to each research participant. This was done because these instruments and materials were administered at different stages of this study. The coding and numbering of these instruments and materials were and are still kept extremely confidential by both the researcher and the supervisors, because participants' student identification numbers were used for the said coding or labelling of research instruments. Furthermore, an information letter of consent accompanied research instruments to brief the participants about their role as participants, the research and the research instruments.

3.3 Target population

Trochim (2006) states that, in research, there are two types of populations, namely, the theoretical population to which the researcher needs to generalize the research findings and the accessible population to the researcher. Therefore, while the theoretical population for this study was tertiary institutions' students, the target accessible population for this study was students from selected engineering departments of the Durban University of Technology (DUT), South Africa; to the convenience of the researcher.

3.3.1 Accessible population context

DUT is a multi-cultural and multi-campus (with campuses in the cities of Durban and Pietermaritzburg) university of technology. This institution of higher education has six faculties and the study's accessible population (engineering students) were from the **Faculty of Engineering and the Built Environment**, on the Steve Biko campus, in Durban. This faculty consists of nine departments; however, this study's accessible population were second to fourth semester full-time registered engineering students who were second language English (ESL) speakers, from DUT's departments of **Electrical Engineering** and **Industrial Engineering**. Students from these two departments were chosen as an accessible population, because of the willingness of the heads of departments and the lecturers to work with the researchers. In total, these two departments had a population of 225 ESL speakers in the second semester of 2013. Students who were registered full time were targeted because of their availability during business or normal working or student campus hours. Furthermore, these students were targeted also due to the fact that, like many other ESL speaking students, they need to know English very well, for them to understand academic material and pass examinations; as a need highlighted in the literature.

This study, therefore, intents to generalize its findings to the:

I. Above described accessible population; and

II. ESL tertiary student population.

However, for the effective administration of research instruments and the amount of time required in such administration, it was ideal for a sample of the accessible population to participate in this study, as explained in the next section.

3.4 Sampling

According to Trochim (2006), sampling is the process of selecting representatives of the entire population of interest so that, by studying the sample, the results of the study may be fairly generalized back to the accessible population from which the representatives were chosen. This selection process is based on a sampling frame.

3.4.1 Sampling frame and methods

A sampling frame is, according to Lewis-Beck, Bryman and Liao (2004), a list or device used to determine the research accessible population. In this study, the researcher used a list of all students registered in the departments of **Electrical Engineering** and **Industrial Engineering.** This list was obtained from the DUT Information Technology and Support Services (ITSS) department. The list comprised full-time and part-time registered students from the abovementioned departments from first semester to post-graduate levels. The researcher then had to carefully select only second to fourth semester full-time registered ESL students from the abovementioned departments and the targeted accessible population came up to 225 students. This is the population from which the sample of this study was drawn.

3.4.2 Sampling approach

There are two main approaches to sampling, namely, probability and non-probability sampling (Trochim, 2006). According to Cohen *et al*. (2011), the probability sampling approach utilizes a random selection of participants, where random selection means every participant would have an equal chance of being selected to participate in the study, while non-probability sampling does not involve random selection.

This quasi-experimental mixed methods' study, therefore, used a convenience non-probability sample of the abovementioned accessible population as research participants. According to Teddlie and Yu (2007), convenience sampling draws samples that are both easily accessible and willing to participate in a study. The theories on sampling approach presented above suggest that the more probable the sample, the better the quality of the results of the data gathered from such a sample. It is, therefore, worth acknowledging the non-probability sampling approach of this study's sample due to the following reasons:

I. Even though both groups were supposed to be identical in demographics, getting two groups of equal size from the same pool (department, year, etc.)

was too difficult due to lecturers' reluctance (unwillingness to give up teaching time), etc., and

II. Therefore, the researcher had to rely on unequal groups (demographics wise) from different departments and years, etc., which would have added biasness to the study's results.

3.4.2.1 Sample calculation

The calculations of this study's sample size followed the guidelines for inferential studies' sample calculations provided by Fox, Hunn and Mathers (2007). They highlight that inferential studies need both significant and statistical power (confidence level) to generalise to the accessible and eventually the target population.

Significant and statistical power assist in avoiding Type I (1) and Type II (2) error while affecting the sample, i.e., the more the sample size and the less the errors, the more statistically significant the results of the study. Trochim (2006) and Fox *et al.* (2007) describe Type I error as "finding an association which is not really there", i.e., the error of falsely rejecting a true null hypothesis. A null hypothesis attempts to show that no variation exists between variables or that a single variable is no different than zero. On the other hand, Type II (2) error is described as an error that results when a study fails to find an association between or amongst variables, when there is in fact an association. It is, however, well known that complete error (Type II error, in particular) is inevitable. Therefore, inferential research studies normally allow for a confidence interval (sampling error probability) of 0.05 (5%); suggesting that the researcher should be 95% accurate in inferences (generalisations) of his/her research study results, i.e., 95% confidence level (Fox *et al*., 2007; Cohen, Manion and Morrison, 2011). Furthermore, there are various statistical tables providing guidelines on how to determine a sample size through confidence interval. The Sekaran and Bougie (2013) sampling table was used in conjunction with online sampling calculators such as ***surveysystems.com*** and ***raosoft.com***, to determine the sample size for this study and the sampling was considered in terms of confidence intervals where the sample size satisfied a 95% confidence level (the range within which the true (population) value for the effect is 95% likely to fall); allowing only

5% confidence interval (sampling error probability). As a result, a sample size of 142 research participants seemed viable when considering the said confidence interval and level. Therefore, 71 participants formed the NBC group, while the remaining 71 made up the CPE group.

3.4.3 Sampling exclusion criteria

The sample size for this study excluded students who were registered for the above-mentioned engineering programmes on a part-time basis. Part-time students spend most of the day in their respective working environments and usually attend to their studies after working hours. As a result, the researcher assumed and believed that recruiting part-time students, as participants in the study, would inconvenience them due to limited time they have because most of them are working during the day and research activities required some more time (time they may not have). This limitation could further jeopardize the quality of data that was expected from this study.

3.5 Pilot study

As part of the research design, a pilot study was undertaken to certify the validity and reliability of the research instruments and procedures mentioned above. Lancaster, Dodd, and Williamson (2004) describe a pilot study as a mini version of a full-scale study as well as the specific pre-testing of a particular research instrument, such a questionnaire. According to Lancaster *et al*. (2004), a well-conducted pilot study with clear aims and objectives ensures methodological thoroughness, reliability, validity, and feasibility factors such as time to complete questionnaires, and respondent adherence (Hertzog, 2008). Pilot studies normally require a subset of the full-scale study sample (Hertzog, 2008). According to Hertzog (2008), this subset normally represents 10% of the full sample size, even in experimental studies. As a result, 10 % of the of this study's sample size (142) equates to 14 participants. However, the researcher was able to work with 20 willing participants, for the pilot study.

For each of the research instruments tested (piloted), the researcher aimed for the following feedback from the participants (Lancaster, Dodd, and Williamson, 2004):

I. Ambiguity in questionnaire items, English Vocabulary Test questions, instructions in the game guide and all the research documents that were handed to the participants; and

II. Difficulty in understanding questionnaire items, and the various questions and any instructions meant to help them understand what is expected of them in this research study.

3.5.1 Pilot study procedure

Based on theories presented in the previous section, the pilot study for this research had to also mimic the projected data collection processes of this study. At the time of the pilot study, only six instruments were tested, namely, the questionnaire on background and computer gaming experience, etc., the English Vocabulary Tests, the computer game, the computer game guide, the computer game observer checklist and the post-computer gaming questionnaire. The reasons for the bringing in the NBC group's narrative are explained in section 3.5.3 below. Due to the number of instruments and the mixed methods' nature of this study, it seemed feasible to conduct the pilot study in durations that were within two days, as shown in Table 3-2 below:

Table 3-2 Pilot study procedure activities

Pilot study research activity	Expected duration of completion	Responsible group(NBC or CPE)	Day
Briefing session and distribution of letter of information and consent to participants	15 minutes	Both groups	1
Administration of a questionnaire on participants' background information and their computer gaming experiences	25 minutes	Both groups	1
Administration of an English vocabulary pre-test	30 minutes	Both groups	1
Computer game playing session: playing the abovementioned computer game	1.5 hours	CPE group	1
Administration of an English vocabulary post-test	30 minutes	Both groups	2
Administration of a post-experiment questionnaire on perceived ease of use, usefulness of the computer game, the perceived impact of the computer game on English vocabulary and Autonomous English language learning/Out-of-class English language learning	25 minutes	CPE	2

3.5.2 Pilot study data analysis

Statistical Product and Service Solutions software (SPSS version 21) was used to perform the Fisher's Exact (McDonald, 2009) statistical test on the pre- and post-EVTs' (EVT) collected data. SPSS was further used to perform validity and reliability tests on the questionnaire and EVT instruments' collected data.

According to McDonald (2009), Fisher's Exact Test was used to determine if the there was a significant difference in the pre- and post- EVTs for both the NBC and CPE groups. Fisher's Exact Test was chosen because of its suitability for sample sizes that range from as little as 10 upwards and also for ensuring validity on binominal type of data: correct and incorrect answers of the EVT. Fisher's Exact Tests are commonly used to test what scientists call a null hypothesis (Ho) against an alternative hypothesis (Ha). This study's null hypothesis and alternative hypothesis are as follows:

Ho: The proportion (quantity) of students (research participants) whose English vocabulary increased is independent of the computer gameplay; and

Ha: The proportion (quantity) of students (research participants) whose English vocabulary increased is associated with the computer gameplay.

The null hypothesis can only be rejected if the English vocabulary improvements based on the computer game are significant.

Differences for the pre- and post- EVTs for each group were tested with the above-mentioned statistical test at three categories, namely; AWL sub-list 1 academic words and non-academic words (general words based on this study's computer game context) improvements and also the images section (where participants were prompted to name the images provided).

A follow-up semi-structured interview was used as a qualitative research instrument to explore reasons behind the data results.

3.5.3 Lessons learned from pilot study results

Reliability and validity results came out positive for the questionnaire instruments. However, reliability and validity tests on the EVTs suggested rewording of some of the test question items due to some grammatical errors and ambiguity. Fisher's Exact Test proved the results to be significantly different between the pre- and post- EVTs for the experiment group and slightly different for the NBC group.

Furthermore, the administration of the pilot study allowed for the EVT for both groups to be attempted in durations that took place within two days, i.e., the pre-test

was attempted on day 1 (as shown in Table 3-2) and the post-test on day 2. This administration procedure has, therefore, allowed both groups to discuss amongst themselves the contents of the pre-test; gaining the advantage of performing very well in the (similar) post-test. This discussion may have, therefore, been good for learning purposes but may have also been bad in obscuring the effects of the intervention, i.e., the selected computer game.

Nonetheless, the Fisher's Exact Test result predicted potentially positive (or as hypothesized) results. The semi structured interview confirmed that the computer game is fun to play and suitable for all age groups and, furthermore, a suitable computer game for English vocabulary expansion. CPE participants (from the pilot study) also expressed the fun and ease of play experienced from nice visuals, resulting in elements of attention and engagement in the computer game.

The CPE group indicated that, because they encountered these academic words for the first time while playing the game, they became familiar with the words but did not retain their meaning. This suggests that, if these participants were given enough time (more than the given 1, 5 hours in pilot study), there would have been better retention of words that the experimental group participants first encountered during the game.

An outside expert reviewer, upon reviewing the pilot study results (Lingwati *et al*., 2013) recommended that the NBC group (called the control group during the pilot study), be exposed to some intervention; either a computer game of some sort, or a traditional vocabulary learning method, hence, the introduction and use of a narrative for the NBC group.

The target accessible population of this study was second to fourth semester engineering students from the Durban University of Technology, South Africa and appropriate sampling procedures were followed to obtain a desired sample size of 142 research participants. This sample further guided data collection procedures in terms of planning and execution of data collection administration.

Collected data were carefully prepared for capturing and cleaning. This process was followed by rigorous data analysis that included quantitative (working with numbers or statistics) and qualitative (opinions or explorations) data analysis procedures, in

search for answers to this study's questions. These answers (research results) are elaborated on, in the subsequent chapters.

3.6 Summary

This quasi-experimental mixed methods research attempted to explore the effectiveness of a selected computer game on English vocabulary improvement; in a quasi-experimental nature of a control and experimental groups, namely, NBC and CPE respectively, and the utilization of the pre and post-tests. This chapter outlined in detail, the quantitative and qualitative (mixed) approaches that were implemented to investigate the effectiveness of the selected computer game on English vocabulary improvement. The core or main types of research instruments presented, were the off-shelf selected computer game and the pre and post EVTs, while other essential instruments included survey questionnaires and playability checklist. The majority of the study's research instruments were tested in a pilot study in order to certify the adequacy and feasibility of the research instruments and procedures. The next chapter details the implementation of the study's research method designs in terms of the administration of the data collection instruments and eventually the collected data analysis procedures.

CHAPTER 4

RESEARCH METHODOLOGY IMPLEMENTATION

4.1 Introduction

The purpose of this chapter is to detail the implementation of the research methodology outlined in the previous chapter. However, because this study was collecting data using people and their abilities, ethical considerations are presented first and foremost. This chapter details how the research methods were implemented to address this study's research questions, aims and objectives and the research gaps identified in the literature, as outlined in Chapter 2. Data were collected from a convenient sample of university English-As-A-Second language speaking Engineering students. Therefore, this chapter particularly presents the administration of the research instruments towards attaining the goals of this study. Data analysis methods that were carefully selected in line with the research design are also presented.

4.2 Ethical considerations

In cases where research collects data from people and about people, Creswell (2014) suggests that a researcher should anticipate some ethical issues. According to Creswell (2014), ethical issues should be considered in different stages, aspects and/ or components of a research project, such as research problem, research purposes and questions, research data collection, research data analysis and interpretation. Ethics in research are, according to Resnik (2011), norms for conduct that distinguish between acceptable and unacceptable behavior. This research considered ethics early at a proposal stage, guided by the DUT's ethical considerations and post- graduate proposal ethical checklist (see Appendix A). Furthermore, DUT has a committee dedicated to research ethical clearances called the Institutional Research Ethics Committee (IREC). It was, therefore, essential for this study's research proposal and

research instruments to be cleared by the DUT IREC as this study involved human participants. Table 4-1 highlights the instruments' administration activities.

Main study research activity	***Allocated duration of completion***	***Responsible group(NBC or CPE)***
Briefing session and distribution of letter of information and consent to participants	10 minutes	Both groups
Administration of a questionnaire on participants' background information and their computer gaming experiences	20 minutes	Both groups
Administration of an English vocabulary pre-test	25 minutes	Both groups
Administration of the computer game-based narrative and comprehension	30 minutes	NBC group (in pairs)
Computer game playing session: playing the abovementioned computer game	1 hour 30 minutes	CPE group (in pairs)
Administration of an English vocabulary post-test	20 minutes	Both groups
Administration of a post-experiment questionnaire on perceived ease of use, usefulness of the computer game, the perceived impact of the computer game on English vocabulary and autonomous English language learning/Out-of-class English language learning	25 minutes	CPE group

Table 4-1 Main study research instruments' administration activities

4.3 Administration of main study collection instruments

The administration of collection instruments relied solely on the availability of the research participants and the computer laboratory (as an efficient and effective venue, particularly for the playing of the computer game). Two hours' lecture periods (known as double lectures), convenient to the researcher at the pleasure and consent of the lecturer allocated to such lecture periods, were selected. However, the duration of the research activities and administration of all research instruments (per available group/subgroup) was 2 hours and 40 minutes, as illustrated in Table 4-1.

4.4 Data analysis

Data analysis, in the context of this research, involved using quantitative and qualitative data analysing techniques; resulting in this study utilizing a mixed methods' research approach. Repetitive decisions taken during the design of the mixed methods' nature of this study revealed that this study took a quantitative dominant mixed methods' approach. Qualitative data and analysis were, therefore, incorporated in this study to increase the understanding of the underlying study phenomenon resulting from quantitative data and analysis (Onwuegbuzie and Combs, 2011). Onwuegbuzie and Combs (2011) further state that a mixed methods' data analysis process must have a time sequence, i.e., analysis of quantitative and qualitative components in a chronological or concurrent order. Moreover, according Onwuegbuzie and Combs (2011), there are several mixed method analysis types such as:

I. Case-oriented: an analysis that aims to understand a particular case or several cases by looking closely at the details of each case or variable; for example, various cases were analyzed in terms of individual EVTs' sections, etc., and
II. Variable-oriented (an analysis that describes and/or explains a particular variable).

Therefore, the case and variable-oriented mixed method data analysis for this study followed the following chronological and (at some point) concurrent order:

I. The quantitative components of some survey questionnaires were concurrently analysed with the qualitative components that were embedded in some instruments (e.g., the post-test questionnaire and computer game playing checklist had both quantitative and qualitative components);

II. EVT and possible correlating factors (from some of the survey questionnaires) were analysed quantitatively; and

III. Computer-game playability data was analysed both quantitatively and qualitatively due to the required type of measurement for playability factor, i.e., playability is normally measured in a mixed methods' manner.

Data were carefully prepared and/or organized after collection to allow for the effectiveness of data analysis methods on this study's collected data.

4.4.1 Data preparation

As mentioned in section 3.5 above, all research instruments were coded or labelled with research participants' student numbers. These student numbers assisted in the first approach to data preparation, where the researcher ensured that all quantitative research instruments related to a specific participant were in the following order:

I. Background or biographical, prior computer gaming experience and autonomous English language learning questionnaire;

II. English vocabulary pre-test;

III. The Agatha Christie 4:50 from Paddington computer gamers' observer checklist (for the CPE group) or the narrative (for the NBC group);

IV. English vocabulary post-test; and

V. Post-test questionnaire (experimental group).

All qualitative data instruments were later grouped together for data analysis (see qualitative data analysis section below), and these included:

I. The Agatha Christie 4:50 from Paddington computer gamers' observer checklist (observer views or opinions on gamer play);

II. Post-test questionnaire (experimental group views or opinions on the perceived usefulness items);
III. The Agatha Christie 4:50 from Paddington narrative (open-ended questions based on the narrative); and
IV. Discussion group data.

4.4.2 Data coding and cleaning

Crossman (2014) describes data coding and cleaning as a process of entering quantitative data into a computer program such as Microsoft Excel or IBM's Statistical Package for the Social Sciences (SPSS) software programs. This process enabled the researcher to capture data in a format that eased the crucial process of detecting and correcting data entry errors; for errors are inevitable during data capturing. It was effective to capture this study's quantitative data into SPSS for thorough data formatting and cleaning.

Furthermore, Crossman (2014) states that there are two types of data cleaning, namely, possible code cleaning and contingency cleaning. In possible code cleaning, any given variable had a specific set of answer choices and codes to match each answer choice, e.g., the variable *Age group* had four answers, where code 1 meant age group 16-20, code 2 meant age group 21-25, code 3 meant age group 26-30 and code 4 meant age group 30 +. SPSS allows for such answer codes to be defined before data could be captured such that, if any code out of the specified range of codes is captured, an error message would warn the researcher or the data capturing personnel; providing for instant error detecting and correcting. In contingency data cleaning, the researcher was concerned with the logical structure of data in terms of limits on the responses of certain respondents or on certain responses. Crossman (2014) further emphasizes that contingency cleaning is the process of ensuring that only those cases that should have data on a particular variable do, in fact, have data. In fact, respondents did fill or complete answers where it was not necessary. However, all sections, where answers were required, were filled in or completed.

4.4.3 Reliability and validity

Reliability and validity are two concepts that determine the quality of results or findings from research projects of vast genres such as medical, educational and social sciences research (Kan, 2005; Drost, 2011). Reliability is, according to Kan (2005), the extent at which research attributes are accurately and consistently measured by a research instrument. On the other hand, validity is described as the extent to which the research instruments' attributes measure what they are intended to measure (Kan, 2005; Drost, 2011).

Furthermore, validity has two important parts; internal and external. Internal validity determines whether the study results are valid based on the relationship amongst research attributes within a particular variable being measured (Drost, 2011). However, external validity determines the extent of generalizability of the results of the research attributes being measured (Drost, 2011); mainly measured through inferential statistics, as mentioned before.

Research instruments, used in this study, were also tested for reliability and validity using SPSS 21 statistical software. In SPSS 21, the most commonly used reliability test method is called Cronbach's coefficient alpha (Tavakol and Dennick, 2011) and it was used to assess the reliability of the data gathered from this study's research instruments. A particular research attribute on a research instrument is considered internally reliable by the Cronbach's alpha test if the Cronbach's coefficient alpha is equaling or greater than 0.7; suggesting an acceptable reliability of 70%.

SPSS 21 also has a functionality called factor analysis meant for testing instruments' validity by identifying factors that can be used to represent relationships among sets of interrelated variables (Williams *et al*., 2010). Factor analysis is performed in four steps, as follows (Williams *et al*., 2010):

I. Suitable quantitative data at interval and or ratio levels are considered;
II. A correlation matrix for all variables is computed, i.e., a rectangular array of quantities set out by rows and columns, and that gives the correlation between all pairs of data sets;
III. Determining the number of factors (e.g., questionnaire items) necessary to represent the data (data that must help answer a research question) and the

method of calculating them (factor extraction that is to extract items that make a variable weak or strong in terms of answering a research question); and

IV. Transforming the factors to make them interpretable (rotation of variables), where necessary.

The goal of factor analysis is, therefore, to identify unobservable factors on the basis of a set of observable (evidence bearing) variables. A correlation component matrix in SPSS 21 was, therefore, used to identify the relationship between individual variable items of the questionnaires and the EVT. Correlations through the component matrix were performed in consideration of:

I. Pearson's coefficients significance levels: the correlation strength denoted by ***r***, where a +1 r denotes a positive correlation, when considered at a 0.05 confidence level, in the context of this study; and

II. Determinant (denoted by r^2): explains the variability of a factor or variable with regards to its relationship to the other factor being correlated with, i.e., the square of the coefficient of correlation, starting from 0 (0%) to 100 (100%). The higher the value of the determinant, the better the fit of the correlation between correlated factors. A negative determinant would, therefore, suggest a need for the adjustments (removal or extraction of items from a factor or variable). This adjustment is done through the Principal Component Analysis (PCA) method in SPSS 21 (Yusoff, 2011). PCA, in SPSS 21, serves the purpose of explaining the variance or covariance of factors as groupings of a component; suggesting, the more various items of a variable or factor are appearing in more than one component (the lower the determinant), the need for extraction and adjustment of components such that they measure only one component.

However, prior to extraction of problematic or unobservable factors within a variable, KMO and Bartlett's test of sphericity needs to be performed. **Kaiser_Meyer_Oklin (**KMO) and Bartlett's test of sphericity tests the equality of variance (adjustments) of the differences between each pair of correlated factors. The presence of sphericity is denoted by Ɛ (an epsilon). This test's importance, according to Lund and Lund (2013), of testing for sphericity is in ensuring the reduction of Type 1 (I) error (the error of falsely rejecting a true null hypothesis), where Ɛ=1

indicates that the condition of sphericity (equality of variance) is met and, therefore, the null hypothesis can be confidently and truthfully rejected.

The abovementioned aspects are the most popular and recommended correlation options for thorough validity testing (Williams *et al*., 2010).

4.4.4 Data analysis tests

The following data analysis tests were performed using the SPSS 21 statistical data analysis software:

I. **Descriptive statistics** in a form of means (averages) are presented to describe basic features or characteristics of the data;

II. **Cronbach's alpha** was calculated for the grouped score for each of the EVT components or sections to determine reliability in terms of internal consistency. An alpha value of greater than 0.7 indicates that the grouped score for each of the components or research variables is reliable in terms of internal consistency;

III. **Chi-Square Goodness-of-Fit-Test**: A univariate test, used on a categorical variable to test whether any of the response options were selected significantly more or less often that the others. Under the null hypothesis, it is assumed that all responses are equally selected. This test assisted this study in interpreting any above or below average responses in relation to the research questions or research investigated factors;

IV. **Wilcoxon Signed Ranks** test for two related samples: A non-parametric (not based on parameterized families of probability distribution) used in the comparison of the distributions of two variables; and a non-parametric equivalent to the Paired Sample T-Test. This test, used due to non-probability of quasi-experimental nature of this study, assisted in interpreting all data that were collected and based on Likert-scale and interpretations from the comparison between the pre- and post- EVT data;

V. **Chi-square Test of Independence**: Used on cross-tabulations to discover whether a significant relationship exists between the two variables represented in the cross-tabulation. When conditions are not met (usually because statistical

conditions are not met due to insufficient sample), Fisher's exact test is used. These tests helped to determine whether or not variable one is related to –or independent of variable two; such as in comparing demographic variables;

VI. **Pearson's (and Spearman's) Correlation** test for a correlation between two ordinal variables. This test assisted in interpreting how the pre- and post-test performances, and the EVT performance and various other variables, such as Autonomous English vocabulary learning, were related;

VII. **Paired Samples T-Test**: Compares the means of two variables for a single group. This test assisted in interpreting the significant difference of the two means, especially in terms of the EVT means; and

VIII. **ANCOVA (analysis of covariance)**: to test for the impact of the intervention on the English scores, by testing the main interaction effects of the test scores on the post-test while controlling the effects of the pre-test scores which co-vary with the post-test scores. This test assisted in interpreting whether the post-test scores' improvements or lack of improvements in post-test scores (from the average controlled pre-test scores to actual post-test scores) were attributed to the interventions (particularly the core intervention of this study; a computer game).

Qualitative data were analysed in terms of data coding (see section 4.4.4), word frequencies, word charts and word correlations using NVIVO 10 (qualitative analysis tool). Furthermore, NVIVO 10 was used for an in-depth analysis and interpretation of opinions that were provided through focus group discussions, in order to confirm and justify the most common of the statistical findings.

4.4.5 Mixed methods' quasi-experimental relevant data analysis techniques

In terms of quantitative data analysis, SPSS 21 was used for all statistical data analysis. Statistical data was analysed in terms of the following statistical points of inquiry (Burns and Bush, 2003):

I. Descriptive analysis that included means (averages of various scores or participations) and frequency distributions amongst participants' variables or characteristics; and

II. Inferential analysis concerned with estimating population values and testing of study theories or hypotheses, such as:

   a. Differences in analysis to determine significant differences in the CPE and NBC groups' EVTs' performances; and

   b. Associative data analysis, where statistical correlations amongst various study variables were analysed.

Furthermore, a detailed descriptive coding-related qualitative data analysis technique was used to analyse the qualitative data for this study (see section 4.4.4.3 below).

4.4.5.1 Statistical data analysis techniques' rationale: descriptive statistical data analysis

According to Trochim (2006), descriptive statistical data aims at describing the basic features of the data, i.e., explaining the statistical characteristics of the research data so as to identify patterns that may emerge from the data. These patterns are, according to Burn and Bush (2003), achieved through descriptive analysis techniques such as central tendency (typical or frequent responses) and variability (similarities in responses). Therefore, for the purpose of this study, central tendency was analysed through three measures (Burn and Bush, 2003; Trochim, 2006):

I. Mode: descriptive data analysis that intended to reveal frequent response with regards to categorical nominal questions (such dichotomous questions) or ordinal (Likert-scale) questions;

II. Median: descriptive data analysis that was concerned with the positive or negative skewness of the ordinal data, i.e., the more positive the distribution of such data, the more normal and reliable the data is; and

III. Mean: data analysis that described data characteristics in terms of averages, i.e., providing quick interpretations of data patterns of regions, for example, how high or low were EVT scores of this study, or on average, how many participants may have indicated that they played detective computer games before participating in this study.

Furthermore, the following measures were used to satisfy data analysis in terms of the variability or similarities in the data collected for this research study (Burn and Bush, 2003):

I. Frequency distribution: where data was analysed in terms of percentage descriptive presentations, e.g., the percentage of males that claim to have played detective computer games as compared to the percentage of females in the same regard; and

II. Range: statistically identifying the distance between the minimum and maximum values or simply subtracting the lowest values of some score-based data attribute from the highest scores; for example, the distance between pre-test score (if lowest) and the post-test scores would be considered as the EVT performance range, in the context of this study (Trochim, 2006)

4.4.5.2 Statistical data analysis techniques' rationale: inferential statistical data analysis

Inferential statistical data analysis techniques are, according to Trochim (2006) and Hebl and Lane (n.d.), methods that allow the researcher to generalise data results to the population from which the samples were drawn; methods that assist the researcher to reach conclusions that extend beyond the immediate data alone. Trochim (2006) specifically concentrates on inferential statistics that are useful in experimental and quasi-experimental research designs that evaluate an outcome of an intervention.

Therefore, in the context of this study, inferential statistics were mainly used to measure study parameters, such as comparison of means (using Paired Sample T-Test), correlations, analysis of covariance (reliability corrected), in order to test this study's theories and assumptions (hypotheses). T-tests are measures that are used to determine the significant differences between means (averages) obtained from two groups or two variables of a research study (Trochim, 2006). The Paired Sample T-Test (performed using SPSS) was used to examine the significant differences in the means' performances of the CPE and NBC groups in terms of the EVT. The differences in the averages' comparison through the Paired Sample T-Test is said to

be significant if the significant value (also known as ***p value***) is normally less or equal to 0.05 (Park, 2009).

The Pearson Correlation Test feature, found in SPSS, was used to measure the strength of a linear association between two variables (Lund and Lund, 2013). Therefore, a correlation of various variables of this study were measure based on Pearson's correlation coefficient (constant number or relations) denoted by *r*. A Pearson's correlation attempts to draw a line of best fit through the data of any correlated (two) variables, and indicates how far away all variables' data points are to this line of best fit. In simple terms, the Pearson's correlation coefficient *r* must be between +1 and -1, where a value of:

I. 0 indicates that there is no association between the two variables;
II. Greater than 0 indicates a positive association; that is, as the value of one variable increases, so does the value of the other variable; and
III. Less than 0 indicates a negative association; that is, as the value of one variable increases, the value of the other variable decreases.

Analysis of covariance (ANCOVA) was used to measure the deviations (abnormalities) in means of two related variables; particularly the mean performance of the pre- and post-tests in English vocabulary of the NBC and CPE groups of this study. Covariance, in statistical research, is the degree at which two variables are symmetrical, i.e., balanced or equal in their correlation (Trochim, 2006). Covariance may sound similar to correlation; however, covariance is concerned with the correlation of variables where data was collected from a random assignment of research participants. However, lack of such random assignment results in quasi-experimental studies, such as in the context of this study (Trochim, 2006; May, 2012). Quasi-experimental studies are, therefore, said to be biased in nature and the reliability of their intervention results are, therefore, questionable. This is because of the lack of random assignment of research participants; which may mean that, since the participants were not given equal chances to choose the group in which they want to partake the research, i.e., NBC or CPE, the two groups may never be equivalent (comparable). For instance, it may be a case that the participants that belonged to the NBC group or vice versa may have had better English vocabulary than those in their counterpart group. The above examples may have introduced biasness and

confounding variables that the researcher did not have control over or did not even measure within the scope of this study.

One of the aims of ANCOVA is to eliminate unmeasured variables that confound the results of an experimental study (Field, 2012). Reliability-corrected ANCOVA, therefore, suggests an adjustment of all English Vocabulary pre-test's results or differences between the NBC and the CPE group. In a nutshell, Trochim (2006) states that reliability-corrected ANCOVA for quasi-experimental research is performed for the purposes of estimating intervention results by making sure that the pre-test measurement error is adjusted in such a way that each participant's pre-test score will be closer to the mean of the whole group; while the focus is in the actual post-test's results.

The rationale behind the adjustments is based on the biasness in quasi-experimental studies. This biasness is statistically due to (Trochim, 2006) the attenuation (weakening) of slope (rise or drop) that results from pre-test (additive) measurement error, i.e., the deviation of the pre-test results from their (results) true value due to additional (additive) values from variables that were not accounted for or measured.

Therefore, the problem or biasness is not caused by the post-test measurement error because of the criterion that is used in regression analysis (the process of estimating the relationship between the pre- and the post-tests); the criterion being that the relationship between the pre- and post EVTs is undeviating, i.e., the relationship does not have any variances at the post-test level, after the intervention.

SPSS 21 was, therefore, used to perform a reliability-corrected ANCOVA to determine whether there were any significant differences between the means of the post-tests of the EVT instrument data of the two (intervention) groups. Reliability-corrected ANCOVA suggests the determination of the significant differences in the post-tests' results while having a statistical control over confounding variables (covariates) that may have affected the pre-tests' results. The means of the post-tests are said to be significantly different if the significant value (*p value*) is less than 0.05 ($p<0.05$), i.e., at the 95% confidence level.

4.4.5.3 Qualitative data analysis techniques' rationale

Qualitative data coding is, according to Saldana (2013), a word or short phrase that symbolically assigns a summative, noticeable, essence-capturing, and/or suggestive attribute for a portion of language-based or visual data. Qualitative data that was produced in this study, did not have a wide variance in opinions and, therefore, it was found suitable to use Descriptive Coding. Descriptive Coding summarizes the primary topic of the opinion extract (Saldana, 2013) and provides a systematic, semi-rigorous method of analysis of qualitative data, to derive a defined set of opinions or thoughts that can be compared and analysed and is most useful when there is little variance in opinions, making aggregations easier. In order to achieve the qualitative data analysis and obtain results, a software called NVIVO 10 (a product of http://www.qsrinternational.com.), was used to organise and analyses all sorts of unstructured data, such as opinions and open-ended questions. NVIVO 10 allows the researcher to create codes or themes that groups a set of opinions together for analysis that could yield statistical frequencies of words and correlations between coded themes or ideas.

4.5 Summary

This chapter outlined the ethical issues, data collection administration, data preparation for and analysis. The analysis techniques presented in this chapter assisted in yielding data results that could be interpreted in accordance with this study's research questions, aims and objectives. In the next chapter, the presentation of the data results is outlined and further interpretation and analysis of such results are presented.

CHAPTER 5

ANALYSIS AND INTERPRETATION OF RESULTS

5.1 Introduction

This chapter reports on the analysis of the data collected using the various methods which were outlined in the previous chapter. The chapter starts by outlining the specific data analysis tests that were used to analyse the collected data. Results are reported on the following factors:

I. Participants' demographics;
II. Reliability of English vocabulary assessment instrument;
III. Participants' computer gaming history and experience;
IV. Participants' autonomous English vocabulary learning;
V. English Vocabulary Test (EVT from here on) performances amongst the study's groups;
VI. Attributes or factors that influenced the EVT performance;
VII. The selected computer game's perceived competence in English vocabulary improvement; and
VIII. Correlations on some of the study factors.

5.2 Demographics

SPSS 21 was used (as outlined in the previous chapter) to assist in describing basic features or characteristics of the data collected. The various data features are presented below.

5.2.1 Natural participants' characteristics

The study's participants were made up of 70% males, with the African race attributing 93%. The majority of the participants (52%) were in the 16-20 age group, with just a few (2.8%) in the 26-30 group.

The majority of the 142 participants (97%) were South African nationals. The majority of them (70 %) speak isiZulu (one of South Africa's official languages) as their first language. On the other hand, 42% also indicated that they reside in urban areas; with 38% residing in rural areas and 16% in suburbs. Demographic data were also analysed as per group of participants, i.e., narrative- based control (NBC group) and a computer-game playing experiment (CPE) groups. The following chart (Figure 5-1) summarizes the demographics in terms of the above stated groups' distributions:

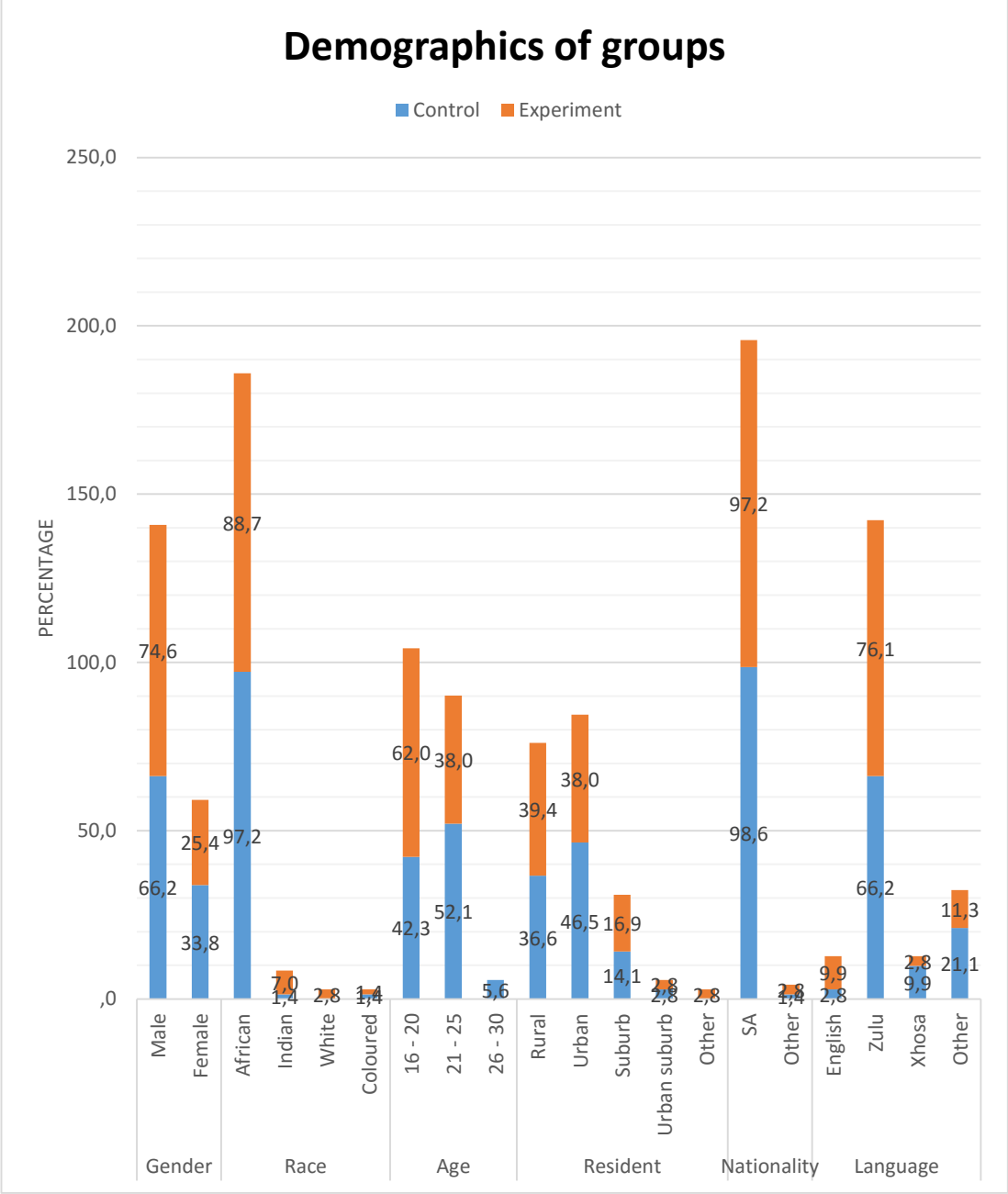

Figure 5-1 Natural demographics of all research participants

Fisher's exact test was performed on these demographic distributions to test for any significant differences in the demographic variables, amongst the two groups. Results from a Fisher's exact test show that there is a significant relationship between age and grouping (Fisher's (N=142) = 7.891, p=.012). Specifically, more than expected from the NBC (control) group are 26 – 30 years old and more than expected of the experimental group are between 16 and 20 years of age; suggesting that the majority of the NBC group is generally older than participants from the CPE group. This may explain the better performance in English vocabulary of the NBC group, i.e., they are much older and had more opportunities to be exposed to and learn English than the CPE group.

A significant relationship also exists between grouping and mother-tongue language (Fisher's (N=142) = 7.896, p=.043). In this case, more than expected from the NBC group are Xhosa speaking while more than expected from the CPE group are English speaking (see Appendix I) This finding suggests that the CPE group is expected to perform better than the NBC group in English vocabulary assessments, unless these CPE mother tongue selections were just fluke or misinterpretation of the question.

5.2.2 Participants' acquired characteristics

The overall study sample indicated that only 30% studied English as a first or home language in high schools; with the remaining 70% studied English as a second language. Furthermore, the majority (44%) obtained a pass mark (grade) of 60-74%; 35% obtained between 50 and 59% and only 9% obtained 75+%. Unfortunately, the data collection instrument did not disseminate between percentages obtained either at first language or second language level of English.

While the majority, as reported above, indicated that they are or were residing in urban areas, the majority (58%) also indicated that they only have access to computers at the Durban University of Technology (DUT). However, 32.4% of the CPE group and 36.6% of the NBC group indicated that they have access to computers at both their home and DUT. On the basis of the study's two groups (NBC and CPE), the following chart (Figure 5-2) summarizes the remaining participants' characteristics:

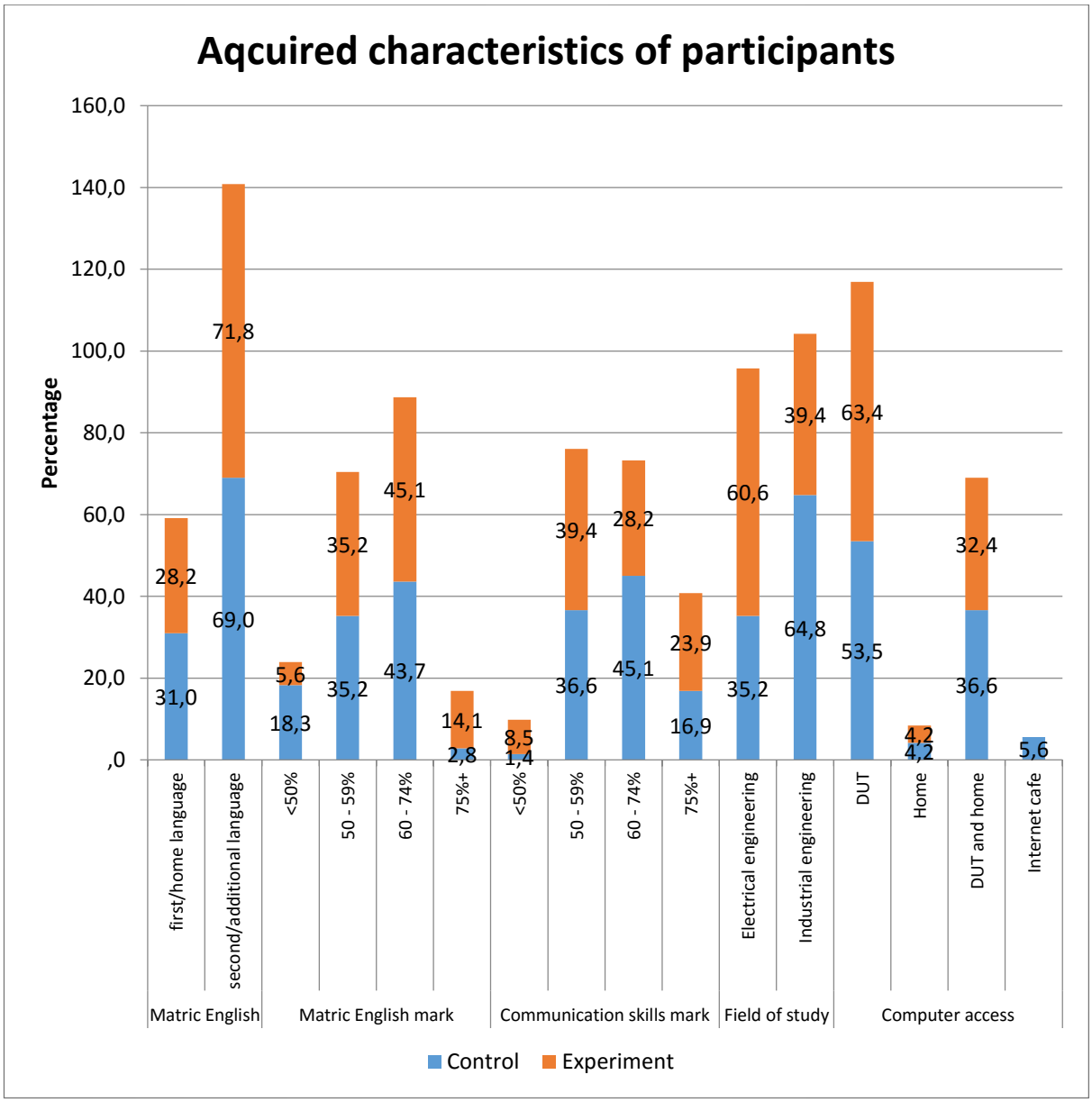

Figure 5-2 Acquired characteristics of all research participants

The chi-square test of independence was used on cross-tabulations to see whether a significant relationship exists between any two of the remaining demographic variables represented in the cross-tabulation. Chi-square test results show that there is a significant relationship between Grade 12 (Matric) marks (high school exit English mark) and grouping (X^2 (3, N=142) = 10.114, p=.018). The results indicate that more than expected from the NBC obtained less than 50% in their Grade 12 English marks. However, more than expected of the CPE group obtained more than

75% (Appendix I). Once again, the expected impact of these demographic elements on the study's results would be better English vocabulary performance from the CPE group than the NBC group. This is further confirmation of the disparity between the two groups.

5.3 Computer gaming history and experiences

While 78% of participants from the NBC group indicated to have played a computer game of any type before participating in this study, only about 63% from the CPE group fell in this category. Coincidentally, 2.8% from each group indicated to have played this study's selected computer game, i.e., the **Agatha Christie 4:50 from Paddington.** The study's selected computer game is of a detective role playing type and 21% of the NBC group participants indicated to have played other detective role-playing computer games; with only 11% from CPE group indicating to have this genre of computer games. Perhaps these statistics show that the NBC group may be more acquainted with the concept of storylines, characters and other features of criminal detective contexts. In terms of the other several types of computer games (on how frequently participants played, for how long since the last time they have played some computer games, etc.), both groups showed small percentages of participants who played such computer games (see Appendix J).

5.4 Autonomous English vocabulary learning

The following autonomous English vocabulary learning activities (Table 5-1) stood out interestingly amongst the rest, between the groups:

Table 5-1 Autonomous English vocabulary learning activities that descriptively stood out amongst the rest

	Autonomous activity	**Duration**	**Descriptive percentages per group**	
			NBC	**CPE**
1.	Speaking English with friends	more than 3 hours	48%	41%
2.	Reading English newspapers and magazines	less than 30 minutes	39 %	47%
3.	Watching English television programmes	30-60 minutes	32 %	34%
4.	Do not read novels at all	N/A	44%	52%
5.	Do not read academic books and articles	N/A	30 %	18%

Table 5-1 indicates that more of the CPE read magazines, but they are less likely to read novels and academic books. Academic books use lots of AWL and, as a result, there may be an impact on participants' familiarity with the AWL list.

A chi-square goodness of fit test was applied on the autonomous English vocabulary learning activities to determine whether the response options were selected equally or not. This test indicated that the expected equal selection of options (anticipated by the test itself) on autonomous English vocabulary learning is 14.2 for each of the two groups at 5% probability distribution (per group); meaning that any selection of options above 14.2 would be significant.

In terms of the NBC, the following results from a chi-square goodness of fit test show a significant selection of response options for the questions on some of the durations that participants spend watching English-based television programmes and listening to English-based radio shows:

I. Watch TV for between 30 minutes and 3 hours ($\chi^2(4, N=71) = 16.958$, p=.002); and

II. Listen to the radio for <30 minutes, if not at all ($\chi^2(4, N=71) = 11.887$, p=.018).

Furthermore, there were comparable significant selections in some similar autonomous activities between the two groups, as follows:

Table 5-2 Autonomous English vocabulary learning activities that are significantly practised by participants from each group

	Autonomous activity	**Duration**	**Chi-square goodness of fit test significance per group**	
			NBC	**CPE**
1.	Reading newspapers and magazines	less than 30 minutes	($\chi^2(4, N=71) = 28.366$, **p<.005**)	($\chi^2(4, N=71) = 45.268$, **p<.005**);
2.	Do not read novels at all	N/A	($\chi^2(4, N=71) = 26.676$, **p<.005**)	($\chi^2(4, N=71) = 47.803$, **p<.005**);
3.	Speaking English with colleagues/fellow students	more than 3 hours	($\chi^2(4, N=71) = 22.873$, **p<.005**)	($\chi^2(4, N=71) = 14.282$, **p=.006**);

The implications of the chi-square goodness of fit test, as presented above in Table 5-2, suggest that the observed selections are significantly practised amongst research participants; implying that the English vocabulary improvement cannot entirely be attributed to this study's selected intervention only, as other factors may have contributed to some level of English vocabulary proficiency. The intervention was designed to improve English vocabulary, but, due to confounding factors, it would be difficult to isolate this intervention's effect.

5.5 English Vocabulary Test (EVT) reliability

The pre- and post- EVT (separately) and for each section (1-3) and the EVT, as a whole, were tested for reliability by calculating Cronbach's alpha in SPSS21. An alpha value of equal or greater than **0.7** indicates that the grouped score for each of the EVT components or the EVT as a whole is/are reliable in terms of internal consistency. However, a score of equal or greater than 0.6 indicates less internal consistency but is still acceptable for reliability.

As a result, the following Cronbach's alphas were observed on the EVT at both pre- and post-test levels:

Table 5-3 EVT assessment tool reliability

	EVT Category	**Sections**	**Cronbach's alphas**
	Pre-Test	Question Items 1.1-1.9	0.725
		Question Items 2.1-2.5	0.700
		Question Items 3.1-3.15	0.673
		Whole pre-test combined	**0.810**
	Post-Test	Question Items 1.1-1.9	0.778
		Question Items 2.1-2.5	0.733
		Question Items 3.1-3.15	0.643
		Whole post-test combined	**0.832**

Overall, given the results outlined in Table 5-3, one can claim reliability of the EVT scores at both the pre- and post-tests' levels. However, Section 3 of the EVT has less consistent answers due to the subjective nature of game play and image-word (for the NBC group), but is still acceptable.

5.6 English vocabulary assessment performance

The English vocabulary assessment had a total score weighting of **34 points,** i.e., **Section 1** (for fill in the blanks) had a weight of **14 points**, **Section 2** (for using synonyms) weighing **6 points** and **Section 3** (for image mapping/naming) weighing **14 points**. The allocation of these points is simply based on the number of missing blanks for Section 1, number of synonyms expected to be used for Section 2, and the number image-word mapping elements for Section 3. The NBC group scored an average of 25 points at pre-test and 27 points in the post-test, i.e., 79% performance at post-test. On the other hand, the CPE group scored an average of 26 points at pre-test and scored 28 points in the post-test, i.e., 82%.

The above findings are merely descriptive performance statistics that show good performance at a cursive level. However, further statistical tests were performed to determine significant improvements in performances of the English vocabulary assessment (EVT).

5.6.1 The significance in the English vocabulary assessment performance

The independent Paired Samples T-Test, which applied Wilcoxon non-parametric test (when needed), was used to test for any significant differences (using 95% confidence interval of difference) in the mean performances of both groups on the whole test and/or its sections. The results of this test are as follows:

Table 5-4 Significant improvements (in red) on EVT performances for the whole sample and per group of participants

Group	EVT Section	Mean improvement from pre to post-test	Wilcoxon non-parametric test's significance
Whole sample	For the whole test	2	(t(141)=-6.694, **p<.0005)**
	Section 1	0.41	(t(141)=-2.464, **p<.015)**
	Section 2	None	(t(141)=- -.076, p<.940)
	Section 3	1.4	(t(141)=-7.977, **p<.0005)**
NBC	For the whole test	1.8	(t(70)=-4.681, **p<.0005)**
	Section 1	0,7	(t(70)=-2.785, **p<.007)**
	Section 2	0.1	(t(70)=- -1.120, p<.267
	Section 3	1.0	(t(70)=-4.229, **p<.0005)**
CPE	For the whole test	2	(t(70)=-4.752, **p<.0005)**
	Section 1	None	(t(70)=- -.584, p<.561)
	Section 2	None	(t(70)=- .932, p<.354)
	Section 3	2	(t(70)=-7.113, **p<.0005)**

Table 5-4 shows that, for the **whole sample**, there are significant differences, from pre- to post-test, for Sections 1 and 3 of the EVT, and the whole EVT. Table 5-4 further indicates various levels of significance (***p)*** in measuring the compatibility of the EVT data collected, with the null hypothesis (i.e., there is no difference in performance of participants from both groups in the pre- and post- EVT).

As stated, the value of ***p*** must be 0.05 for the null hypothesis to be rejected and it is therefore evident that there are some significant improvements in EVT's pre- to post-levels. Therefore, the lower the p value is away from 0.05, the better the evidence that the null hypothesis is being rejected (Manion, Cohen and Morrison, 2011).

The significant performance in Section 3 confirms what Gülseçen and Kubat (2006) stated in that "associating a vocabulary term with an image (presenting the learner with non-linguistic representation of the new word) is one of the most effective means to learn a new word."

Furthermore, Section 2 had no significant performance improvements, according to the Wilcoxon non-parametric test. This lack of significant performance could be attributed to the nature of Section 2; being a synonyms' sentence construction, where a deeper understanding of words' context was required in a shorter experiment time (see more justifications in section 5.8 below). It is further stated in the literature that it is crucial for any context-related English vocabulary teaching and learning to incorporate instructional guidance (Kinsella, Stump and Feldman, 2002). Unfortunately, due to time constraints of this research project, such instructional guidance could not be practised. However, the main focus of this study was also on computer-game playing, rather than a traditional instructional guidance towards English vocabulary improvement. Moreover, even the supplementary tools that were meant to facilitate some context understanding, namely, a printed computer-game guide, was not thoroughly consulted by the CPE research participants. The results presented above indicate that the NBC group outperformed the CEP group by Section 1's significant improvement. This is despite the fact that descriptive results presented above indicate that the CPE group obtained better Grade 12 English language marks (grades); with the chi-square goodness of fit test confirming more than expected of the CPE group indicating that they obtained more than 75%. On the other hand, Fisher's exact test indicated that a significant number of CPE group

participants indicated to be English 1st language speakers; this could be a result of misinterpretation of EVT questions or other confounding factors, such as participants having played similar games more, read more academic books, etc. The focus group discussion results, presented further in section 5.8.3 below, elaborate on further implications of the marks (grades) obtained in the Grade 12 English language learning.

5.6.2 The effect of the selected computer game on the English vocabulary assessment performance

In order to test whether the selected computer game had an effect on the EVT scores or not, an analysis of covariance (ANCOVA) test was performed. The pre-test served as a covariate (kept at constant average), while the post-test served as a dependent variable (performances in English vocabulary were observed through the post-test) and the grouping as a fixed factor. The ANCOVA test revealed that the selected computer game had no significant effect on the test scores. However, descriptive means from this test show that the CPE group scored 28, while the NBC group scored 27.

Furthermore, Pearson's correlation test was applied to test for a correlation between English vocabulary improvement and the agreement of CPE participants to understanding the selected computer-game instructions and rules. This test revealed no correlation; suggesting that the understanding of computer-game instructions of the selected computer game played by the CPE group has no direct relation to or did not enhance English vocabulary improvement and or performance in the EVT. This could mean that the CPE group did not understand the instructions and/or rules or they just did not pay attention to the rules or instructions (meaning they were merely selecting objects in the game without constructing the storyline with the aid of the instructions and game objects).

5.7 EVT performance's contributing attributes

Data were further collected in an attempt to identify factors or attributes that contributed to the EVT performance for both groups. These data were collected in the following forms:

I. Observer checklist (quantitative and opinions);
II. Narrative tutorial questions; and
III. Focus group discussions.

5.7.1 Gameplay observations

Quantitative frequencies (see Appendix O) were generated on the observer checklist's data per chapter of the selected computer game (chapter 1 to 5). The following were observed:

I. A worrying 51.9% of game players never consulted the computer-game guide in Chapter 1 of the computer game, while 37% consulted the computer- game guide for 1-2 times in the same chapter. The number of participants that did not bother consulting the computer-game guide increased as players progressed from one chapter to the next. While the increase in the number of participants who never bothered to consult the computer game could be attributed to participants getting used to the computer game as they progressed playing, the 51.9% can be accountable for the poor performance in the EVT post-test results; and

In terms of those who bothered to consult the computer-game guide, results show that 42.9% did so for at least a minute, while 57.1% did so up to at least 2 minutes; in Chapter 1 of the computer game. These figures changed to 80% and 20%, respectively, in Chapter 2. However, at Chapter 3, only three sets of computer-game players consulted the computer-game guide for some time, i.e., one set did so for less than a minute, the other did so for up to 2 minutes while the last one did so for up to 5 minutes; Chapters 4 and 5 showed no results in this regard. These results may also mean that the majority of the participants saw no need to consult the computer-game guide from Chapter 3 onwards; it is assumed that they were already used to the game. Table 5-5 summarizes these observations:

Table 5-5 Statistical descriptive observations of printed computer game guide by the CPE group

Computer game guide observed consultation outstanding duration	Chapter 1	Chapter 2	Chapter 3	Chapter4 -5
At least 1 minute	42.9%	80%	0%	0%
At least 2 minutes	57.1%	20%	0%	0%

II. 46.4 % of the research gaming participants were observed to have been assisted by the computer game's instructions in Chapter 1 to find at least 2 locations on the map presented to them from within the computer game. In the same chapter, 35.7% of participants were found to have been assisted by game instructions in finding 4 or more locations. While these figures changed to 50% and 32 %, respectively, in Chapter 2, Chapter 3 shows that 53.6% found 3 locations and 35.7% found 4 or more in this regard. Chapter 4 shows that 7 sets of research gamers (36.8%) were observed to have been aided by computer-game hints to locate at least 4 or more locations on the map presented in the game. In Chapter 5, a significant 42.9% of participants were observed to have been aided by computer-game instructions and hints in order for them (participants) to locate 4 or more locations, i.e., the rest of the participants did not need instructions to assist them in locating places on the map presented in the study's computer game. Hence, the participants relied heavily on hints for help rather than consulting the provided game guide. By chapter 5, they may have gotten the idea of how to play the game without using hints so often.

Table 5-6 summarizes the above detailed results:

Table 5-6 Statistics on descriptive observations of game playing goals achieved through instructions' following

Locations through computer game's instructions	**Chapter 1**	**Chapter 2**	**Chapter 3**	**Chapter 4**	**Chapter 5**
2-3 locations	46.4%	50%	53.6%	0%	0%
4 or more locations	35.7%	32%	35.7%	36.8%	42.9%

III. 75% of the gaming participants did not consult the built-in computer-game gallery of characters, in Chapter 1; with 17.9% consulting it 1-2 times and 7.1% consulting 3-4 times. 78.6% never consulted the said gallery in both Chapters 2 and 3; increasing to 78.9% in Chapter 4 in the computer game.

Furthermore, observers' comments, on the CPE group playing the study's selected computer game, were captured in their qualitative format and analysed using **NVIVO 10** qualitative data analysis software in order to provide a numerical analysis of similar qualitative comments. Keywords that were used when coding the observer comments were:

I. "Consulted", meaning the seeking of information to assist in playing the computer game, from the computer games in built-in gallery or even the printed computer game guide; and

II. "Used", meaning to determine participants' usage of in-game hints.

The following analysis and results emerged from this data in a quantitative manner (mere frequencies):

I. 11.11% of the time, the word **'consulted'** was used by the observers to indicate that the players examined the computer-game's built-in characters' gallery. The gallery is believed to assist the gamer in constructing the computer game's storyline and, hence, enhance the retention of the targeted English vocabulary words; which correspond particularly to Sections 1 and 2 of the EVT, respectively;

II. A further 13.04% of the time, the word **'consulted'** frequently appeared to be used by observers to indicate that the game-playing research participants consulted the printed computer game guide. This is an unsatisfactory percentage in terms of observations of the gamers consulting the printed game guide; especially when most of the targeted English vocabulary words were incorporated within the guide; and

III. The usage of hints from within the computer game during play was also observed. The word **'used'** was analysed for its frequency in the observer comments and it was found that, for 7.41% of the time, the observer indicated the usage of hints in the game. This is a fair usage, bearing in mind that the gamers did know all of the items they had to identify from within the game.

Table 5-7 summarises these observed factors, after coding analysis during game play of this study's selected computer game.

Table 5-7 Statistics on descriptive observations of computer game elements believed to enhance English vocabulary through a storyline construction

	Observed Factor	**Observations in duration %**
1.	Examination of the computer game's built-in gallery	11.11% of the time
2.	Examination of the printer computer game guide	13.04% of the time
3.	Usage of in-game hints in locating objects that were either not known or not visible enough to the players	7.41% of the time

5.7.2 Narrative tutorial questions' answers

The NBC group went through a narrative straight after the pre-test (EVT). This narrative, like the CPE's game guide, incorporated targeted words to be learned through the narrative, provided the NBC participants go through the narrative thoroughly. The said narrative had tutorial questions (see Appendix H) and the

outcomes of the narrative tutorials strongly suggest that NBC participants went through the narrative much more than CPE participants' game guide consultation. It is, however, worth noting that the NBC group had a clear motivation that ensured that they re-read the narrative time and again, i.e., the narrative tutorial questions. In other words, they had motivation, in terms of being able to answer the narrative tutorial questions, to re-read the narrative while the gamers could get by playing the game without consulting the provided game guide or following the storyline. This is in relation with the study conducted by Shokouhi and Maniati (2009) where it was found that there is a relative superiority of expository texts over narratives in terms of enhancing readers' incidental acquisition of unknown words. The game guide was seldom consulted; hence, expository, though more successful, was not possible. It was believed and hoped that as they play the computer game, they would be motivated to revisit the computer game guide so as to also come across the targeted words. However, this revisiting did not occur in the majority of cases such that the CPE group had a brief exposure to words while focusing more on playing the game. This may have contributed to the significant performances of the NBC group that are much similar and/or, in some instances, a bit higher than those of the CPE group.

5.7.3 Focus group discussion's findings

Furthermore, the researcher organized a focus group discussion with some of the participants from both groups. A total of 10 participants (5 from each group) participated in this discussion. It was a challenge for the researcher to get more of the participants to take part in the discussions, hence, this small sample of discussions group participants. The purpose of this discussion was to determine factors that may have influenced their EVT performance in terms of results' observations that were as follows:

I. Lack of significant improvement in some sections of the EVT; where specifically, both the NBC and CPE groups had no significant improvement in Section 2, i.e., the NBC group had a significant improvement on both Sections 1 and 3, while the CPE group improved significantly only on Section 3;

II. Lack of significant effect of the selected computer game on the EVT scores; and

III. No correlation between English vocabulary improvement of the EVT and CPE participants' perceived or claimed understanding of the selected computer-game instructions.

The above results' observations were, therefore, explored through the discussion group as follows; in terms of:

5.7.3.1 General opinions on computer game playing

All the discussion group participants agreed that they play computer games to some extent or particularly when they have some spare time. They further gave examples of games that they play, such as FIFA sports game and the latest Facebook accessible games, such as Candy Crush and Farm Heroes. Three participants particularly highlighted that some computer games, such as the FIFA, require them to be knowledgeable of context (soccer sport context in a case of FIFA), in order to play such a game successfully. These participants further indicated that the FIFA computer game is both strategic and logical in its nature of play. This suggests that some computer games "force" the player (in a fun-friendly way) to pay attention to details such as game instructions in order for them to proceed and succeed in playing the game. This implies that, to successfully play such as computer game (FIFA), one needs a lot of learning and practice before one can play competently. This was a factor that the researcher had to avoid when selecting this study's computer game, due to time constraints that revolved around the availability of and the nature of research participants (students that were urged to participate in this study, in between their lectures).

Moreover, while "force" motivation to read the game guide for FIFA may be present in order to play the game, this "force" motivation is contrary to this study's intervention; meaning that this study's intervention computer game is easy to play so that gamers can learn as they play. The researcher had to choose a game that was easy to learn to play and appealed to all groups. FIFA may appeal to some, but lacked full general appeal. In FIFA, a number of different strategies may be employed which lead individual players to take different paths during game play.

Furthermore, pre-test, intervention, and post-test were done at one time in order to prevent contamination from other sources of learning English (such as conversations, TV, etc.). Hence, there was only one sitting and a short time frame to ensure the surety of results. If FIFA was used, this research would have to stretch out over several months and it would have been difficult to factor out other sources to learn English.

Perhaps, the "enforcement" to strictly follow instructions in this study's selected computer game was absent. This is evident in the findings from observer comments, where the majority (during about 86% of game play time) of the CPE participants did not read the game guide.

Moreover, it may also be possible that the high usage of hints during game play was just a way of quickly identifying objects within the game, without actually using the hints in conjunction with storyline construction. It was hoped that through this storyline (together with the in-game and printed game guide) there would be some assistance in improving post-test performances. However, the selected computer game did not contain any stage in which a player must demonstrate his/her competence acquired in previous stages of play, such as understanding of the developing storyline, before proceeding further. One reason that this selected computer game did not contain such a stage to better its ease of playability of the game.

5.7.3.2 General opinions on difficulties in English comprehension

In order for the researcher to establish if there were any English comprehension difficulties that may have attributed to the EVT's lack of significant performance in some sections, focus group participants were questioned about any general difficulties in **English based classrooms/lectures** and in understanding English based academic texts.

One participant highlighted his inability to grasp concepts that are unfamiliar in context of real life situations (like in the simulated 'murder' environment of game). The rest of the discussion group nodded in agreement to the above point. Section 2 of the EVT is based on context and the above point could be a possible reason for lack of improvement in the said section.

The first possible solution towards the difficulties raised, was consulting a dictionary (during their English-based lectures, for instance). This is another justification on the importance of consulting the printed computer game for the CPE, which may have assisted in some construction of meaning to some of the unknown words to them. However, one participant expressed being anti-dictionary as, according to him, the dictionary is misleading. He states:

"…. you consult a dictionary and comes the test you give the same answer you saw in the dictionary; you don't even get half a mark…"

This comment suggests that students such as the participants in this study, normally use the dictionary to apply words in irrelevant contexts, as highlighted by Kinsella, Stump and Feldman (2002), in the literature section. Furthermore, the above comment prompted the other participants to respond by stating that dictionary consultation requires some analysis of what they are consulting, in terms of definitions, etc., in relation to the context or content that they are consulting the dictionary. Perhaps, these participants felt that the dictionary gave multiple words, each with its own context for the same word that was looked up. This substantiates the importance of understanding the context of English words in order for one to claim some level of English vocabulary proficiency. Moreover, comments such as the one above, confirm and align very well with the problem statement of this study. These research participants clearly went through a schooling system where there was little emphasis on this teaching of English vocabulary. However, it may have been possible that the intervention may have been a bit foreign (not real life) and difficult in requiring that the participants determine and understand the context of words in such a short time.

Overall, the above arguments are just some of substantiating facts that there are difficulties of context retention across many fields of study amongst university students.

5.7.3.3 Comments on the EVT assessment tool

Focus group participants were finally asked to comment on the EVT for this study and their experience as they attempted this crime investigation context-based assessment tool at both pre- and post- levels.

One participant confidently led the discussion on this point by stating that the study's EVT reminded him of his school days when he used to "learn English in Zulu". The rest of the group cheered in agreement and names such as ZuEnglish (learning English through isiZulu), XhosEnglish (learning English through isiXhosa) and SoEnglish (learning English through Sotho) started to emerge as they were trying to elaborate on how they learned English in their high schools. Precisely, what they meant is thast their English teachers would code-switch between English (when teaching it) and their mother-tongue, in an attempt to simplify English teaching. This confirms the findings of Brock-Utne and Holmarsdottir (2005) that code-switching is a common practice in the teaching of English vocabulary. They further claimed that their former high school English teachers have taught them an answering technique when it comes to fill in the blanks and synonym types of questions. They describe this technique as "fill in the answer that you feel is correct, especially if you are given multiple choices of answers to choose from". This is clearly in line with the claims made by Greenwood (2004) when stating that some teachers do not put more emphasis on the teaching of English vocabulary. This is also in line with the findings of a study conducted by Huang and Eslami (2013) when they discovered that, in terms of contextual vocabulary learning, "learners used the main idea and background information to formulate their guesses; meaning they developed their own relationship between new words and other words in a sentence, and or a relationship between a sentence's word and a conjunction." This may have been a similar case in terms of this current study, where participants may have used the game-based background information in formulating guesses. Moreover, even schooling code-switching practices, mentioned in the literature above, are in line with these types of English vocabulary learning techniques, described above as per student participants' shared experiences.

However, the study's research participants denied to call this technique "guessing" as they claim that their technique still required some effort. Therefore, they confirmed to have applied this technique when answering these questions in the EVT, especially at pre-test level.

The above explanations may/or, in fact, suggest that the answering of the pre-test may have been mere guessing than in-depth analysis and choosing of the correct word for the Cloze section (Section 1). The same could have been a case for the Synonyms section (Section 2), in particular i.e., they quickly guessed at the word rather than do an in-depth analysis to find the context and carefully choose the most appropriate word. In terms of Sections 1 and 2, the answers or words for answering to questions were provided for choosing with a few extra irrelevant answers which may have enabled guessing, as opposed to no answers supplied.

When asked to share their experiences on the EVT at post-test level, they stated that the "answering mode" was influenced by either the narrative (for the NBC group) or the computer-game playing (for the CPE group). At this level of the test, it was no longer about which answer they felt was correct according to how they were taught in high school, but the insight they got from the computer-game playing and/or the narrative. These arguments show contradictions to suspected guessing, however, they may suggest, for instance, that there was not enough game play time for the CPE group in order for participants to retain content-based vocabulary. On the other hand, they may have acquired some vocabulary from the narrative or the game guide but used the "schooling answering method" that they described to answer questions based on incomplete vocabulary just gained.

When asked which one of the three sections of the EVT they improved on answering in the post-level due to either intervention, they all applauded Section 3 (images to word mapping section). Those from the NBC agreed to have discussed some of the images they did not know during the pre-test, while going through the narrative.

The CPE group participants confirmed that the computer game played a big role in learning new words through images. The computer game helped them to keep word text in mind while searching for the image referred to by the word; they either knew the image they were searching for or used hints to assist in identifying the image. In its nature, the selected computer game allows the gamer to search for hidden image,

given a name, which pops up in full view for a few seconds to impress the image-word combination to the gamer's mind before disappearing. If the research participants focused mostly on game play, Section 3 would likely be their most predominant gain through game play. This advantage in game play was not available to NBC participants and may explain the differences in EVT post-test scores in Section 3. It was, however, clear that there was excitement in terms of the images to word mapping section of the post-test for both groups.

Another follow-up question was on whether they thought they improved on the other sections, i.e., Sections 1 and 2. No clear answers emerged from both groups. The researcher then attempted to give them some time to re-look at the EVT instrument. However, no answers emerged still, from the NBC group. Participants from the CPE group identified test instrument items 1.3 (from Section 1; fill in the blanks) and 2.3 and 2.5 (from Section 2; synonyms). They stated that the identified question items (1.3, 2.3 and 2.5) were directly related to the computer game's storyline; making it easy for them to answer them at post-test level. However, results on EVT questions, that performed significantly, do not indicate any of the abovementioned question items as outstanding. This may imply that they may have remembered the words but did not have time to fully understand or remember them or their context due to their short exposure to new words and contexts.

5.7.4 Further statistical analysis on the EVT performance

Further analysis tests were performed on the EVT performance, particularly in terms of individual EVT items per section for both groups combined and also on an individual basis. These tests we performed in order to determine any significant performance amongst individual EVT items within EVT sections.

5.7.4.1 Both groups' performances

Statistical analysis to identify any statistical differences between the pre- and post-individual question items was applied on the EVT, through the Wilcoxon Signed Ranks test on paired data. This revealed that there's a significant difference in the performances (improvement from pre- to post-test) of question items 1.1 and 1.8 (b) as follows, for both groups combined, as outlined in Table 5-8:

Table 5-8 Section 1's AWL words that improved significantly in terms of the whole sample

	Section 1 word	**Wilcoxon Signed Ranks significance**
1.	individuals	(Z(N=142) = -2.982), **p=.003**)
2.	environment	(Z(N=142) = -3.266), **p=.001**)

There are no significant differences in the entire Section 2 of the EVT for the groups combined. Section 2 of the EVT is context-based type of English vocabulary assessment in a form of synonym usage. In light of the English context-based vocabulary shortcomings in both teaching and learning, as presented in the literature, and in the some of the results above, it is highly understandable as to why there was no significant differences between pre- and post- EVT in terms of the section in question. There are, however, significant differences in the images to words mapping Section 3 of the test for both groups combined, as shown in Table 5-9 below (please see the EVT instrument in Appendix D and E for images with significant improvement):

Table 5-9 Image to word mapping significant performance for the whole sample

	Section 3 images-to-words mapping	**Wilcoxon Signed Ranks significance**
1.	birdcage	(Z(N=142) = -4.796), **p<.005**)
2.	axe	(Z(N=142) = -3.578), **p<.005**)
3.	golf club	(Z(N=142) = -4.158), **p<.005**)
4.	hat	(Z(N=142) = -2.530), **p=.011**)
5.	Chinese fan	(Z(N=142) = -4.243), **p<.005**)
6.	basket	(Z(N=142) = -3.207), **p=.001**)
7.	binoculars	(Z(N=142) = -3.530), **p<.005**)

8.	comb	(Z(N=142) = -3.900), **p<.005**)
9.	cart	(Z(N=142) = -4.243), **p<.005**)
10.	spider web	(Z(N=142) = -2.333), **p=.020**)

The results in Table 5-9 show significant improvements for the bird cage (3.3), axe (3.4), golf club (3.6), hat (3.8), Chinese fan (3.9), basket (3.10), binoculars (3.12), comb (3.13), cart (3.14 and spider web (3.15) images.

5.7.4.2 NBC groups' performance

There are significant statistical differences between the pre- and the post-test as per results of the Wilcoxon Signed Ranks test on paired data, on Section 1 of the EVT for the NBC group as follows:

Table 5-10 NBC group Section 1's words significant performance

	Section 1 word	**Wilcoxon Signed Ranks significance**
1.	individuals	(Z(N=71) = -3.207), **p=.001**)
2.	theory	(Z(N=71) = -2.000), **p=.046**)
3.	occurred	(Z(N=71) = -2.121), **p=.034**):
4.	environment	(Z(N=71) = -2.828), **p=.005**):

The improvement in Section 1 of the EVT pre- to post-test for the NBC group, as shown in table 5-10 above, may be attributed to the advantage the NBC had in terms of the narrative; i.e., the narrative focused on a storyline which entailed words to understand for the participants. On the other hand, the CPE played a computer game that focused on a similar storyline but in a different presentation of vocabulary (incidental orientated). There were no significant differences between the pre- and post-test of the Section 2 (synonyms) for the NBC group. There are however, significant differences between the performances of the following images for the NBC group, as outlined in Table 5-11:

Table 5-11 NBC group Section 3's images to words mapping significant performance

	Section 3 image to word mapping	**Wilcoxon Signed Ranks significance**
1.	birdcage	(Z(N=71) = -3.873), **p<.005**)
2.	golf club	(Z(N=71) = -2.496, **p=.013**)
3.	hat	(Z(N=71) = -2.000), **p=.046**)
4.	comb	(Z(N=71) = -2.530), **p=.011**)
5.	cart	(Z(N=71) = -2.294), **p=.022**)

5.7.4.3 On CPE groups' performance

There are significant statistical differences between the pre- and the post-test as per results of the Wilcoxon Signed Ranks on paired data, on Section 1 for the CPE group, as follows in Table 5-12:

Table 5-12 CPE group Section 1's words significant performance

	Section 1 word	**Wilcoxon Signed Ranks significance**
1.	occurred	(Z(N=71) = -2.530), **p=.011**)
2.	environment	(Z(N=71) = -2.000), **p=.046**):

There were no significant differences between and pre- and post-test of the Section 2 (synonyms) for the CPE group. The following significant differences between the pre- and post- EVT performances of the following images for the CPE group were evident in terms of Section 3, as outlined in Table 5-13:

Table 5-13 CPE group Section 3's images to words mapping significant performance

	Section 3 image to word mapping	Wilcoxon Signed Ranks significance
1.	birdcage	(Z(N=71) = -2.828), **p=.005**)
2.	axe	(Z(N=71) = -3.317, **p=.001**)
3.	golf club	(Z(N=71) = -3.357), **p=.001**)
4.	helmet	(Z(N=71) = -3.742), **p<.005**)
5.	Chinese fan	(Z(N=71) = -4.123), **p<.005**)
6.	basket	(Z(N=71) = -2.646), **p=.008**)
7.	binoculars	(Z(N=71) = -3.771), **p<.005**)
8.	comb	(Z(N=71) = -2.982), **p=.003**)
9.	cart	(Z(N=71) = -3.657), **p<.005**)
10.	spider web	(Z(N=71) = -2.449), **p=.014**)

5.8 Selected computer game's playability characteristics

This study's selected computer game was tested for its playability through a post-test questionnaire that incorporated usability factors for computer games, as outlined by Desurvire, Caplan and Toth (2004). The data gathered on these computer gaming playability factors yielded the following significant findings, as illustrated in Table 5-14 through the chi-square goodness of fit test, in addition to 100% agreement to clarity of computer-game instructions:

Table 5-14 The significance in playability of The Agatha Christie 4:50 from Paddington detective computer game

	Study's selected computer game playability characteristics as favoured by research participants	**Chi-square goodness of fit test significance**
1.	Game main goal well presented	(χ^2(2, N=71) = 103.296, **p<.005**)
2.	Ability to identify the goal in the game	(χ^2(2, N=71) = 60.028, **p<.005**)
3.	Game overview helping to understand how to play the game	(χ2(2, N=71) = 89.690, **p<.005**)
4.	The in-game tutorial assisted with skills to play the game	(χ^2(2, N=71) = 55.887, **p<.005**)
5.	Ability to identify scores and outputs throughout the game	(χ^2(2, N=71) = 49.465, **p<.005**)
6.	Consistent game user interface, with variability in game scenes	(χ^2(2, N=71) = 65.268, **p<.005**)
7.	Ability to interact with the menus as part of the game-playing activity	(χ^2(2, N=71) = 23.676, **p<.005**)
8.	Sufficient information provided by the computer game on startup	(χ^2(2, N=71) = 80.479, **p<.005**)
9.	Access to content-related help while playing the game	(χ^2(2, N=71) = 89.690, **p<.005**)

10.	No need to use a printed manual for gamers, throughout the gameplay	(χ^2(2, N=71) = 30.197, **p<.005**)

The chi-square goodness of fit test confirms that the selected computer game is playable, with respect to the above-tabulated playability heuristics.

5.9 Selected computer game's perceived competence

This section reports on the findings of a questionnaire instrument that was completed by the CPE group, based on the selected computer game that they played (see Appendix G for this instrument and Appendix M for more on its results). Firstly, the data from this questionnaire show that all the participants agreed to have understood the rules and/or instructions of the selected computer game.

Chi-square goodness-of-fit-test results further show a significant positive computer-game playability perception from CPE group participants, i.e., significantly agreeing on the clarity or usefulness of the selected computer-game characteristics such as, in-game tutorial, menus and the general computer-game user interface.

On the other hand, chi-square goodness of fit test indicated that the CPE group significantly agreed to perceptions that the selected computer game has an impact on English vocabulary improvement, as shown in Table 5-15.

Table 5-15 CPE group significant perceptions on the impact of this study's selected computer game on English vocabulary improvement

	Study's selected computer game competence perceptions on English vocabulary improvement impact	**Chi-square goodness of fit test significance**
1.	Believing that the game could improve their English vocabulary	(χ^2(2, N=71) = 74.563, **p<.005**)
2.	Believing that the game could help in daily English communications	(χ^2(2, N=71) = 114.113, **p<.005**)
3.	Believing that the game taught them new English words	(χ^2(2, N=71) = 94.845, **p<.005**)
4.	Believing that the game could improve their English vocabulary writing skills	(χ^2(2, N=71) = 57.577, **p<.005**)

Furthermore, the CPE group indicated their perceived ease of use of the computer game, through the chi-square goodness-of-fit-test, where all items were favoured more than expected, i.e., significantly as indicated in Table 5-16.

Table 5-16 CPE group significant perceptions on the impact of this study's selected computer game's ease of use

	Study's selected computer game competence perceptions on its ease of use	**Chi-square goodness of fit test significance**
1.	Computer game instructions sufficiently clear to enable them to play the game properly	(χ^2(2, N=71) = 88.676, **p<.005**)
2.	Participants found it easy to recover from mistakes or from faults encountered while playing the game	(χ^2(2, N=71) = 85.380, **p<.005**)
3.	It was easy for participants to remember how to play the game especially after taking a break from game play	(χ^2(2, N=71) = 59.352, **p<.005**)

In terms of the CPE group assisting this research in finding out if the selected computer game was perceived useful in English vocabulary improvement, chi-square goodness-of-fit-test results show that the group significantly agreed more than expected on the game, as outlined in Table 5-17.

Table 5-17 CPE group significant perceptions on the usefulness of this study's selected computer game towards English vocabulary improvement

	Study's selected computer game competence perceptions on its usefulness towards English vocabulary improvement	**Chi-square goodness of fit test significance**
1.	Enabling them (students) to improve performance in interpreting academic texts or text books in English	(χ^2(2, N=71) = 81.239, **p<.005**)
2.	Having the potential to increase their learning productivity (output)	(χ^2(2, N=71) = 76.423, **p<.005**)
3.	Having the potential to enhance their effectiveness (success) in some of their academic learning activities	(χ^2(2, N=71) = 80.479, **p<.005**)
4.	Possibly playing some role in the improvement of their grades	(χ^2(2, N=71) = 43.718, **p<.005**);
5.	Desired to be part of at least one study course in the university so that students can have fun while learning and,	(χ^2(2, N=71) = 74.901, **p<.005**)
6.	Being an interesting way to learn new English words	(χ^2(2, N=71) = 93.662, **p<.005**)

5.10 Correlations

Pearson's (and Spearman's) correlation test(s), using SPSS21, were applied to test correlations between various variables and the pre- and post- EVT, as shown in Table 5-18.

Table 5-18 Correlations between various study factors and EVT performances

Variables correlated to English vocabulary assessment performance (at pre- and post-levels of the EVT)	**Results**
Autonomous English vocabulary learning (for the entire sample of 142 participants)	There is a significant positive correlation between **pre-test** total and reading academic books and articles (r=0.248, **p=.003**). There is a significant positive correlation between **post-test** total and Speak with colleagues/fellow students (r=0.167, **p=.046**).
Time spent playing educational computer games (for the entire sample of 142 participants)	There are no significant associations or differences between these two variables for any of the game types.
Time spent playing other types of computer games (for the entire sample of 142 participants)	Analyses NOT possible because of fewer responses
Perceived impact of the selected computer game on English vocabulary improvement (applicable only to the 71 CPE participants)	No significant correlations
Perceived ease of use of the selected computer game (applicable only to the	There is a significant negative correlation between **pre-test** total and the clarity of

71 CPE participants)	game instructions in helping to play the computer game (r=-.241, **p=.043**). There is a significant negative correlation between **post-test** total and the clarity of game instructions in helping to play the computer game (r=-0.332, **p=.005**). It is worth noting that low scores in terms of clarity of game instructions are in agreement, i.e., the researcher coded the agreement to the clarity of instructions to helping in playing the computer game as 1 (1=agree). This implies that a high pre- and post-test scores were correlated with low scores on clarity of instructions, hence the negative correlation. Therefore, the above reported correlations are translated as being good or positive.
Perceived usefulness of the selected computer game (applicable only to the 71 CPE participants)	There is a significant positive correlation between **pre-test** total and the perception that the computer game will enhance effectiveness in academic learning activities (r=0.260, **p=.029**).

Further correlations were performed in SPSS21 between the study's selected computer game's perceived usefulness and various variables, such as, respondents' agreement to have:

I. Played any computer game before;
II. Played the Agatha Christie 4:50 from Paddington computer game before; and
III. Played any other detective computer game.

Correlations in this regard were not possible due to insufficient responses (sample may have been small at 71). However, cross tabulations that applied Fisher's Exact Test (for the purposes of finding out if there is a significant relationship between perceived usefulness and some variables) show that a significant number of CPE participants who have played the selected computer game before responded with:

I. Neutral or by being in disagreement to or with (6.2 on the questionnaire) the perception that playing the study's selected computer game would increase participants' learning productivity (Fisher's (N=71) = 10.086, p=.009);
II. Neutral or by being in disagreement to or with (6.3 on the questionnaire) the perception that playing the study's selected computer game would enhance their effectiveness (success) in some of their learning activities (Fisher's (N=71) = 8.733, p=.027); and
III. Neutral to (6.5 on the questionnaire) the perception that the study's computer game should be part of at least one course of study in the university (Fisher's (N=71) = 8.292, p=.031).

Table 5-19 summarises the Fisher's Exact Test findings above.

Table 5-19 Fisher's Exact Test findings on PU and history of playing the study's selected computer game

	Significant relationships between level of agreement to have played this study's selected computer game before, and some of the perceived usefulness factors	
Factor number on questionnaire (Appendix G)	**Perceive usefulness item/factor**	**Fisher's Exact**
6.2	I think playing the game has the potential to increase my learning productivity (output)	(Fisher's(N=71) = 10.086, **p=.009**)
63.	I think playing the game will enhance my effectiveness (success) in some of my academic learning activities	(Fisher's(N=71) = 8.733, **p=.027**)
6.5	I think playing the game should be part of at least one study course in the university so that students can have fun while learning	(Fisher's(N=71) = 8.292, **p=.031**)

CPE group participants further justified their agreement to the perceived usefulness of the computer game through written expressions on the questionnaire. NVIVO 10 software was used to analyse the correlations of these opinions. The opinions were coded in NVIVO 10 using a coding scheme with the code expression representative of the questionnaire items (see Appendix G, Section 6 of the post-gamming questionnaire) and the following results were yielded:

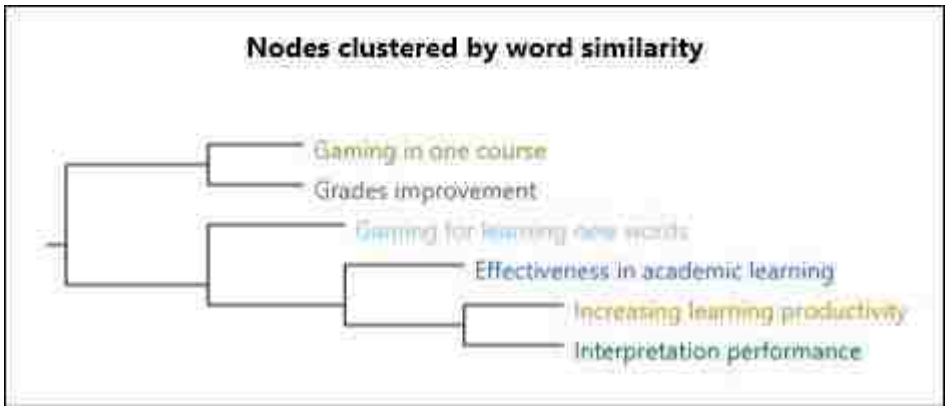

Figure 5-3 Correlations between PU items through justifications to agreements to Section 6 of the questionnaire in Appendix G

The following chart, further clearly outlines strong Pearson's correlation coefficients of between 0.01 and 0.3, among some of the perceived usefulness items' agreement and justifications:

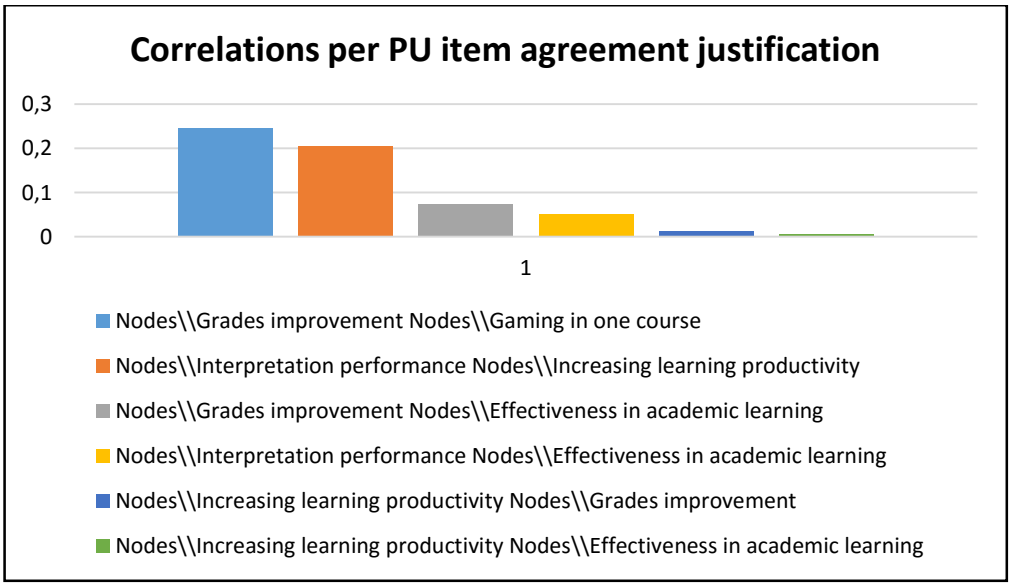

Figure 5-4 Correlations of the perceived usefulness opinions in justifying the usefulness of this study's selected computer game towards English vocabulary improvement

As per legend, in the above chart of Figure5-4, there are clear correlations as follows:

I. Perceived improvement grades' performance (in various areas where English is a medium of instruction) has a relationship with the desired usage (desire by research participants) of a gaming in at least one course of study; and

II. The perception that the computer game would assist in improving academic text interpretation and learning productivity.

Perceived grades' improvement performance (in various areas where English is a medium of instruction) has a relationship with improved effectiveness in learning.

5.11 Summary

The results presented in this chapter were achieved through a number of statistical and qualitative analysis techniques on the various types of data collected from this study. Research participants for this study fully satisfied the required sample size of 142; 71 of which were in the CPE group, with the remainder forming part of the NBC group. Although the two groups suggested an experimental study (in fact, quasi-experimental due to pre- and post-tests and non-equivalency of the groups), the overall characteristics of the research participants revealed, amongst others, that the majority (71%) are isiZulu (one of South Africa's official languages) native speakers, with other percentages spread across isiXhosa (6.3%), other languages (16.2%) and remainder claiming to be English natives. All these participants are studying all their courses of study in English, making them ESL speakers, except the native English speaker. Moreover, the majority (93%) of the participants were of the African race with 97% of them being South African nationals.

A statistical test, called Fisher's Exact Test, was applied on the demographics (characteristics) of the participants to test if there were any significant differences amongst demographic variables across the two groups, i.e., NBC and CPE groups. This test only revealed a significant difference between the age groups of the two groups; with the majority of those in NBC being older than those in the CPE group.

It was also important for this study to explore the computer- gaming experience of the research participants in order to understand their computer gaming history, so as to later, if possible, correlate such history with their English vocabulary performance

in the study's pre- and post- EVT assessments. The majority (more 60%) from both groups indicated to have played computer games in general and 2.8% from each group shown to have played this study's selected computer game.

This study further explored participants' autonomous English vocabulary learning, i.e., activities such as watching English television programs, speaking English with friends and or family members, etc. This research factor was undertaken to see if this study can also attribute the participants' English vocabulary to some other learning activities or only to the interventions of this study. The majority of the research participants seemed to be familiar with the majority of the autonomous English vocabulary. However, it stood out that 44% of the NBC group stated that they do not read novels at all and about 30 % indicated that they do not read academic books and articles. A total of 52% of the CPE group indicated that they do not read novels at all and at least 18% of them do not bother reading academic books and articles. These statistics concurred with the initial confirmation of the seriousness of lack of English proficiency amongst the participants. Furthermore, a chi-square goodness of fit test, which explored the selection distributions of the autonomous English vocabulary learning activities, revealed significant selection of activities, in that some of the activities were selected more than expected (expected number of selections was calculated by the said test). This suggests that some of the research participants may have lied about autonomous English vocabulary activities that they claimed to practise.

The EVT was also analysed statistical and basic means (averages) analysis and showed that the NBC group scored an average of 25 points at pre-test and 27 points in the post-test, with the CPE group scoring an average of 26 points at pre-test and scored 28 points in the post-test. Furthermore, the independent Paired Samples T-Test that applied Wilcoxon non-parametric test (when needed), were used to test for any significant differences in the pre- and post-test performances of each group. This test showed that the NBC group improved significantly by 2 points (average of two words) on the entire EVT and also had significant improvement on both Sections 1 and 3 of the same test at post-test. However, even though the CPE group also showed significant improvement on the whole EVT instrument, no significant improvements were prevalent in Sections 1 and 2. Thus, Section 2 has been difficult for both

groups. Moreover, the ANCOVA test showed no effect of the selected computer game on EVT scores. There was also no correlation between the EVT and the participants' agreement to understanding computer-game instructions.

This study also explored attributes that may have affected the EVT scores' performance. Firstly, observer checklists showed that a large percentage of CPE group participants did not consult the computer-game guide; an instrument that was supposed to assist them in constructing the computer-game storyline thoroughly and also encounter the targets words that were tested in both the pre- and post-tests. Secondly, on the other hand, the NBC group seem to have gone through the narrative between the pre- and post-test thoroughly, as this narrative had motivational tutorial questions that they had to answer. This may well explain their significant improvement on the entire EVT and two sections better than the CPE group. Thirdly, focus group discussions revealed context building or understanding seemed to be a prevalent problem amongst all participants. Participants from both groups stated that they played computer games and emphasised on the importance of following instructions in computer gaming. They further expressed difficulties in understanding English-based academic text and lectures. They further stated in the focus group discussion that the EVT was fair and that their answering to the test differed from pre- to post-test in the hope of improvement.

CPE group participants were also surveyed on the perceived competence of this study's selected computer game in English vocabulary improvement. These participants significantly agreed that the instructions of the computer game were clear and, therefore, assisted them to easily play the computer game. They further significantly believe that computer games, similar to the game of this study, can assist them to communicate better in English and can improve their English writing skills, amongst other competencies. Lastly, the Pearson's correlations statistical test was applied to various research variables to test for any relationship between these variables and the EVT performance. A significant positive correlation was found by this statistical test, between EVT performance and reading academic books and articles at pre-test of EVT and also speaking English with colleagues or fellow students at post-test of EVT, amongst research participants. Another correlation also exists between EVT performance and clarity of this study's computer game's

instructions, at both pre- and post-test of EVT. Moreover, a positive correlation also exists between pre-test EVT scores and the perception amongst research participants that the selected computer game would enhance effectiveness in academic learning activities. The next chapter presents conclusions on the presented results and recommendations based on the study's procedures and data results.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

In this chapter, the study reflects on the research findings in order to draw conclusions based on the possible implications of the results. These conclusions are made on some of the significant research participants' demographics, and on the interpretation of the results in terms of the study's objectives. Further conclusions are drawn in relation to the study's findings and the theoretical framework that informed this study. Recommendations, based on the successes and/or limitations of this study, are finally made in this chapter.

6.2 Participants' demographics and autonomous English vocabulary learning

The demographics of this study's research participants clearly show the extent to which the research sample was non-probable, i.e., lack of equal opportunity for participants to choose a group in which they want to participate. As stated in Chapter 3, this type of sampling was due to limitations revolving around participants' attendance of lectures throughout weekdays. As a result, there was no specific timeslot to allow them to be randomly assigned to the research group in which they participated. This may be the reason why a significant majority of the NBC group were older than (i.e., a significant number of them were 26-30 years of age) the CPE group. This may have, in turn, meant that the NBC group was at a possible advantage over the CPE group in terms of English vocabulary, since it may be part of their life experience. This would be particularly true in the academic environment; hence, the significant performance of the NBC group in terms of the EVT's Section 1, compared to a non-significant performance of the CPE group in the said section of the EVT. Thus, this conclusion is based on an assumption that an older age group

have been through a schooling system that mainly used English as a medium of instruction for longer than the younger age group. There is, however, no significant results showing the NBC group performing autonomous English vocabulary activities more than the CPE group or vice versa.

Surprisingly, a significant number of the CPE group indicated to be English native speakers. This finding is contrary to the CPE EVT performances in comparison to the NBC group. This may have been due to various reasons such as:

I. The selected computer game using an English vernacular that's different from the research participants; or
II. Perhaps, what the research participants' revealed as a skill acquired in secondary school "to tackle English vocabulary teaching and learning exercises", did not work well with respect to the intervention's vocabulary testing.

Interestingly, the CPE group significantly indicated to have passed secondary school English with more than 75%. However, their EVT performances are significantly less in comparison to those of the NBC group. On the other hand, it may be concluded that the NBC group may have benefitted from a South African English-based narrative and EVT as it was developed in its entirety by a South African fluent in English. However, it also worth emphasizing that, in terms of the English subsets (as presented earlier in the literature review), the Agatha Christie 4:50 from Paddington computer game, is, in its nature, taking the British English subset. Therefore, the English presented in the computer game differed from the South African English subset and this may have affected the EVT performances of the CPE group.

Moreover, the aim of investigating the autonomous English vocabulary learning activities that research participants practised was to establish any correlation between these activities and participants' English vocabulary performances from pre- to post-test of the EVT. Indeed, this study found that there is a positive correlation between the autonomous English vocabulary learning activities and the performances of the EVT from pre- to post-levels. This implies that the credit for the EVT performances cannot entirely be attributed to this study's selected computer game and the narrative,

but, none the less, it confirms that such a computer game is an effective tool to utilize for English vocabulary improvement, especially in classroom settings meant for English vocabulary teaching and learning. The enjoyment of the game contributed towards a positive attitude towards learning.

6.3 Research objectives and findings

This study's findings addressed the research objectives (outlined in Chapter 1), as follows:

6.3.1 Participants' English vocabulary competence

It was important for this study to ascertain the level of the English vocabulary of the research participants through a pre-English vocabulary test using the EVT, before administration of the targeted interventions, namely, the computer game and the narrative. After the said intervention tools, an assessment of English vocabulary competence, using the same EVT, was administered to investigate any English vocabulary improvement resulting from the said interventions. This objective was met through an acceptably reliable EVT assessment tool at both pre- and post-test level of this quasi-experimental study. This study's EVT reliability test results confirm the (partial) achievement of this objective. However, English vocabulary competence varied between groups, as follows:

I. Significant improvement of 1.8 words on average in terms of the NBC group, in comparison to the 2 words on average of the CPE group, for the entire EVT;
II. Significant improvement of 0.7 words on average in terms of the NBC group, with no significant improvement of the CPE group for Section 1 of the EVT;
III. No significant improvement for Section 2 of the EVT for both groups; and
IV. Significant improvement of 2 images-to-words mapping on average in performances of Section 3 of the EVT, for the CPE group, as compared to a significant 1 image-to-word mapping on average for the NBC group.

Given the above performances, this study arrives at the following conclusions in terms of the study objective in question:

I. Both groups (combined) had a significant improvement of at least 2 words on average on the whole EVT, i.e., from pre- to post- EVT;

II. The lack of significant performance in both Sections 1 and 2 of the EVT for the CPE group may still concur with the fact that the computer game intervention is of an English subset that's foreign to the CPE group. Therefore, given other findings that the CPE group did not pay attention to the South African English subset-based printed computer-game guide, it is clear as to why there's a lack of significant performance in both context-based sections of the EVT for the CPE group. It was believed and hoped that the provided printed computer game guide would assist the CPE group to achieve some contextual incidental learning that would have assisted in improving the performances in Sections 1 and 2. Unfortunately, the CPE group rarely consulted the printed computer game guide, as the findings of the game-playing observations indicate. Time is needed to learn context- based vocabulary for both groups and not consulting the game guide (in terms of the CPE) and the narrative (in terms of the NBC group) was not sufficient. The consultation of the computer game guide and the narrative with allocated sufficient time would have given exposure to the targeted AWL words, as Brock-Utne and Holmarsdottir (2005) emphasise the thoroughness in learning context-based English;

III. On the other hand, the NBC's significant performance in, at least, Section 1 of the EVT may be attributed to the advantage of them going through the South African English subset-based narrative that incorporated targeted words that were assessed in the EVT several times in order to answer tutorial questions;

IV. Moreover, both Sections 1 and 2 were context-based sections that may have required enough time of context comprehension before assessment could take place. Hence, the little or lack of significant performance on both sections may be attributed to time constraints of the study; where participants may have not had enough time to be exposed to some incidental learning;

V. Nonetheless, the significant performance on the images-to-words mapping (Section 3 of the EVT) clearly indicated that the CPE group benefited from playing the computer game because, even though the NBC group performed

significantly on this section, the CPE group outperformed the NBC group by 5 more images-to-words mapping (see Table 5-11 and Table 5-13 in Chapter 5 above). Image-word mapping is the basic component of game playing in this study's selected computer game.

Overall, the competence of the research participants' English vocabulary seems to have improved through the interventions of this study, particularly through the focus intervention, i.e., **The Agatha Christie 4:50 from Paddington** detective computer game, though not to the desired extent.

6.3.2 The impact of the selected computer game on students' English vocabulary competence

The core focus of this study was to investigate the impact of **The Agatha Christie 4:50 from Paddington** detective computer game on English vocabulary improvement through the pre- and post-EVT. Statistical data results on attempting to achieve this objective revealed that CPE research participants believe that the said computer game can improve their English vocabulary, English communication skills, English vocabulary writing skills and help them learn new English words (see Table 5-15, Chapter 5 above). Furthermore, qualitative data results, through focus group discussions, confirmed that the answering of the post-EVT assessment questions was mainly influenced by the participation in the computer-game playing, hence, the significant performance of the CPE group on Section 3 of the EVT (outperforming the control NBC group). Even though CPE gamers perceive the game's potential in improving English vocabulary, they did not attain a significant performance in context-based sections of the EVT, i.e., Sections 1 and 2. This can only suggest that the CPE group was very much involved in playing the game rather than focusing on both game playing and English acquisition through the game guide. Section 3 of the EVT is directly related to the game, hence, the significant improvement.

6.3.3 The perceived ease of use and usefulness of the selected computer game towards English vocabulary improvement

Theorists around the world concur that adaptable and acceptable technology for certain intended goal(s) must, amongst others, be easy to use and useful, at least through potential user perceptions. Therefore, **The Agatha Christie 4:50 from Paddington** detective computer game was put to the test in terms of whether CPE research participants perceived it to be easy to use and useful in terms of its potential abilities to contribute towards English vocabulary improvement, particularly in the classroom environment. Data results, that were statistically analysed, confirmed that the said computer game is easy to use in terms of clear instructions, recovery from mistakes encountered while playing the computer game and easiness of continuing playing the game after the computer game player takes a break. On the other hand, there are significant perceptions that the said game is useful in terms of perceptions clearly outlined in Table 5-19 of Chapter 5. Focus group discussions further confirmed the usefulness of this computer game towards English vocabulary improvement. Figure 5-6, in Chapter 5 above, confirms, through qualitative data correlations, that the usefulness of the said game is perceived in a sense that:

I. If the said game is used in a classroom setting, it would impact on grades' improvement; and
II. Gaming to learn new words correlates to effectiveness in academic learning and increases learning productivity and word interpretation.

6.3.4 The perceived mechanisms or characteristics of the game that could enable students to expand their academic English vocabulary

The last objective of this study was to also identify characteristics of the selected computer game that are believed to enable students to improve their English vocabulary. This study, therefore, concludes that a computer game that incorporates the elements, outlined in Table 5-17 of Chapter 5, can assist in English vocabulary improvement, hence, research participants significantly perceive them to be useful.

6.4 Research findings and theoretical framework

In summary, this study's theoretical framework (Figure 6-1) hypothesised that the computer gaming experience of a particular learner has a direct relationship with the learners' perceived usefulness of a computer game believed to improve the learners' academic performance improvement. Moreover, a computer game is believed to be academic task relevant, easy to play and has a potential to demonstrate or contribute towards intended academic results, through its perceived usefulness towards English vocabulary improvement.

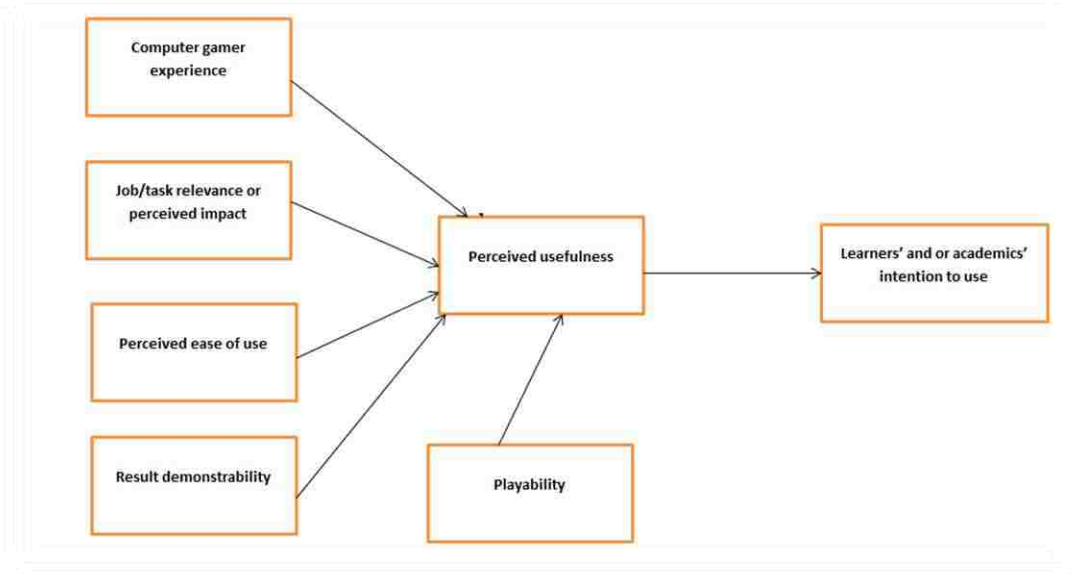

Figure 6-1 Study's Theoretical Framework

In particular, this study's selection of **The Agatha Christie, 4:50 from Paddington** was guided by the framework's task relevance component and the researcher's comparison of this game with others, in view of ease of play (ease of use) and all genders' and age groups' suitability; amongst other selection criteria.

6.4.1 Computer gamer experience and results' demonstrability

In terms of the CPE group, 63% showed to have played computer games (generally) before, and only 3% from each group i.e. NBC and CPE claimed to have played this study's selected computer game. However, there's no significant correlation between the said experience and English vocabulary improvement (results' demonstrability through the EVT) of the CPE group and the perceived usefulness of the selected computer game. Hence, the claimed computer-gaming experience is not necessarily an English improvement determining factor, but an element that is believed to facilitate ease of use or play such that English vocabulary improvement could be attained quicker. Nonetheless, there is also no correlation between the claimed gaming experience and ease of use or play of the game.

6.4.2 Task relevance or perceived impact

There are significant agreements from the study's research participants' perceptions that the said computer game has a potential impact on the targeted task for which it was intended, i.e., English vocabulary improvement (see Table 5-15). This significant perceived impact of the computer game towards English vocabulary by the CPE participants suggests the usefulness of the selected computer game. However, there's no significant correlation between the said impact and English vocabulary improvement of the CPE group and the perceived usefulness of the selected computer game. Furthermore, there was no significant improvement on the entire EVT for the CPE group due to various limitations.

6.4.3 Perceived ease of use, playability and usefulness of the computer game

There are significant agreements to the ease of use of the study's selected computer game in terms of clarity of game instructions and ease of recovery from in-game player-created faults and ease of continuation of play after a break. Furthermore, in terms of playability heuristics, outlined by Desurvire, Caplan and Toth (2004), there are significant agreements on all of the heuristic factors, as outlined in the

questionnaire in relation to the game. These findings indicate the ease of play and suitability of the game as a teaching and learning supplement. There is also significant agreement on the study's selected computer game's perceived usefulness (PU) towards English vocabulary improvement (task relevance), in terms of all the questionnaire items of the PU.

6.4.4 Concluding on the theoretical framework

TAM2 of the study's theoretical framework has a component called cognitive instrumental processes that encompasses job relevance, results demonstrability and perceived ease of use. Cognitive instrumental process is defined as the "mental representations that people use in order to make a decision as to whether to adopt a technology or not" (Vankantesh & Davis, 2000). This study's results confirm the study's selected computer game as an acceptable and adoptable cognitive instrumental processes' technological component that can assist in English vocabulary improvement in the classroom setting (see results in Chapter 5, section 5.6). Results also show that the said computer game is perceived useful with relevance to English vocabulary improvement; perceived usefulness being a component of the original TAM framework.

On the other hand, Heuristics Evaluation for Playability (HEP) component of the study's theoretical framework confirmed the study's selected computer game, as a playable computer game. This is confirmed by significant user agreements to characteristics of a playable game (see Table 5-14) being visible and/or experienced during game play of the study's selected computer game; influencing the job relevance of the said game. Furthermore, the significant improvements in Section 3 of the EVT in relation to the prominent selected computer-game feature, namely, image word mapping, also align with the confirmed perceived playability and usefulness of the computer game towards English vocabulary improvement.

6.5 Disparities between perceptions and reality

In a nutshell, this study shows significant beliefs in perceptions around the selected computer game, in terms of:

I. Playability;
II. Ease of use;
III. Usefulness, particularly as a tool in classroom setting meant for English vocabulary teaching and learning; and
IV. Impact on English vocabulary improvement.

Research participants from the CPE group specifically and significantly indicated their desire to have computer-gaming technology as part of, at least, one study course in the university so that they can have fun while learning. However, the significance of their perceptions on this study's selected computer game are far more or higher than their EVT performances, especially for the context-based sections.

These are disparities between perceptions and reality and they can be attributed to various reality factors, such as:

I. Insufficient usage of supplementary material (printed computer game) as instructional support;
II. The insufficiency mentioned above led to lack of storyline construction, which may have affected the expository factor meant to enhance incidental learning that was required to assist in answering Sections 1and 2 of the EVT;
III. Limitations such as non-randomized selection and allocation of research participants into research groups; and
IV. Insufficient time to allow for enough play of the selected computer game and facilitation of any supplement material usage, due to time constraints that revolved around research participants lecture attendance periods.

The above factors reflect the reality of events. However, perceptions indicate promises of success in the usage of a selected computer game with the perceived characteristics towards English vocabulary improvement.

6.6 Limitations and delimitations of the study

The following were the limitations of this study:

1. Limited time to allow research participants to play the selected computer game. This may have limited the chances for the computer-game participants to learn new words thoroughly, especially in context. There was, therefore, no opportunity to practise and reinforce learning by using words in context. As stated by Brock-Utne and Holmarsdottir (2005), contextual vocabulary acquisition requires some thoroughness other than practices such as code-switching and, therefore, thoroughness in ensuring good contextual vocabulary acquisition requires time. This limitation was due to crammed or busy student lecture timetables that allowed for at least two and half hours for participation in this study.

2. Lack of random assignment of participants to either experimental or control groups. This lack of randomization may have introduced variances and imbalances in the data and the results obtained from the data. For example, it may be a possibility that more participants with better English vocabulary were assigned (by the researcher) to either the control or the experiment group. The main advantage of the random assignment is that the group attributes for the different groups will be roughly equivalent (not a guaranteed equivalence) and, therefore, any effect observed between the groups can be linked to the treatment effect and is not a characteristic of the individuals in the group (Manion, Cohen and Morrison, 2011). This limitation was due to a lack of cooperation from the lecturing staff in assisting the researcher to get the students together in an attempt to give them an opportunity to randomly choose the research group in which they wanted to participate. As a result, the researcher ended up using the only available time slot to conduct the research.

6.7 Recommendations

The recommendations of this study are mostly based on the study's limitations. The first limitation of this study was the non-randomised and non-probability selection of research participants, from different groups, as this introduced some level of biasness which may have had a great effect on the study's results. It is, therefore, recommended that future studies, interested in investigating factors of the nature of

this study experimentally, follow sound random sampling approaches from the same group to mitigate possible biases within the selected groups.

It is further recommended that the potential studies on computer-gaming technology towards academic tasks or exercise allow gamers ample time of gaming so as to emphasise or reinforce pedagogical elements believed to be inherent in the computer game in question. Furthermore, any supplementary material that accompanies game playing should be kept short, exciting and not with too much text. Researchers or educators should also ensure that gamers (students) also go through such supplementary material in conjunction with the game playing, especially if some of the targeted exercises are in the said material. Perhaps, researchers and/or educators should look for games that require knowledge of the supplementary material to proceed to the next level or to achieve some level of success in a particular game. The game choice in this regard may be difficult due to the need to appeal to a very broad audience of players with varying levels of playing experience.

In terms of the study's theoretical framework, future research could investigate correlations between results' demonstrability of TAM2 and perceived usefulness of computer gaming technology; perhaps in a different context from that of this study. Similarly, future research could also investigate the influence of computer gaming experience and the correlation between ease of use and actual vocabulary improvement. Recommendations on the characteristics of a game that proves to maximise vocabulary improvement could be identified.

6.8 Concluding remarks

The significant findings of this study led to informed conclusions, such as facts around partial improvements in English vocabulary resulting from the study's selected computer game. Precisely, the partiality of the improvements confirms the effectiveness of the selected computer-game's dominant characteristics, namely, the gathering of murder case clues through the selection of images. Hence, out of three sections of the EVT, the CPE group performed significantly and even better than the NBC group on the images-to-word mapping section. Further lessons learned from this study are in confirmation that ICT relevant types (such as this study's computer

game), in the current age, do complement teaching and learning. This study arrives at this conclusion due to the significant fact that, not only did the CPE group significantly agree to the playability characteristics of the game such clarity of instructions, player friendliness of the game, etc., they showed significant improvement, at least, on the images-to-word mapping section on the EVT. Indeed, a carefully selected computer-gaming technology, that is perceived to be task relevant, playable and useful, can complement teaching and learning activities.

The research question and the aim of this study positively support the research topic, particularly in terms of perceived ease of use, and the perceived impact and measured impact of the selected computer game on or towards English vocabulary improvement. Participants further confirmed significant playability of this study's selected computer game; suggesting a good choice of computer game for the purposes of English vocabulary improvement amongst tertiary students in need and also the confirmation of the TAM 2 constructs' validity.

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Appendix A: Ethical clearance

DURBAN UNIVERSITY of TECHNOLOGY

INSTITUTIONAL RESEARCH ETHICS COMMITTEE (IREC)

28 July 2013

IREC Reference Number: REC 91/12

Mr M L Lingwati
P O Box 508
Nelspruit
1200

Dear Mr Lingwati

The perceived usefulness and ease of use of a selected computer game in expanding vocabulary in English among second year Accounting students at a University of Technology

The Institutional Research Ethics Committee acknowledges receipt of your final data collection tools for review.

We are pleased to inform you that the questionnaires have been APPROVED, you may now proceed with data collection on the proposed project.

Yours Sincerely

[redacted]

Prof K Adam
Chairperson: IREC

Appendix B: Consent letters

INSTITUTIONAL RESEARCH ETHICS COMMITTEE (IREC)

LETTER OF INFORMATION

Title of the Research Study:

The perceived usefulness and ease of use of a selected computer game in expanding vocabulary in English

Principal Investigator/s/researcher: Mr. Matshafeni Lucas Lingwati, BTech IT

Co-Investigator/s/supervisor/s: Prof. P Singh, PhD and

Prof. R Millham, PhD

Brief Introduction and Purpose of the Study:

This research intends to measure the usefulness, ease of use and some usability aspects of a selected computer game in improving English vocabulary.

As a research participant, you will belong to either the control group or the experiment group. The researcher will kindly inform you about which of the two groups you belong to. The researcher hopes to achieve the goals of this research by kindly examining your level of English vocabulary through a pre-test in both the control and the experiment group. A selected computer game will then be introduced to an experiment group through play intervention. The researcher will then re-examining your level of English vocabulary through a post-test in both the control and the experiment group. Furthermore, note that the control group will not play the game during the research intervention; however, control group participants are entitled access to the game, free of charge on request after participation in the research English vocabulary post-test. The final intention of this study is to make recommendations to academic departments at universities of technology in South Africa in terms of the usefulness of selected computer gaming technology for the English vocabulary improvement.

Outline of the Procedures:

As a research participant you are expected to take part in a few research activities, depending on the group of participants you belong to i.e. Control or Experiment group.

As the Control group participant you are expected to take part in the following activities: ***Please note that the following activities will be completed on different occasions/sessions***		
Research activity	***Venue and time***	***Expected duration of completion***
Complete a questionnaire on your background information, and your prior and current computer gaming experiences where applicable.		25 minutes
Complete an English vocabulary pre-test		45 minutes
Complete an English vocabulary post-test		25 minutes

As an Experiment group participant you are expected to take part in the following activities: ***Please note that the following activities will be completed on different occasions/sessions***		
Research activity	***Venue and time***	***Expected duration of completion***
Complete a questionnaire on your background information, and your prior and current computer gaming experiences where applicable.		25 minutes
Complete an English vocabulary pre-test		45 minutes
Participate in a game playing sessions where you are expected to play the selected computer game		1,5 hour
Complete a post experiment questionnaire on Perceived ease of use, usefulness of the computer game, the computer game player satisfaction and Autonomous English language learning/ Out-of-class English language learning		25 minutes
Complete an English vocabulary post-test		25 minutes

Furthermore, please note that as an Experiment group research participant, you will be under observation of the researcher as you play the selected computer game. The researcher will be taking note of questions and queries that you may pose in relation to your game play.

Risks or Discomforts to the Participant:

There are no foreseeable risks or discomforts in participating in the research.

Benefits:

The benefits of this study to you as a participant is to gain knowledge in terms of how far can some computer game types assist you in English vocabulary improvement. Furthermore, the final copy of this research publication will be made available to you. Benefits to the researcher will be research publications and completion of a MTECH IT qualification.

Reason/s why the Participant May Be Withdrawn from the Study:

Should you experience any illness or discomforts, feel free to voluntarily withdraw from research activity. Furthermore, should you react adversely (unpleasantly); the researcher will immediately withdraw you from this research activity.

Remuneration:

No remuneration is to be received by the research participant.

Costs of the Study:

There is no charge to you participating in the study.

Confidentiality:

The researcher undertakes to assure you of the following:

- to maintain your confidentiality and security of all your questionnaire responses, test results and observation
- to protect your rights and welfare, i.e. to ensure that no harm comes to you as a result of your participation in this research,
- to present information and transcripts used in this research in such a way as to maintain your dignity and confidentiality, and if in doubt to first consult with you, and,
- to make available to you the final copy of this research publication.

Research-related Injury:

No injuries are expected for the research of this nature, however, if any unforeseen injury occurs, the researcher will make efforts to get first aid and further appropriate help.

Persons to Contact in the Event of Any Problems or Queries:

Supervisor: Prof. P. Singh, PhD

Please contact the researcher: 078 141 5246, my supervisor: 031 373 6767 and/or my co-supervisor: richardmillham@hotmail.com or the Institutional Research Ethics administrator on 031 373 2900. Complaints can be reported to the DVC: TIP, Prof F. Otieno on 031 373 2382 or dvctip@dut.ac.za.

INSTITUTIONAL RESEARCH ETHICS COMMITTEE (IREC)

CONSENT

Statement of Agreement to Participate in the Research Study:

- I hereby confirm that I have been informed by the researcher, **Mr Matshafeni Lucas Lingwati**, about the nature, conduct, benefits and risks of this study - Research Ethics Clearance Number: _____,
- I have also received, read and understood the above written information (Participant Letter of Information) regarding the study.
- I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials and diagnosis will be anonymously processed into a study report.
- In view of the requirements of research, I agree that the data collected during this study can be processed in a computerised system by the researcher.
- I may, at any stage, without prejudice, withdraw my consent and participation in the study.
- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.
- I understand that significant new findings developed during the course of this research which may relate to my participation will be made available to me.

_____ _____ _____

_____

Full Name of Participant **Date** **Time** **Signature / Right Thumbprint**

I, **Matshafeni Lucas Lingwati** herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

Matshafeni Lucas Lingwati _____ _____

Full Name of Researcher **Date** **Signature**

_____ _____ _____

Full Name of Witness (If applicable) **Date** **Signature**

_____ _____ _____

Full Name of Legal Guardian (If applicable) Date **Signature**

References:

Department of Health: 2004. *Ethics in Health Research: Principles, Structures and Processes* http://www.doh.gov.za/docs/factsheets/guidelines/ethnics/

Department of Health. 2006. *South African Good Clinical Practice Guidelines*. 2nd Ed. Available at: http://www.nhrec.org.za/?page_id=14

Appendix C: Background or biographical, prior computer gaming experience and autonomous English language learning questionnaire

DUT DURBAN UNIVERSITY OF TECHNOLOGY

Questionnaire Number C

Faculty of Accounting and Informatics
Department of Information Technology
Research Questionnaire

This questionnaire is designed to capture background information and prior experience with general computer games of research participants.
This data is for the purposes of the MTech IT research project titled:
The perceived usefulness and ease of use of a selected computer game in expanding vocabulary in English

Biographical Details

1. Gender	☐ Male	☐ Female							
2. Race	☐ African	☐ Indian	☐ White	☐ Coloured	☐ Other Please specify				
3. Age group	☐ 16-20	☐ 21-25	☐ 26-30	☐ 30+					
4. Area of residence	☐ Rural	☐ Urban	☐ Surbub	☐ Urban Suburb	☐ Other ☐ Please specify				
	Urban-suburb means in between urban and suburb in opinion (not sure)								
5. Nationality	☐ South African	☐ Other	Please specify						
6. My mother tongue is	☐ English	☐ isiZulu	☐ isiXhosa	Other Please specify					

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Faculty of Accounting and Informatics

Department of Information Technology

Research Questionnaire

7. Grade 12/Matric English level	☐ First/home language	☐ Second/additional language				
8. Grade12/Matric English mark obtained	☐ Below 50%	☐ 50-59%	☐ 60-74%	☐ 75%+	☐	
9. Final mark range obtained for Communications Skills at DUT	☐ Below 50%	☐ 50-59%	☐ 60-74%	☐ 75%+	☐	
10. My field of study is	☐ Elec. Eng	☐ Ind. Eng				
11. I have access to computers at	☐ DUT	☐ Home	☐ Both DUT & Home	☐ Internet Café	☐ Relative's / Friend's home	
		☐ Other computer access; please specify				

Elec Eng=Electrical Engineering; Ind Eng= Industrial Engineering

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Faculty of Accounting and Informatics

Department of Information Technology

Research Questionnaire

	Yes	No
12. Have you ever played any type of computer game before?		
13. Have you ever played the Agatha Christie 4:50 to Paddington computer game before?		
14. Have you ever played any version(s) of a detective computer game?		

A detective computer game is a type of computer game where the player assumes an adventurous role of being a crime detective

15. If you answered YES to Question 14, please indicate which of the following versions of computer games that you played AND whether you are are still playing or you quit playing them.

	I quit playing	Still playing
15.1 Batman: Arkham Asylum		
15.2 Sam and Max hit the road		
15.3 L.A. Noire		
15.4 Gillian seed snatcher		
15.5 Any other detective game		
Please specify		

15.1-15.4 are top 4 detective computer games from nowgamer.com

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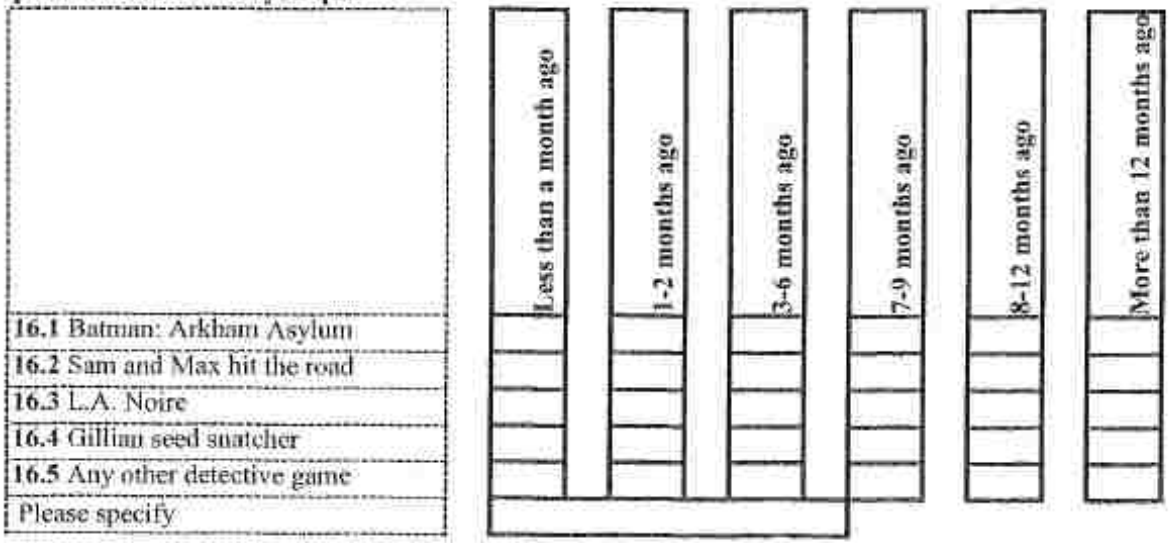
Department of Information Technology

Research Questionnaire

16. If you indicated that you played and quit any of the games in 15.1-15.5 above, please indicate when you quit



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Department of Information Technology

Research Questionnaire

17. Indicate how long you CURRENTLY play each of the following types of detective computer games in an average week (on a computer or any type of computer gaming console) as a single player

	0-3 hours	4-5 hours	More than 5 hours
17.1 Batman: Arkham Asylum			
17.2 Sam & Max hit the road			
17.3 L.A. Noire			
17.4 Gillian seed snatcher			
17. 5 Any other detective game			
Please specify			

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Department of Information Technology

Research Questionnaire

18. Indicate how long you typically play each of the following types of educational computer games in an average week

	1-3 hours	4-5 hours	More than 5 hours	Never	I quit
18.1 Board based computer games e.g. Chess, Scrabble, Monopoly, Trivial Pursuit					
18.2 Adventure based computer games e.g. Mist, Zork, Sam and Max Hit The Road					
18.3 Role based computer games e.g Sims, Civilization, Tycoon, World of Warcraft					
18.4 Strategy based computer games e.g. Ages of Empires III, Civilization IV, Warcraft III					
18.5 Simulation based computer games e.g. Sim City, Roller Coaster Tycoon					

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Department of Information Technology

Research Questionnaire

19. If you indicated that you have never played any of the games in the section above, ignore this question. Otherwise, please indicate how long you played before quitting the following computer games

	Less than 3 months	3-6 months	7-9 months	10-12 months	More than 12 months
19.1 Board based computer games e.g. Chess, Scrabble, Monopoly, Trivial Pursuit					
19.2 Adventure based computer games e.g. Mist, Zork, Sam and Max Hit The Road					
19.3 Role based computer games e.g Sims, Civilization, Tycoon, World of Warcraft					
19.4 Strategy based computer games e.g. Ages of Empires III, Civilization IV, Warcraft III					
19. 5 Simulation based computer games e.g. Sim City, Roller Coaster Tycoon					

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Department of Information Technology

Research Questionnaire

20. Autonomous English language learning/out-of-class English language learning

How long do you carry out the following activities in English on a daily basis?

	Not at all	For less than 30 minutes	30-60 minutes	2-3 hours	More than 3 hours
20.1 Watch TV programmes					
20.2 Listen to the radio					
20.3 Read newspapers and magazines					
20.4 Read academic books and articles					
20.5 Read novels					
20.6 Speak with colleagues/fellow students					
20.7 Speak with friends					
20. 8 Speak with family members					
20.9 Surf the Internet					
20.10 Watch videos/DVDs/VCDs					
20.11 Talk on the phone					
20.12 Correspond via emails					

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Research Questionnaire

Thank you very much for taking the time to complete this questionnaire.

Appendix D: English Vocabulary Test (EVT)

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FACULTY OF ACCOUNTING & INFORMATICS

Department of Information Technology

MTech IT Research

Research Title: The perceived usefulness and ease of use of a selected computer game in expanding vocabulary in English.

Research Instrument: English Vocabulary Post-Test

Question 1

Please fill in the blanks by using the words provided in Table 1 below

1.1 _____ of advanced years in age are called the elderly.

1.2 In most cases, crime takes place in secluded _____

1.3 Crime investigators make _____ based on clues gathered at a crime scene

1.4 Crime investigators play an important _____ in solving crime.

1.5 It is important for crime detectives to _____ the _____ of clues that they obtain from a crime scene.

1.6 Based on their _____ of these clues, the police develop a _____ to explain what had _____ at the crime scene.

1.7 A police supervisor has _____ over the management of different _____ of the police force, such as traffic control, theft, etc.

1.8 Based on useful clues present from the crime scene, the clues may _____ who may be responsible for the crime and the _____ (such as surroundings) in which it happened.

1.9 Once the person who committed the crime confesses, the facts of the crime are _____.

Table 1

assess	assumptions
make	individuals
role	significance
occurred	authority
sections	areas
theory	available
interpretation	indicates
environment	established

English Vocabulary Test Number:

E

DUT DURBAN UNIVERSITY OF TECHNOLOGY

(14)

Question 2

Please provide a synonym (word similar in meaning) for the words within brackets in each of the sentences below. Choose only one of the synonyms in Table 2 below. Write only the sentence number and the correct synonym. Where a sentence contains more than one word (e.g. 2.1 below) please separate your answers with a comma.

2.1 It is normally (**obligatory**) [ ] of police detectives to (**evaluate**) [ ] each clue gathered, so they can end up assessing the murder crime.

2.2 Police detectives normally have a few (**methods**) [ ] to use in the investigation of the murder crime.

2.3 Crime clues are also needed for (**lawful**) [ ] processes that need to be followed in laying charges against the suspect.

2.4 (**Proof of occurrence**) [ ] is what investigators need to solve crimes.

2.5 The police detectives' main goal is to end up (**finding**) [ ] the murderer.

(5)

Table 2

identifying	undertake
approaches	legal
speculate	evidence
required	analyze

English Vocabulary Test Number:

E

DUT DURBAN UNIVERSITY OF TECHNOLOGY

Question 3

Observe each image/picture in the table below and name it in the corresponding column

Table 3

#	Image	Name
3.1		
3.2		

English Vocabulary Test Number

E

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3.4		
3.5		
3.6		

English Vocabulary Test Number:

E

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3.7		
3.8		
3.9		
3.10		

English Vocabulary Test Number:

E

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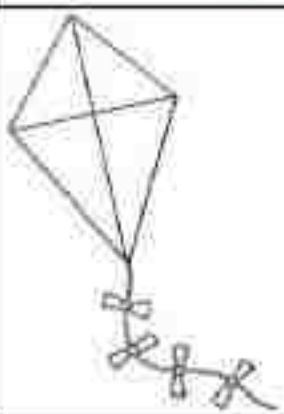
3.11		
3.12		
3.13		
3.14		
3.15		

(15)
[35]

English Vocabulary Test Number:

E

Appendix E: English Vocabulary Test (EVT) with answers

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FACULTY OF ACCOUNTING & INFORMATICS

Department of Information Technology

MTech IT Research

Research Title: The perceived usefulness and ease of use of a selected computer game in expanding vocabulary in English

Research Instrument: English Vocabulary Test

Question 1

Please fill in the blanks by using the words provided in Table 1 below

1.1 individuals of advanced years in age are called the elderly.

1.2 In most cases, crime takes place in secluded areas.

1.3 Crime investigators make assumptions based on clues gathered at a crime scene.

1.4 Crime investigators play an important role in solving crime.

1.5 It is important for crime detectives to assess the significance of clues that they obtain from a crime scene.

1.6 Based on their interpretation of these clues, the police develop a theory to explain what had occurred at the crime scene.

1.7 A police supervisor has authority over the management of different sections of the police force, such as traffic control, theft, etc.

1.8 Based on useful clues present from the crime scene, the clues may indicate who may be responsible for the crime and the environment (such as surroundings) in which it happened.

1.9 Once the person who committed the crime confesses, the facts of the crime are available.

Table 1

assess	assumptions
make	individuals
role	significance
occurred	authority
sections	areas
theory	available
interpretation	indicates
environment	established

(14)

English Vocabulary Test Number:

E

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Question 2

Please provide a synonym (word similar in meaning) for the words within brackets in each of the sentences below. Choose only one of the synonyms in Table 2 below. Write only the sentence number and the correct synonym. Where a sentence contains more than one word (e.g. 2.1 below) please separate your answers with a comma

2.1 It is normally (obligatory(required)) of police detectives to (evaluate(analyze)) each clue gathered, so they can end up assessing the murder crime

2.2 Police detectives normally have a few (methods(approaches)) to use in the investigation of the murder crime

2.3 Crime clues are also needed for (lawful(legal)) processes that need to be followed in laying charges against the suspect

2.4 (Proof of occurrence (evidence)) is what investigators need to solve crimes.

2.5 The police detectives' main goal is to end up (finding (identifying)) the murderer

(5)

Table 2

identifying	undertake
approaches	legal
speculate	evidence
required	analyze

English Vocabulary Test Number:

E

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Question 3

Observe each image/picture in the table below and name it in the corresponding column

Table 3

#	Image	Name
3.1		Train
3.3		Birdcage
3.4		Axe

English Vocabulary Test Number:

E

3.5		Map
3.6		Golf club(stick)
3.7		Helmet

English Vocabulary Test Number:

E

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3.8		Hat
3.9		(Chinese) Fan
3.10		Basket

English Vocabulary Test Number:

E

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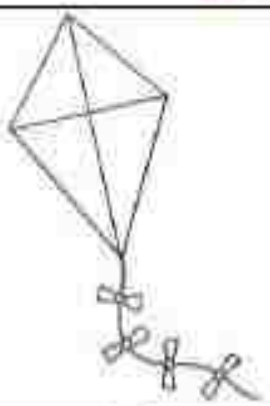
3.11		Kite
3.12		Binoculars
3.13		Comb
3.14		Cart
3.15		Spider web

(15)
[35]

English Vocabulary Test Number:

E

Appendix F: Computer game guide

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FACULTY OF ACCOUNTING & INFORMATICS

Department of Information Technology

MTech IT Research

Agatha Christie 4:50 to Paddington PC game guide

For research game play sessions

Research Title: The perceived usefulness and ease of use of a selected computer game in expanding vocabulary in English.

General Tips

- There are 3 modes in this game: TIMED, CAREFREE, and FIND ALL. TIMED mode sets a time limit for each chapter, and CAREFREE lets you play at your own leisure. FIND ALL mode is unlocked after you complete the main story.
- You can choose between TIMED and CAREFREE mode at any time during the main story in the options menu. If you run out of time you will have to start from the beginning of the chapter again.
- Items displayed in a highlighted text are KEY ITEMS. These items must be found in a descending order (relevant to their positions on the item list).
- You will receive 3 HINTS at the beginning of each chapter (if you have less than 3 HINTS saved up). You will gain an extra HINT for every 3 items found in rapid succession. HINTS will replenish over time if you have less than 3 available.
- Random clicking has a different consequence in each game mode. In TIMED mode you will lose 30 seconds instantly. In CAREFREE mode your mouse will spiral out of control. And in FIND ALL mode you will Lose 1 hint.
- The MAP button allows you to exit a scene and return to the World map.

- Sometimes you will have to find new locations on the World map. Use the highlighted hint texts to guide you to each location. You can also use your HINTS to find new locations.
- After discovering a location it will remain visible until the game is complete. You can only enter the locations listed on the location list.

- Bonus puzzles can be skipped at any time by clicking on the skip button in the left panel. **However, you will receive an extra HINT if you complete it.**
- HINTS will not work in these scenes but there is information about the puzzle in the left panel.

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Game Overview

Each section of the game introduces individuals in addition to the intrusive, yet unassuming[1] Miss Marple. Miss Marple wants to investigate what Miss Elspeth McGillicuddy witnessed occurring[2] on a parallel passing train while looking through her train carriage window.

Your tasks throughout the game is to explore various sites[3] and identify the items listed as shown in the example below, in a quest to help investigate the murder that Elspeth witnessed. For example, you need to identify the tea that Elspeth claims was cold when she woke up to witness the murder of a woman from a parallel passing (going opposite direction alongside the one Elspeth was travelling in) train through the window blind of Elspeth's train carriage. Elspeth reports what she witnessed to the ticket collector and at the police station at the train station in Paddington as soon as she jumps off. As a further example, at the Paddington station area, you are required to assist with the investigation as in the previous scene and also identify key items that may lead to finding the murderer.

As the game progresses and you go from chapter to chapter, you will follow dialogue within the game, in the form of text, and gather evidence, in the form of clues, which are usually given at the end after solving a puzzle. Using these clues, you must interpret[4] them in order to construct[5] a theory that indicates who the possible murderer(s) might be. Although the clues given may be complex, you must evaluate each clue as to whether it is appropriate or not, without assuming anything. In order to assist you, it may be helpful to assess the clues as to their importance and to categorise the significant clues as pertaining to different characters of the game. Each character plays a different role[6] in the story – the father, sons, daughters, doctor, etc.

You will be given several chances to guess the murderer during the game so it is important that you obtain[7] clues and develop a theory that provides possible suspects of the murder.

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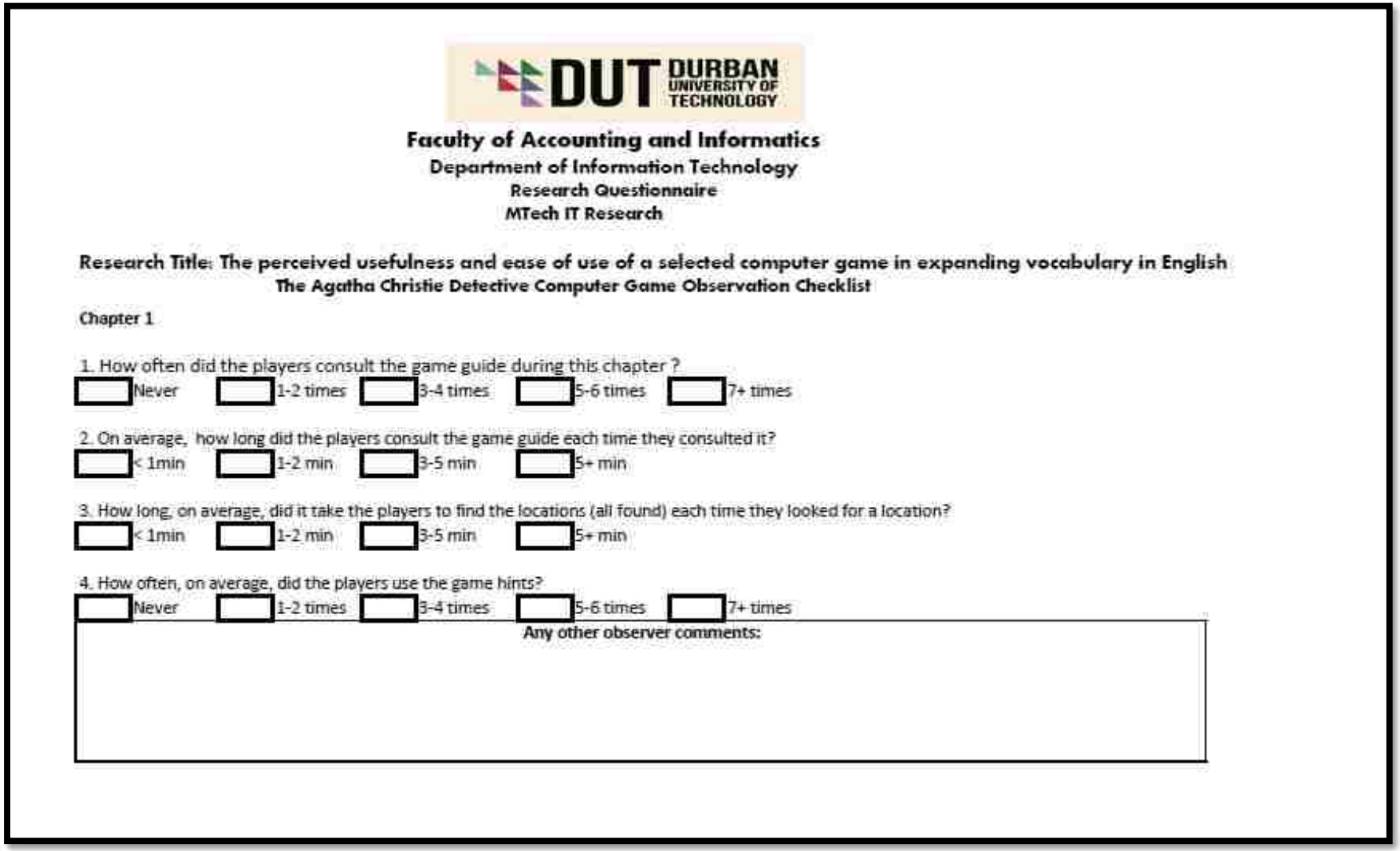
Train Carriage

- Enter the Train Carriage location (highlighted on the World map) to arrive at this scene.
- Collect the normal items before collecting the KEY ITEMS. Not everyone will receive the same normal item.
- Collect the TEA to reveal the blurred KEY ITEM on the list.
- Collect the WINDOW BLIND afterwards to complete this scene.

Appendix F: Observer questionnaire



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Faculty of Accounting and Informatics
Department of Information Technology
Research Questionnaire
MTech IT Research

Research Title: The perceived usefulness and ease of use of a selected computer game in expanding vocabulary in English
The Agatha Christie Detective Computer Game Observation Checklist

Chapter 1

1. How often did the players consult the game guide during this chapter ?

☐ Never ☐ 1-2 times ☐ 3-4 times ☐ 5-6 times ☐ 7+ times

2. On average, how long did the players consult the game guide each time they consulted it?

☐ < 1min ☐ 1-2 min ☐ 3-5 min ☐ 5+ min

3. How long, on average, did it take the players to find the locations (all found) each time they looked for a location?

☐ < 1min ☐ 1-2 min ☐ 3-5 min ☐ 5+ min

4. How often, on average, did the players use the game hints?

☐ Never ☐ 1-2 times ☐ 3-4 times ☐ 5-6 times ☐ 7+ times

Any other observer comments:

Chapter 2

4. How often did the players consult the game guide during this chapter ?

☐ Never ☐ 1-2 times ☐ 3-4 times ☐ 5-6 times ☐ 7+ times

5. On average, how long did the players consult the game guide each time they consulted it?

☐ < 1min ☐ 1-2 min ☐ 3-5 min ☐ 5+ min

6. How long, on average, did it take the players to find the locations (all found) each time they looked for a location?

☐ < 1min ☐ 1-2 min ☐ 3-5 min ☐ 5+ min ☐ 7+ times

7. How often, on average, did the players use the game hints?

☐ Never ☐ 1-2 times ☐ 3-4 times ☐ 5-6 times ☐ 7+ times

Any other observer comments:

Chapter 3

7. How often did the players consult the game guide during this chapter ?

☐ Never ☐ 1-2 times ☐ 3-4 times ☐ 5-6 times ☐ 7+ times

8. On average, how long did the players consult the game guide each time they consulted it?

☐ < 1min ☐ 1-2 min ☐ 3-5 min ☐ 5+ min

9. How long, on average, did it take the players to find the locations (all found) each time they looked for a location?

☐ < 1min ☐ 1-2 min ☐ 3-5 min ☐ 5+ min

10. How often, on average, did the players use the game hints?

☐ Never ☐ 1-2 times ☐ 3-4 times ☐ 5-6 times ☐ 7+ times

Any other observer comments:

Chapter 4

10. How often did the players consult the game guide during this chapter ?

☐ Never ☐ 1-2 times ☐ 3-4 times ☐ 5-6 times ☐ 7+ times

11. On average, how long did the players consult the game guide each time they consulted it?

☐ < 1min ☐ 1-2 min ☐ 3-5 min ☐ 5+ min

12. How long, on average, did it take the players to find the locations (all found) each time they looked for a location?

☐ < 1min ☐ 1-2 min ☐ 3-5 min ☐ 5+ min

13. How often, on average, did the players use the game hints?

☐ Never ☐ 1-2 times ☐ 3-4 times ☐ 5-6 times ☐ 7+ times

Any other observer comments:

Chapter 5

13. How often did the players consult the game guide during this chapter ?

☐ Never ☐ 1-2 times ☐ 3-4 times ☐ 5-6 times ☐ 7+ times

14. On average, how long did the players consult the game guide each time they consulted it?

☐ < 1min ☐ 1-2 min ☐ 3-5 min ☐ 5+ min

15. How long, on average, did it take the players to find the locations (all found) each time they looked for a location?

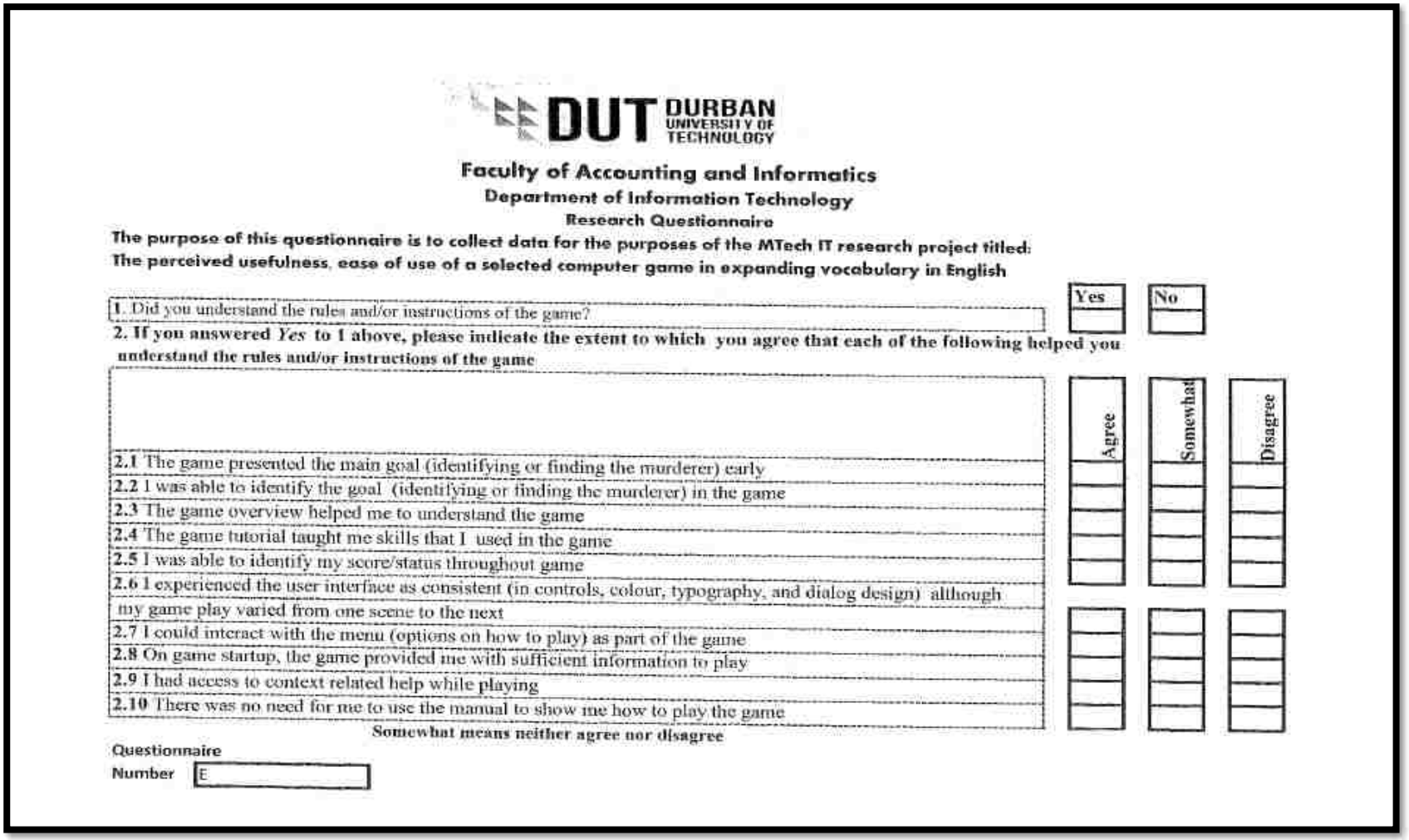
☐ < 1min ☐ 1-2 min ☐ 3-5 min ☐ 5+ min

16. How often, on average, did the players use the game hints?

☐ Never ☐ 1-2 times ☐ 3-4 times ☐ 5-6 times ☐ 7+ times

Any other observer comments:

Appendix G: Post-test questionnaire



DUT DURBAN UNIVERSITY OF TECHNOLOGY

Faculty of Accounting and Informatics

Department of Information Technology

Research Questionnaire

The purpose of this questionnaire is to collect data for the purposes of the MTech IT research project titled:
The perceived usefulness, ease of use of a selected computer game in expanding vocabulary in English

	Yes	No
1. Did you understand the rules and/or instructions of the game?		

2. If you answered *Yes* to 1 above, please indicate the extent to which you agree that each of the following helped you understand the rules and/or instructions of the game

	Agree	Somewhat	Disagree
2.1 The game presented the main goal (identifying or finding the murderer) early			
2.2 I was able to identify the goal (identifying or finding the murderer) in the game			
2.3 The game overview helped me to understand the game			
2.4 The game tutorial taught me skills that I used in the game			
2.5 I was able to identify my score/status throughout game			
2.6 I experienced the user interface as consistent (in controls, colour, typography, and dialog design) although my game play varied from one scene to the next			
2.7 I could interact with the menu (options on how to play) as part of the game			
2.8 On game startup, the game provided me with sufficient information to play			
2.9 I had access to context related help while playing			
2.10 There was no need for me to use the manual to show me how to play the game			

Somewhat means neither agree nor disagree

Questionnaire Number: E

DUT DURBAN UNIVERSITY OF TECHNOLOGY

Faculty of Accounting and Informatics

Department of Information Technology

Research Questionnaire

3. If you answered *No* to 1 above, please indicate the extent to which you agree that each of the following helped you understand the rules and/or instructions of the game

	Agree	Somewhat	Disagree
3.1 The game **did not** presented the main goal early			
3.2 I was **not** able to identify the goal in the game			
3.3 The game overview **did not** help me to understand the game			
3.4 I was **never** taught skills that I was expected to use in the game, through the game tutorial			
3.5 I was **unable** to identify my score/status in the game			
3.6 The user interface **was not** consistent (in controls, colour, typography, and dialog design)			
3.7 The menu (options on how to play) **did not** look/appear as part of the game			
3.8 Upon initially turning the game on, there was **insufficient** information to get me started with game playing			
3.9 I **did not** have access to context related help while playing			
3.10 I relied on the manual to show me how to play the game			

Somewhat means neither agree nor disagree

DUT DURBAN UNIVERSITY OF TECHNOLOGY

Faculty of Accounting and Informatics

Department of Information Technology

Research Questionnaire

4. Perceived impact of the computer game on English vocabulary improvement

	Agree	Somewhat	Disagree
4.1 I believe that playing this game can help me to improve my English vocabulary			
4.2 I believe that playing this game can help me to use English to communicate better in my daily conversation with others			
4.3 I believe that playing this game has taught me new English words			
4.4 I believe that playing this game can help me to improve my writing skills			

Somewhat means neither agree nor disagree

DUT DURBAN UNIVERSITY OF TECHNOLOGY

Faculty of Accounting and Informatics

Department of Information Technology

Research Questionnaire

5. Perceived ease of use of the computer game

	Agree	Somewhat	Disagree
5.1 I found the instructions sufficiently clear to enable me to play the game properly			
5.2 I found it easy to recover from mistakes or from faults encountered while playing the game			
5.3 It was easy for me to remember how to play the game especially after taking a break from game play			

Somewhat means neither agree nor disagree

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Faculty of Accounting and Informatics

Department of Information Technology

Research Questionnaire

6. Perceived usefulness of the computer on English vocabulary improvement

	Agree	Somewhat	Disagree	Please explain your answer
6.1 I think playing the game will enable me to improve my performance in interpreting academic texts or text books in English				
6.2 I think playing the game has the potential to increase my learning productivity (output)				
6.3 I think playing the game will enhance my effectiveness (success) in some of my academic learning activities				
6.4 I think playing the game may play some role in the improvement of my grades				
6.5 I think playing the game should be part of at least one study course in the university so that students can have fun while learning				
6.6 I think playing the game can be an interesting way to learn new English words				

Somewhat means neither agree nor disagree

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Faculty of Accounting and Informatics

Department of Information Technology

Research Questionnaire

Thank you very much for taking the time to complete this questionnaire.

Appendix H: Narrative (for NBC group)

FACULTY OF ACCOUNTING & INFORMATICS

Department of Information Technology

MTech IT Research

Research Title: The perceived usefulness and ease of use of a selected computer game in expanding vocabulary in English.

The Agatha Christie 4:50 from Paddington Station

The Narrative

Mrs Elspeth McGillicuddy's train has left Paddington Station. She is on her way to visit her old friend, Jane Marple. On the way, her train **approaches** and passes another train running parallel to hers and in the same direction. The rush of air causes a **section** of the window blinds in one of the compartments to fly up and she sees a man strangling a woman. She can only see the back of the man. She immediately reports the matter to a ticket collector but he does not believe her. When she arrives at Miss Marple's cottage, she tells her what she saw. Mrs McGillicuddy describes the woman as wearing a fur coat and with blonde hair. Miss Marple believes the story even though there is no **available evidence** to support Mrs McGillicuddy's story. Because Miss Marple is an intrusive **individual,** she decides to investigate.

The first task in Miss Marple's crime detective **role**, is to ascertain whether a murder had been committed and if so, where the body could have been hidden as nobody else reported or witnessed the crime or found a body. Miss Marple and Mrs McGillicuddy's first attempts to get help from the police fail, as the police do not believe Mrs McGillicuddy's story. Miss Marple and Mrs McGillicuddy then retrace the route taken by the train on which the murder was committed. En route, Mrs McGillicuddy retells what happened and Miss Marple further **analyses** her story. A short while after the train passes the spot where Mrs McGillicuddy witnessed the murder, it passes Rutherford Hall in the distance. Using their binoculars, they ascertain the **environmental** location of Rutherford Hall. It is situated in an isolated **area.** As **indicated** on the map, the 4:50 from Paddington goes past Rutherford Hall. Miss Marple **assumes** that there is a connection between the incident and Rutherford Hall as it is the only building on the railway route in the vicinity where the alleged crime took place.

Josiah Crackenthorpe, a tea biscuits businessman had built his house, Rutherford Hall, in 1884. As his son, Luther was reckless in his youth, Josiah used his **authority** as the house owner to make

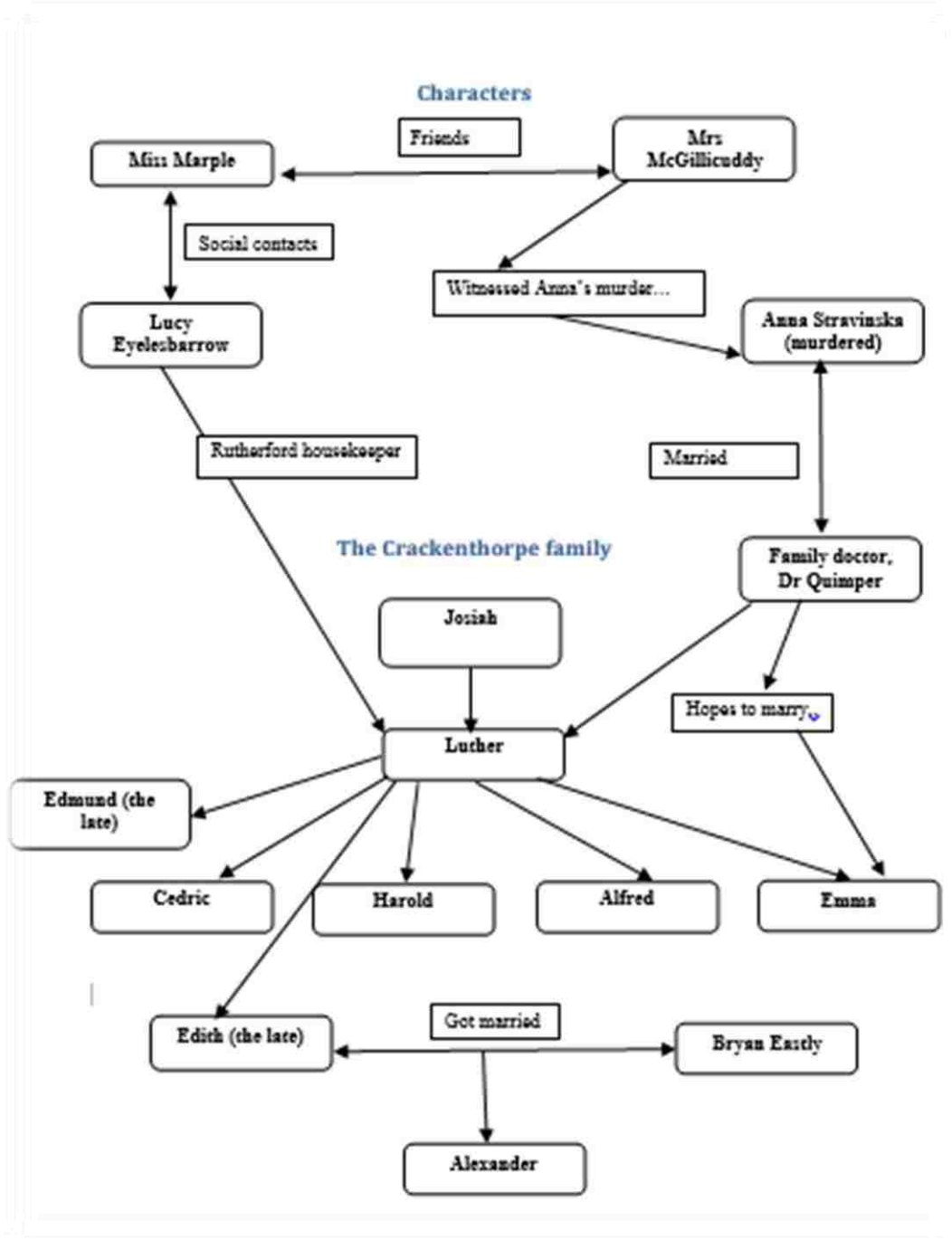
Luther a mere trustee of Rutherford Hall and to leave his **significant** wealth in a trust. According to the will, Luther Crackenthorpe cannot sell the house; he receives only the interest from Josiah's wealth and cannot touch the capital (principal or original money put into the trust). After Luther's death, the capital is to be divided equally among Luther's children. The eldest of Luther Crackenthorpe's children, Edmund, died during World War II. His youngest daughter, Edith, died four years before. The remaining heirs to the estate are: Cedric, an Ibiza-based (Ibiza is an island in the Mediterranean Sea) laidback painter and a lover of women; Harold, a cold and stuffy banker; Alfred, the black sheep of the family who is known to engage in shady business dealings; Emma, a spinster who lives at home and takes care of Luther; and Alexander, son of Edith. The others in the house are: Bryan Eastley, Alexander's father; and Dr David Quimper, who looks after Luther's health and who is secretly in love with Emma.

Miss Marple sends Lucy Eyelesbarrow, her social contact and a young professional housekeeper undercover to Rutherford Hall to search for clues. Lucy Eyelesbarrow uses golf practice as an excuse to search or **assess** the grounds for any **evidence**. She finds a number of items lying around, a: cart, bird cage, kite, comb, basket, fan, hat, fur (that seems to have torn off from a coat), make-up powder compact, and an axe. Lucy tells Miss Marple about these items who in turn interprets them as clues. Lucy continues searching. While searching a dark stable full of spider webs, she eventually finds a woman's body hidden in a coffin among Luther's suspicious collection of antiques (collectible objects). But who is this woman? Given that this is now a murder case due to the discovery of the body, Miss Marple enlists the help of **legal** personnel by bringing in Inspector Craddock into the investigation process. Inspector Craddock and his team **identify** the piece of fur as being of French manufacture.

The police, led by Inspector Craddock, try to find out more information about the deceased. Craddock eventually learns of a missing dancer called Anna Stravinska who left her ballet troupe in Paris (the capital city of France) at about the time of the murder. Although Inspector Craddock theorizes that the victim may be the missing woman, he's unable to find any definite information and the investigation comes to a standstill.

Then, one evening Alfred Crackenthorpe falls ill. Doctor Quimper attends to him and although the symptoms only seem to be mild, Alfred dies in the night. Upset, Harold orders sedatives but upon taking one of the tablets, he also dies.

It **occurs** that the murdered woman, Anna Stravinska had been married to Dr Quimper. She was estranged from her husband but as she was a devout Catholic, she was **required** to remain married to him and she was prohibited from divorcing him. She travelled with a dance troupe while her husband stayed at Rutherford Hall under the guise of caring for Josiah but he actually wanted to be close to Emma and the Crackenthorpe fortune. Consequently, Dr Quimper hoped to marry Emma Crackenthorpe. Strangely, Emma's brothers died, after the illness evening her family experienced.



Tutorial questions

- **From where had Mrs. McGillicuddy started her trip?**
- **Which was the most likely place where the body may have been thrown out of the train?**
- **Whom did Miss Marple send to Rutherford Hall to look for clues?**
- **Where was the body found?**
- **Who do you think murdered Anna Stravinska and why?**

Narrative and questions adapted from:

http://en.wikipedia.org/wiki/4.50_from_Paddington

http://completedisregard.com/2012/04/22/the-450-from-paddington-agatha-christie-1957/

http://www.funtrivia.com/en/subtopics/Agatha-Christie-450-From-Paddington-339477.html

http://readfreeonline.net/OnlineBooks/4_50_from_Paddington/4_50_from_Paddington_27.html

Appendix I: Demographics

Group = Control (NBC)

Gender[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	47	66.2	66.2	66.2
	Female	24	33.8	33.8	100.0
	Total	71	100.0	100.0	

a. group = Control

Race[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	African	69	97.2	97.2	97.2
	Indian	1	1.4	1.4	98.6
	Coloured	1	1.4	1.4	100.0
	Total	71	100.0	100.0	

a. group = Control

Age[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	16 - 20	30	42.3	42.3	42.3
	21 - 25	37	52.1	52.1	94.4
	26 - 30	4	5.6	5.6	100.0
	Total	71	100.0	100.0	

a. group = Control

Reside[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Rural	26	36.6	36.6	36.6
	Urban	33	46.5	46.5	83.1
	Suburb	10	14.1	14.1	97.2
	Urban suburb	2	2.8	2.8	100.0
	Total	71	100.0	100.0	

a. group = Control

Nationality[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	SA	70	98.6	98.6	98.6
	Other	1	1.4	1.4	100.0
	Total	71	100.0	100.0	

a. group = Control

Language[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	English	2	2.8	2.8	2.8
	Zulu	47	66.2	66.2	69.0
	Xhosa	7	9.9	9.9	78.9
	Other	15	21.1	21.1	100.0
	Total	71	100.0	100.0	

a. group = Control

Group = Experimental (CPE)

Gender[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	53	74.6	74.6	74.6
	Female	18	25.4	25.4	100.0
	Total	71	100.0	100.0	

a. group = Experimental

Race[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	African	63	88.7	88.7	88.7
	Indian	5	7.0	7.0	95.8
	White	2	2.8	2.8	98.6
	Coloured	1	1.4	1.4	100.0
	Total	71	100.0	100.0	

a. group = Experimental

Age[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	16 - 20	44	62.0	62.0	62.0
	21 - 25	27	38.0	38.0	100.0
	Total	71	100.0	100.0	

a. group = Experimental

Reside[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Rural	28	39.4	39.4	39.4
	Urban	27	38.0	38.0	77.5
	Suburb	12	16.9	16.9	94.4
	Urban suburb	2	2.8	2.8	97.2
	Other	2	2.8	2.8	100.0
	Total	71	100.0	100.0	

a. group = Experimental

Nationality[a]

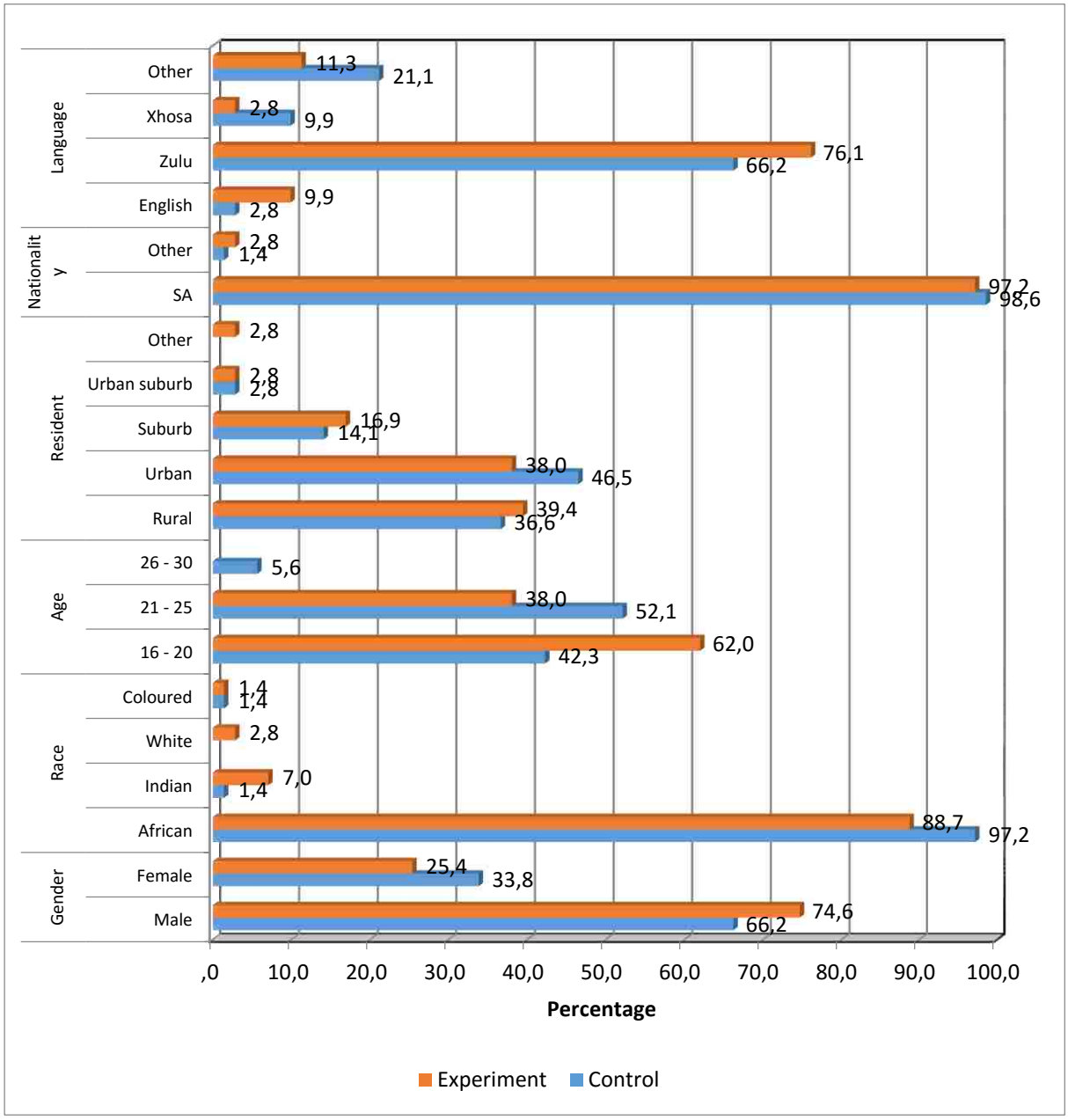
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	SA	69	97.2	97.2	97.2
	Other	2	2.8	2.8	100.0
	Total	71	100.0	100.0	

a. group = Experimental

Language[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	English	7	9.9	9.9	9.9
	Zulu	54	76.1	76.1	85.9
	Xhosa	2	2.8	2.8	88.7
	Other	8	11.3	11.3	100.0
	Total	71	100.0	100.0	

a. group = Experimental



Crosstab

			Age			Total
			16 - 20	21 - 25	26 - 30	
group	Control	Count	30	37	4	71
		Expected Count	37.0	32.0	2.0	71.0
		Std. Residual	-1.2	.9	1.4	
	Experimental	Count	44	27	0	71
		Expected Count	37.0	32.0	2.0	71.0
		Std. Residual	1.2	-.9	-1.4	
Total		Count	74	64	4	142

Crosstab

			Age			Total
			16 - 20	21 - 25	26 - 30	
group	Control	Count	30	37	4	71
		Expected Count	37.0	32.0	2.0	71.0
		Std. Residual	-1.2	.9	1.4	
	Experimental	Count	44	27	0	71
		Expected Count	37.0	32.0	2.0	71.0
		Std. Residual	1.2	-.9	-1.4	
Total		Count	74	64	4	142
		Expected Count	74.0	64.0	4.0	142.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	8.211[a]	2	.016	.012		
Likelihood Ratio	9.779	2	.008	.009		
Fisher's Exact Test	7.891			.012		
Linear-by-Linear Association	7.397[b]	1	.007	.010	.005	.003
N of Valid Cases	142					

a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is 2.00.

b. The standardized statistic is -2.720.

Crosstab

			Language				Total
			English	Zulu	Xhosa	Other	
group	Control	Count	2	47	7	15	71
		Expected Count	4.5	50.5	4.5	11.5	71.0
		Std. Residual	-1.2	-.5	1.2	1.0	
	Experimental	Count	7	54	2	8	71
		Expected Count	4.5	50.5	4.5	11.5	71.0
		Std. Residual	1.2	.5	-1.2	-1.0	
Total		Count	9	101	9	23	142
		Expected Count	9.0	101.0	9.0	23.0	142.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	8.171[a]	3	.043	.040		
Likelihood Ratio	8.534	3	.036	.042		
Fisher's Exact Test	7.896			.043		
Linear-by-Linear Association	6.014[b]	1	.014	.018	.009	.004
N of Valid Cases	142					

a. 4 cells (50.0%) have expected count less than 5. The minimum expected count is 4.50.

b. The standardized statistic is -2.452.

Matric_level

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	first/home language	42	29.6	29.6	29.6
	second/additional language	100	70.4	70.4	100.0
	Total	142	100.0	100.0	

Matric_mark

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<50%	17	12.0	12.0	12.0
	50 - 59%	50	35.2	35.2	47.2
	60 - 74%	63	44.4	44.4	91.5
	75%+	12	8.5	8.5	100.0
	Total	142	100.0	100.0	

Comm_skills_mark

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<50%	7	4.9	4.9	4.9
	50 - 59%	54	38.0	38.0	43.0
	60 - 74%	52	36.6	36.6	79.6
	75%+	29	20.4	20.4	100.0
	Total	142	100.0	100.0	

Field_of_study

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Electrical engineering	68	47.9	47.9	47.9
	Industrial engineering	74	52.1	52.1	100.0
	Total	142	100.0	100.0	

Computer_access

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	DUT	83	58.5	58.5	58.5
	Home	6	4.2	4.2	62.7
	DUT and home	49	34.5	34.5	97.2
	Internet cafe	4	2.8	2.8	100.0
	Total	142	100.0	100.0	

Crosstab

			Matric_mark				Total
			<50%	50 - 59%	60 - 74%	75%+	
group	Control	Count	13	25	31	2	71
		Expected Count	8.5	25.0	31.5	6.0	71.0
		Std. Residual	1.5	.0	.0	-1.6	
	Experimental	Count	4	25	32	10	71
		Expected Count	8.5	25.0	31.5	6.0	71.0
		Std. Residual	-1.5	.0	.1	1.6	
Total		Count	17	50	63	12	142
		Expected Count	17.0	50.0	63.0	12.0	142.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	10.114[a]	3	.018	.017		

Likelihood Ratio	10.855	3	.013	.015		
Fisher's Exact Test	10.082			.017		
Linear-by-Linear Association	7.180[b]	1	.007	.009	.005	.002
N of Valid Cases	142					

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.00.

b. The standardized statistic is 2.679.

Crosstab

			Field_of_study		
			Electrical engineering	Industrial engineering	Total
group	Control	Count	25	46	71
		Expected Count	34.0	37.0	71.0
		Std. Residual	-1.5	1.5	
	Experimental	Count	43	28	71
		Expected Count	34.0	37.0	71.0
		Std. Residual	1.5	-1.5	
Total		Count	68	74	142
		Expected Count	68.0	74.0	142.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	9.143[a]	1	.002	.004	.002	
Continuity Correction[b]	8.155	1	.004			
Likelihood Ratio	9.245	1	.002	.004	.002	
Fisher's Exact Test				.004	.002	
Linear-by-Linear Association	9.079[c]	1	.003	.004	.002	.001
N of Valid Cases	142					

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 34.00.

b. Computed only for a 2x2 table

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	9.143[a]	1	.002	.004	.002	
Continuity Correction[b]	8.155	1	.004			
Likelihood Ratio	9.245	1	.002	.004	.002	
Fisher's Exact Test				.004	.002	
Linear-by-Linear Association	9.079[c]	1	.003	.004	.002	.001
N of Valid Cases	142					

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 34.00.

b. Computed only for a 2x2 table

c. The standardized statistic is -3.013.

Appendix J: Computer gaming history and experience

Group = Control (NBC)

12. Have you ever played any type of computer game before? [a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	55	77.5	77.5	77.5
	No	16	22.5	22.5	100.0
	Total	71	100.0	100.0	

a. group = Control

13. Have you ever played the Agatha Christie 4:50 to Paddington computer game before?[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	2	2.8	2.8	2.8

	No	69	97.2	97.2	100.0
	Total	71	100.0	100.0	

a. group = Control

14. Have you ever played any version(s) of a detective computer game?[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	15	21.1	21.1	21.1
	No	56	78.9	78.9	100.0
	Total	71	100.0	100.0	

a. group = Control

Group = Experimental (CPE)

12. Have you ever played any type of computer game before? [a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	45	63.4	63.4	63.4
	No	26	36.6	36.6	100.0
	Total	71	100.0	100.0	

a. group = Experimental

13. Have you ever played the Agatha Christie 4:50 to Paddington computer game before?[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	2	2.8	2.8	2.8
	No	69	97.2	97.2	100.0
	Total	71	100.0	100.0	

a. group = Experimental

14. Have you ever played any version(s) of a detective computer game?[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	8	11.3	11.3	11.3
	No	63	88.7	88.7	100.0
	Total	71	100.0	100.0	

a. group = Experimental

No significant differences for the above questions between CPE and NBC.

Group = Control (NBC)

Statistics[a]

		15.1 Batman: Arkham Asylum	15.2 Sam and Max hit the road	15.3 L.A. Noire	15.4 Gillian seed snatcher	15.5 Any other detective game
N	Valid	12	3	4	2	3
	Missing	59	68	67	69	68

a. group = Control

Frequency Table

15.1 Batman: Arkham Asylum [a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Quit playing	9	12.7	75.0	75.0
	Still playing	3	4.2	25.0	100.0
	Total	12	16.9	100.0	
Missing	System	59	83.1		
Total		71	100.0		

a. group = Control

15.2 Sam and Max hit the road[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Quit playing	2	2.8	66.7	66.7
	Still playing	1	1.4	33.3	100.0
	Total	3	4.2	100.0	
Missing	System	68	95.8		
Total		71	100.0		

a. group = Control

15.3 L.A. Noire[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Quit playing	3	4.2	75.0	75.0
	Still playing	1	1.4	25.0	100.0
	Total	4	5.6	100.0	
Missing	System	67	94.4		
Total		71	100.0		

15.4 Gillian seed snatcher[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Quit playing	1	1.4	50.0	50.0
	Still playing	1	1.4	50.0	100.0
	Total	2	2.8	100.0	
Missing	System	69	97.2		
Total		71	100.0		

a. group = Control

15.5 Any other detective game[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Quit playing	2	2.8	66.7	66.7
	Still playing	1	1.4	33.3	100.0
	Total	3	4.2	100.0	
Missing	System	68	95.8		
Total		71	100.0		

a. group = Control

Group = Experimental (CPE)

Statistics[a]

		15.1 Batman: Arkham Asylum	15.2 Sam and Max hit the road	15.3 L.A. Noire	15.4 Gillian seed snatcher	15.5 Any other detective game
N	Valid	8	2	2	2	3
	Missing	63	69	69	69	68

a. group = Experimental

Frequency Table

15.1 Batman: Arkham Asylum [a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Quit playing	7	9.9	87.5	87.5
	Still playing	1	1.4	12.5	100.0

	Total	8	11.3	100.0	
Missing	System	63	88.7		
Total		71	100.0		

a. group = Experimental

15.2 Sam and Max hit the road[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Quit playing	2	2.8	100.0	100.0
Missing	System	69	97.2		
Total		71	100.0		

a. group = Experimental

15.3 L.A. Noire[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Quit playing	1	1.4	50.0	50.0
	Still playing	1	1.4	50.0	100.0
	Total	2	2.8	100.0	
Missing	System	69	97.2		
Total		71	100.0		

a. group = Experimental

15.4 Gillian seed snatcher[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Quit playing	2	2.8	100.0	100.0
Missing	System	69	97.2		
Total		71	100.0		

a. group = Experimental

15.5 Any other detective game[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Quit playing	2	2.8	66.7	66.7
	Still playing	1	1.4	33.3	100.0
	Total	3	4.2	100.0	

Missing	System	68	95.8		
Total		71	100.0		

a. group = Experimental

No analysis – too small a sample.
Group = Control (NBC)

Statistics[a]

		16.1 Batman: Arkham Asylum	16.2 Sam and Max hit the road	16.3 L.A. Noire	16.4 Gillian seed snatcher	16.5 Any other detective game
N	Valid	9	2	3	1	2
	Missing	62	69	68	70	69

a. group = Control

Frequency Table

16.1 Batman: Arkham Asylum [a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 - 2 months ago	1	1.4	11.1	11.1
	3 - 6 months ago	1	1.4	11.1	22.2
	more than 12 months ago	7	9.9	77.8	100.0
	Total	9	12.7	100.0	
Missing	System	62	87.3		
Total		71	100.0		

a. group = Control

16.2 Sam and Max hit the road[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	more than 12 months ago	2	2.8	100.0	100.0
Missing	System	69	97.2		
Total		71	100.0		

a. group = Control

16.3 L.A. Noire[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	more than 12 months ago	3	4.2	100.0	100.0
Missing	System	68	95.8		
Total		71	100.0		

a. group = Control

16.4 Gillian seed snatcher[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	more than 12 months ago	1	1.4	100.0	100.0
Missing	System	70	98.6		
Total		71	100.0		

a. group = Control

16.5 Any other detective game[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	more than 12 months ago	2	2.8	100.0	100.0
Missing	System	69	97.2		
Total		71	100.0		

a. group = Control

Group = Experimental (CPE)

Statistics[a]

		16.1 Batman: Arkham Asylum	16.2 Sam and Max hit the road	16.3 L.A. Noire	16.4 Gillian seed snatcher	16.5 Any other detective game
N	Valid	7	2	1	2	2
	Missing	64	69	70	69	69

a. group = Experimental

Frequency Table

16.1 Batman: Arkham Asylum [a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	less than a month ago	1	1.4	14.3	14.3
	7 - 9 months ago	2	2.8	28.6	42.9
	more than 12 months ago	4	5.6	57.1	100.0
	Total	7	9.9	100.0	
Missing	System	64	90.1		
Total		71	100.0		

a. group = Experimental

16.2 Sam and Max hit the road[a]

	Frequency	Percent	Valid Percent	Cumulative Percent

Valid	more than 12 months ago	2	2.8	100.0	100.0
Missing	System	69	97.2		
Total		71	100.0		

a. group = Experimental

16.3 L.A. Noire[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	more than 12 months ago	1	1.4	100.0	100.0
Missing	System	70	98.6		
Total		71	100.0		

a. group = Experimental

16.4 Gillian seed snatcher[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	more than 12 months ago	2	2.8	100.0	100.0
Missing	System	69	97.2		
Total		71	100.0		

a. group = Experimental

16.5 Any other detective game[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3 - 6 months ago	1	1.4	50.0	50.0
	8 - 12 months ago	1	1.4	50.0	100.0
	Total	2	2.8	100.0	
Missing	System	69	97.2		
Total		71	100.0		

a. group = Experimental

No analysis – too small a sample.
Group = Control (NBC)

Statistics[a]

		17.1 Batman: Arkham Asylum	17.2 Sam & Max hit the road	17.3 L.A. Noire	17.4 Gillian seed snatcher	17. 5 Any other detective game
N	Valid	4	1	1	1	1
	Missing	67	70	70	70	70

a. group = Control

Frequency Table

17.1 Batman: Arkham Asylum [a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 - 3 hours	2	2.8	50.0	50.0
	more than 5 hours	2	2.8	50.0	100.0
	Total	4	5.6	100.0	
Missing	System	67	94.4		
Total		71	100.0		

a. group = Control

17.2 Sam & Max hit the road[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 - 3 hours	1	1.4	100.0	100.0
Missing	System	70	98.6		
Total		71	100.0		

a. group = Control

17.3 L.A. Noire[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 - 3 hours	1	1.4	100.0	100.0
Missing	System	70	98.6		
Total		71	100.0		

a. group = Control

17.4 Gillian seed snatcher[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 - 3 hours	1	1.4	100.0	100.0
Missing	System	70	98.6		
Total		71	100.0		

a. group = Control

17. 5 Any other detective game[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 - 3 hours	1	1.4	100.0	100.0
Missing	System	70	98.6		

Total		71	100.0		

a. group = Control

Group = Experimental (CPE)

Statistics[a]

		17.1 Batman: Arkham Asylum	17.2 Sam & Max hit the road	17.3 L.A. Noire	17.4 Gillian seed snatcher	17. 5 Any other detective game
N	Valid	4	0	1	0	1
	Missing	67	71	70	71	70

a. group = Experimental

Frequency Table

17.1 Batman: Arkham Asylum [a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 - 3 hours	3	4.2	75.0	75.0
	4 - 5 hours	1	1.4	25.0	100.0
	Total	4	5.6	100.0	
Missing	System	67	94.4		
Total		71	100.0		

a. group = Experimental

17.2 Sam & Max hit the road[a]

		Frequency	Percent
Missing	System	71	100.0

a. group = Experimental

17.3 L.A. Noire[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 - 3 hours	1	1.4	100.0	100.0
Missing	System	70	98.6		
Total		71	100.0		

a. group = Experimental

17.4 Gillian seed snatcher[a]

		Frequency	Percent
Missing	System	71	100.0

a. group = Experimental

17. 5 Any other detective game[a]

		Frequency	Percent	Valid Percent	Cumulative Percent

Valid	4 - 5 hours	1	1.4	100.0	100.0
Missing	System	70	98.6		
Total		71	100.0		

a. group = Experimental

Group = Control (NBC)

Statistics[a]

		18.1 Board based computer games e.g. Chess, Scrabble, Monopoly, Trivial Pursuit	18.2 Adventure based computer games e.g. Mist, Zork, Sam and Max Hit The Road	18.3 Role based computer games e.g Sims, Civilization, Tycoon, World of Warcraft	18.4 Strategy based computer games e.g. Ages of Empires III, Civilization IV, Warcraft III	18.5 Simulation based computer games e.g. Sim City, Roller Coaster Tycoon
N	Valid	71	71	71	71	71
	Missing	0	0	0	0	0

a. group = Control

Frequency Table

18.1 Board based computer games e.g. Chess, Scrabble, Monopoly, Trivial Pursuit [a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 - 3 hours	15	21.1	21.1	21.1
	4 - 5 hours	9	12.7	12.7	33.8
	more than 5 hours	3	4.2	4.2	38.0
	never	41	57.7	57.7	95.8
	I quit	3	4.2	4.2	100.0
	Total	71	100.0	100.0	

a. group = Control

18.2 Adventure based computer games e.g. Mist, Zork, Sam and Max Hit The Road[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 - 3 hours	4	5.6	5.6	5.6
	4 - 5 hours	1	1.4	1.4	7.0
	more than 5 hours	2	2.8	2.8	9.9
	never	60	84.5	84.5	94.4
	I quit	4	5.6	5.6	100.0
	Total	71	100.0	100.0	

a. group = Control

18.3 Role based computer games e.g Sims, Civilization, Tycoon, World of Warcraft[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 - 3 hours	6	8.5	8.5	8.5
	more than 5 hours	4	5.6	5.6	14.1
	never	57	80.3	80.3	94.4
	I quit	4	5.6	5.6	100.0
	Total	71	100.0	100.0	

a. group = Control

18.4 Strategy based computer games e.g. Ages of Empires III, Civilization IV, Warcraft III[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 - 3 hours	1	1.4	1.4	1.4
	4 - 5 hours	2	2.8	2.8	4.2
	more than 5 hours	5	7.0	7.0	11.3
	never	61	85.9	85.9	97.2
	I quit	2	2.8	2.8	100.0
	Total	71	100.0	100.0	

a. group = Control

18.5 Simulation based computer games e.g. Sim City, Roller Coaster Tycoon[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 - 3 hours	4	5.6	5.6	5.6
	4 - 5 hours	2	2.8	2.8	8.5
	more than 5 hours	5	7.0	7.0	15.5
	never	57	80.3	80.3	95.8
	I quit	3	4.2	4.2	100.0
	Total	71	100.0	100.0	

a. group = Control

Group = Experimental (CPE)

Statistics[a]

		18.1 Board based computer games e.g. Chess, Scrabble, Monopoly, Trivial Pursuit	18.2 Adventure based computer games e.g. Mist, Zork, Sam and Max Hit The Road	18.3 Role based computer games e.g Sims, Civilization, Tycoon, World of Warcraft	18.4 Strategy based computer games e.g. Ages of Empires III, Civilization IV, Warcraft III	18.5 Simulation based computer games e.g. Sim City, Roller Coaster Tycoon
N	Valid	71	71	71	71	71
	Missing	0	0	0	0	0

a. group = Experimental

Frequency Table

18.1 Board based computer games e.g. Chess, Scrabble, Monopoly, Trivial Pursuit [a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 - 3 hours	16	22.5	22.5	22.5
	4 - 5 hours	3	4.2	4.2	26.8
	more than 5 hours	3	4.2	4.2	31.0
	never	46	64.8	64.8	95.8
	I quit	3	4.2	4.2	100.0
	Total	71	100.0	100.0	

a. group = Experimental

18.2 Adventure based computer games e.g. Mist, Zork, Sam and Max Hit The Road[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 - 3 hours	3	4.2	4.2	4.2
	4 - 5 hours	1	1.4	1.4	5.6
	never	65	91.5	91.5	97.2
	I quit	2	2.8	2.8	100.0
	Total	71	100.0	100.0	

a. group = Experimental

18.3 Role based computer games e.g Sims, Civilization, Tycoon, World of Warcraft[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 - 3 hours	1	1.4	1.4	1.4
	more than 5 hours	2	2.8	2.8	4.2
	never	66	93.0	93.0	97.2
	I quit	2	2.8	2.8	100.0
	Total	71	100.0	100.0	

a. group = Experimental

18.4 Strategy based computer games e.g. Ages of Empires III, Civilization IV, Warcraft III[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 - 3 hours	3	4.2	4.2	4.2
	never	66	93.0	93.0	97.2
	I quit	2	2.8	2.8	100.0
	Total	71	100.0	100.0	

a. group = Experimental

18.5 Simulation based computer games e.g. Sim City, Roller Coaster Tycoon[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 - 3 hours	4	5.6	5.6	5.6
	more than 5 hours	1	1.4	1.4	7.0
	never	66	93.0	93.0	100.0
	Total	71	100.0	100.0	

a. group = Experimental

No significant results... i.e. no significant difference between habits of CPE and NBC.

Appendix K: Autonomous English vocabulary learning activities

Group = Control (NBC)
Frequency Table

20.1 Watch TV programmes [a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	10	14.1	14.1	14.1
	<30 minutes	6	8.5	8.5	22.5
	30 - 60 minutes	23	32.4	32.4	54.9
	2 - 3 hours	22	31.0	31.0	85.9
	>3 hours	10	14.1	14.1	100.0
	Total	71	100.0	100.0	

a. group = Control

20.2 Listen to the radio[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	19	26.8	26.8	26.8
	<30 minutes	22	31.0	31.0	57.7
	30 - 60 minutes	10	14.1	14.1	71.8
	2 - 3 hours	6	8.5	8.5	80.3
	>3 hours	14	19.7	19.7	100.0
	Total	71	100.0	100.0	

a. group = Control

20.3 Read newspapers and magazines[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	20	28.2	28.2	28.2
	<30 minutes	28	39.4	39.4	67.6
	30 - 60 minutes	13	18.3	18.3	85.9
	2 - 3 hours	7	9.9	9.9	95.8
	>3 hours	3	4.2	4.2	100.0
	Total	71	100.0	100.0	

20.1 Watch TV programmes [a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	10	14.1	14.1	14.1
	<30 minutes	6	8.5	8.5	22.5
	30 - 60 minutes	23	32.4	32.4	54.9
	2 - 3 hours	22	31.0	31.0	85.9
	>3 hours	10	14.1	14.1	100.0
	Total	71	100.0	100.0	

a. group = Control

20.4 Read academic books and articles[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	21	29.6	29.6	29.6
	<30 minutes	13	18.3	18.3	47.9
	30 - 60 minutes	12	16.9	16.9	64.8
	2 - 3 hours	8	11.3	11.3	76.1
	>3 hours	17	23.9	23.9	100.0
	Total	71	100.0	100.0	

a. group = Control

20.5 Read novels[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	31	43.7	43.7	43.7
	<30 minutes	9	12.7	12.7	56.3
	30 - 60 minutes	14	19.7	19.7	76.1
	2 - 3 hours	7	9.9	9.9	85.9
	>3 hours	10	14.1	14.1	100.0
	Total	71	100.0	100.0	

a. group = Control

20.6 Speak with colleagues/fellow students[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	13	18.3	18.3	18.3
	<30 minutes	8	11.3	11.3	29.6
	30 - 60 minutes	10	14.1	14.1	43.7

	2 - 3 hours	10	14.1	14.1	57.7
	>3 hours	30	42.3	42.3	100.0
	Total	71	100.0	100.0	

a. group = Control

20.7 Speak with friends[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	10	14.1	14.1	14.1
	<30 minutes	10	14.1	14.1	28.2
	30 - 60 minutes	7	9.9	9.9	38.0
	2 - 3 hours	10	14.1	14.1	52.1
	>3 hours	34	47.9	47.9	100.0
	Total	71	100.0	100.0	

a. group = Control

20. 8 Speak with family members[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	17	23.9	23.9	23.9
	<30 minutes	10	14.1	14.1	38.0
	30 - 60 minutes	9	12.7	12.7	50.7
	2 - 3 hours	6	8.5	8.5	59.2
	>3 hours	29	40.8	40.8	100.0
	Total	71	100.0	100.0	

a. group = Control

20.9 Surf the Internet[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	12	16.9	16.9	16.9
	<30 minutes	9	12.7	12.7	29.6
	30 - 60 minutes	18	25.4	25.4	54.9
	2 - 3 hours	12	16.9	16.9	71.8
	>3 hours	20	28.2	28.2	100.0
	Total	71	100.0	100.0	

a. group = Control

20.10 Watch videos/DVDs/VCDs[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	16	22.5	22.5	22.5

	<30 minutes	7	9.9	9.9	32.4
	30 - 60 minutes	10	14.1	14.1	46.5
	2 - 3 hours	19	26.8	26.8	73.2
	>3 hours	19	26.8	26.8	100.0
	Total	71	100.0	100.0	

a. group = Control

20.11 Talk on the phone[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	10	14.1	14.1	14.1
	<30 minutes	32	45.1	45.1	59.2
	30 - 60 minutes	20	28.2	28.2	87.3
	2 - 3 hours	4	5.6	5.6	93.0
	>3 hours	5	7.0	7.0	100.0
	Total	71	100.0	100.0	

a. group = Control

20.12 Correspond via emails[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	24	33.8	33.8	33.8
	<30 minutes	25	35.2	35.2	69.0
	30 - 60 minutes	9	12.7	12.7	81.7
	2 - 3 hours	7	9.9	9.9	91.5
	>3 hours	6	8.5	8.5	100.0
	Total	71	100.0	100.0	

a. group = Control

Group = Experimental (CPE)
Frequency Table

20.1 Watch TV programmes [a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	13	18.3	18.3	18.3
	<30 minutes	10	14.1	14.1	32.4
	30 - 60 minutes	24	33.8	33.8	66.2
	2 - 3 hours	12	16.9	16.9	83.1
	>3 hours	12	16.9	16.9	100.0
	Total	71	100.0	100.0	

20.1 Watch TV programmes [a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	13	18.3	18.3	18.3
	<30 minutes	10	14.1	14.1	32.4
	30 - 60 minutes	24	33.8	33.8	66.2
	2 - 3 hours	12	16.9	16.9	83.1
	>3 hours	12	16.9	16.9	100.0
	Total	71	100.0	100.0	

a. group = Experimental

20.2 Listen to the radio[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	16	22.5	22.5	22.5
	<30 minutes	16	22.5	22.5	45.1
	30 - 60 minutes	22	31.0	31.0	76.1
	2 - 3 hours	8	11.3	11.3	87.3
	>3 hours	9	12.7	12.7	100.0
	Total	71	100.0	100.0	

a. group = Experimental

20.3 Read newspapers and magazines[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	17	23.9	23.9	23.9
	<30 minutes	33	46.5	46.5	70.4
	30 - 60 minutes	16	22.5	22.5	93.0
	2 - 3 hours	4	5.6	5.6	98.6
	>3 hours	1	1.4	1.4	100.0
	Total	71	100.0	100.0	

a. group = Experimental

20.4 Read academic books and articles[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	13	18.3	18.3	18.3
	<30 minutes	16	22.5	22.5	40.8
	30 - 60 minutes	17	23.9	23.9	64.8
	2 - 3 hours	10	14.1	14.1	78.9
	>3 hours	15	21.1	21.1	100.0

	Total	71	100.0	100.0	

a. group = Experimental

20.5 Read novels[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	37	52.1	52.1	52.1
	<30 minutes	10	14.1	14.1	66.2
	30 - 60 minutes	12	16.9	16.9	83.1
	2 - 3 hours	7	9.9	9.9	93.0
	>3 hours	5	7.0	7.0	100.0
	Total	71	100.0	100.0	

a. group = Experimental

20.6 Speak with colleagues/fellow students[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	7	9.9	9.9	9.9
	<30 minutes	14	19.7	19.7	29.6
	30 - 60 minutes	13	18.3	18.3	47.9
	2 - 3 hours	11	15.5	15.5	63.4
	>3 hours	26	36.6	36.6	100.0
	Total	71	100.0	100.0	

a. group = Experimental

20.7 Speak with friends[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	8	11.3	11.3	11.3
	<30 minutes	13	18.3	18.3	29.6
	30 - 60 minutes	10	14.1	14.1	43.7
	2 - 3 hours	11	15.5	15.5	59.2
	>3 hours	29	40.8	40.8	100.0
	Total	71	100.0	100.0	

a. group = Experimental

20. 8 Speak with family members[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	18	25.4	25.4	25.4
	<30 minutes	10	14.1	14.1	39.4
	30 - 60 minutes	11	15.5	15.5	54.9

	2 - 3 hours	11	15.5	15.5	70.4
	>3 hours	21	29.6	29.6	100.0
	Total	71	100.0	100.0	

a. group = Experimental

20.9 Surf the Internet[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	11	15.5	15.5	15.5
	<30 minutes	15	21.1	21.1	36.6
	30 - 60 minutes	24	33.8	33.8	70.4
	2 - 3 hours	13	18.3	18.3	88.7
	>3 hours	8	11.3	11.3	100.0
	Total	71	100.0	100.0	

a. group = Experimental

20.10 Watch videos/DVDs/VCDs[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	16	22.5	22.5	22.5
	<30 minutes	8	11.3	11.3	33.8
	30 - 60 minutes	15	21.1	21.1	54.9
	2 - 3 hours	20	28.2	28.2	83.1
	>3 hours	12	16.9	16.9	100.0
	Total	71	100.0	100.0	

a. group = Experimental

20.11 Talk on the phone[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	12	16.9	16.9	16.9
	<30 minutes	32	45.1	45.1	62.0
	30 - 60 minutes	17	23.9	23.9	85.9
	2 - 3 hours	5	7.0	7.0	93.0
	>3 hours	5	7.0	7.0	100.0
	Total	71	100.0	100.0	

a. group = Experimental

20.12 Correspond via emails[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	22	31.0	31.0	31.0

	<30 minutes	29	40.8	40.8	71.8
	30 - 60 minutes	12	16.9	16.9	88.7
	2 - 3 hours	7	9.9	9.9	98.6
	>3 hours	1	1.4	1.4	100.0
	Total	71	100.0	100.0	

a. group = Experimental

Group = Control (NBC)
Chi-Square Test
Frequencies

20.1 Watch TV programmes [a]

	Observed N	Expected N	Residual
Not at all	10	14.2	-4.2
<30 minutes	6	14.2	-8.2
30 - 60 minutes	23	14.2	8.8
2 - 3 hours	22	14.2	7.8
>3 hours	10	14.2	-4.2
Total	71		

a. group = Control

20.2 Listen to the radio[a]

	Observed N	Expected N	Residual
Not at all	19	14.2	4.8
<30 minutes	22	14.2	7.8
30 - 60 minutes	10	14.2	-4.2
2 - 3 hours	6	14.2	-8.2
>3 hours	14	14.2	-.2
Total	71		

a. group = Control

20.3 Read newspapers and magazines[a]

	Observed N	Expected N	Residual
Not at all	20	14.2	5.8
<30 minutes	28	14.2	13.8
30 - 60 minutes	13	14.2	-1.2
2 - 3 hours	7	14.2	-7.2
>3 hours	3	14.2	-11.2
Total	71		

a. group = Control

20.4 Read academic books and articles[a]

	Observed N	Expected N	Residual
Not at all	21	14.2	6.8
<30 minutes	13	14.2	-1.2
30 - 60 minutes	12	14.2	-2.2
2 - 3 hours	8	14.2	-6.2
>3 hours	17	14.2	2.8
Total	71		

a. group = Control

20.5 Read novels[a]

	Observed N	Expected N	Residual
Not at all	31	14.2	16.8
<30 minutes	9	14.2	-5.2
30 - 60 minutes	14	14.2	-.2
2 - 3 hours	7	14.2	-7.2
>3 hours	10	14.2	-4.2
Total	71		

a. group = Control

20.6 Speak with colleagues/fellow students[a]

	Observed N	Expected N	Residual
Not at all	13	14.2	-1.2
<30 minutes	8	14.2	-6.2
30 - 60 minutes	10	14.2	-4.2
2 - 3 hours	10	14.2	-4.2
>3 hours	30	14.2	15.8
Total	71		

a. group = Control

Test Statistics[b]

	20.1 Watch TV programmes	20.2 Listen to the radio	20.3 Read newspapers and magazines	20.4 Read academic books and articles	20.5 Read novels	20.6 Speak with colleagues/fellow students
Chi-Square	16.958[a]	11.887[a]	28.366[a]	6.958[a]	26.676[a]	22.873[a]

df	4	4	4	4	4	4
Asymp. Sig.	.002	.018	.000	.138	.000	.000

a. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 14.2.

b. group = Control

Group = Experimental (NBC)
Chi-Square Test
Frequencies

20.1 Watch TV programmes [a]

	Observed N	Expected N	Residual
Not at all	13	14.2	-1.2
<30 minutes	10	14.2	-4.2
30 - 60 minutes	24	14.2	9.8
2 - 3 hours	12	14.2	-2.2
>3 hours	12	14.2	-2.2
Total	71		

a. group = Experimental

20.2 Listen to the radio[a]

	Observed N	Expected N	Residual
Not at all	16	14.2	1.8
<30 minutes	16	14.2	1.8
30 - 60 minutes	22	14.2	7.8
2 - 3 hours	8	14.2	-6.2
>3 hours	9	14.2	-5.2
Total	71		

a. group = Experimental

20.3 Read newspapers and magazines[a]

	Observed N	Expected N	Residual
Not at all	17	14.2	2.8
<30 minutes	33	14.2	18.8
30 - 60 minutes	16	14.2	1.8
2 - 3 hours	4	14.2	-10.2
>3 hours	1	14.2	-13.2
Total	71		

a. group = Experimental

20.4 Read academic books and articles[a]

	Observed N	Expected N	Residual
Not at all	13	14.2	-1.2

<30 minutes	16	14.2	1.8
30 - 60 minutes	17	14.2	2.8
2 - 3 hours	10	14.2	-4.2
>3 hours	15	14.2	.8
Total	71		

a. group = Experimental

20.5 Read novels[a]

	Observed N	Expected N	Residual
Not at all	37	14.2	22.8
<30 minutes	10	14.2	-4.2
30 - 60 minutes	12	14.2	-2.2
2 - 3 hours	7	14.2	-7.2
>3 hours	5	14.2	-9.2
Total	71		

a. group = Experimental

20.6 Speak with colleagues/fellow students[a]

	Observed N	Expected N	Residual
Not at all	7	14.2	-7.2
<30 minutes	14	14.2	-.2
30 - 60 minutes	13	14.2	-1.2
2 - 3 hours	11	14.2	-3.2
>3 hours	26	14.2	11.8
Total	71		

a. group = Experimental

Test Statistics[b]

	20.1 Watch TV programmes	20.2 Listen to the radio	20.3 Read newspapers and magazines	20.4 Read academic books and articles	20.5 Read novels	20.6 Speak with colleagues/fellow students
Chi-Square	8.789[a]	9.352[a]	45.268[a]	2.169[a]	47.803[a]	14.282[a]
df	4	4	4	4	4	4
Asymp. Sig.	.067	.053	.000	.705	.000	.006

a. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 14.2.

b. group = Experimental

Appendix L: EVT analysis

Averages of pre and post-test – separate questions and whole test; full sample and by group.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
pre1tot	142	1.00	14.00	9.2817	2.78641
pre2tot	142	.00	6.00	5.0775	1.33195
pre3tot	142	4.00	14.00	11.4155	2.26676
post1tot	142	.00	14.00	9.6901	2.95158
post2tot	142	.00	6.00	5.0845	1.37089
post3tot	142	6.00	14.00	12.7958	1.60910
PRETOTAL	142	11.00	34.00	25.7746	4.93417
POSTTOTAL	142	12.00	34.00	27.5704	4.66068
Valid N (listwise)	142				

By Group

Group = Control (NBC)

Descriptive Statistics[a]

	N	Minimum	Maximum	Mean	Std. Deviation
pre1tot	71	1.00	13.00	8.9437	3.33761
pre2tot	71	.00	6.00	4.8028	1.62674
pre3tot	71	5.00	14.00	11.6197	2.07960
post1tot	71	.00	14.00	9.6338	3.39848
post2tot	71	.00	6.00	4.9437	1.57559
post3tot	71	7.00	14.00	12.5775	1.69589
PRETOTAL	71	11.00	33.00	25.3662	5.59142
POSTTOTAL	71	12.00	33.00	27.1549	5.33358
Valid N (listwise)	71				

a. group = Control

Group = Experimental (CPE)

Descriptive Statistics[a]

	N	Minimum	Maximum	Mean	Std. Deviation
pre1tot	71	4.00	14.00	9.6197	2.06582
pre2tot	71	3.00	6.00	5.3521	.87991
pre3tot	71	4.00	14.00	11.2113	2.43730

post1tot	71	2.00	14.00	9.7465	2.44785
post2tot	71	.00	6.00	5.2254	1.12373
post3tot	71	6.00	14.00	13.0141	1.49755
PRETOTAL	71	17.00	34.00	26.1831	4.17581
POSTTOTAL	71	17.00	34.00	27.9859	3.86742
Valid N (listwise)	71				

a. group = Experimental

Test - Paired Samples T-Test to test for significant differences between pre and post test results for each of the groups and the sample as a whole.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	pre1tot	9.2817	142	2.78641	.23383
	post1tot	9.6901	142	2.95158	.24769
Pair 2	pre2tot	5.0775	142	1.33195	.11178
	post2tot	5.0845	142	1.37089	.11504
Pair 3	pre3tot	11.4155	142	2.26676	.19022
	post3tot	12.7958	142	1.60910	.13503
Pair 4	PRETOTAL	25.7746	142	4.93417	.41407
	POSTTOTAL	27.5704	142	4.66068	.39112

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	pre1tot - post1tot	-.40845	1.97558	.16579	-.73620	-.08070	-2.464	141	.015
Pair 2	pre2tot - post2tot	-.00704	1.10766	.09295	-.19080	.17672	-.076	141	.940
Pair 3	pre3tot - post3tot	-1.38028	2.06192	.17303	-1.72236	-1.03821	-7.977	141	.000
Pair 4	PRETOTAL - POSTTOTAL	-1.79577	3.19694	.26828	-2.32615	-1.26540	-6.694	141	.000

Group = Control (NBC)

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	pre1tot	8.9437	71	3.33761	.39610
	post1tot	9.6338	71	3.39848	.40333
Pair 2	pre2tot	4.8028	71	1.62674	.19306

	post2tot	4.9437	71	1.57559	.18699
Pair 3	pre3tot	11.6197	71	2.07960	.24680
	post3tot	12.5775	71	1.69589	.20127
Pair 4	PRETOTAL	25.3662	71	5.59142	.66358
	POSTTOTAL	27.1549	71	5.33358	.63298

a. group = Control

Paired Samples Test[a]

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	pre1tot - post1tot	-.69014	2.08800	.24780	-1.18436	-.19592	-2.785	70	.007
Pair 2	pre2tot - post2tot	-.14085	1.05959	.12575	-.39165	.10996	-1.120	70	.267
Pair 3	pre3tot - post3tot	-.95775	1.90815	.22646	-1.40940	-.50609	-4.229	70	.000
Pair 4	PRETOTAL - POSTTOTAL	-1.78873	3.22010	.38216	-2.55092	-1.02655	-4.681	70	.000

a. group = Control

Group = Experimental (CPE)

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	pre1tot	9.6197	71	2.06582	.24517
	post1tot	9.7465	71	2.44785	.29051
Pair 2	pre2tot	5.3521	71	.87991	.10443
	post2tot	5.2254	71	1.12373	.13336
Pair 3	pre3tot	11.2113	71	2.43730	.28925
	post3tot	13.0141	71	1.49755	.17773
Pair 4	PRETOTAL	26.1831	71	4.17581	.49558
	POSTTOTAL	27.9859	71	3.86742	.45898

a. group = Experimental

Paired Samples Test[a]

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	pre1tot - post1tot	-.12676	1.82780	.21692	-.55939	.30587	-.584	70	.561

Pair 2	pre2tot - post2tot	.12676	1.14555	.13595	-.14439	.39791	.932	70	.354
Pair 3	pre3tot - post3tot	-1.80282	2.13555	.25344	-2.30829	-1.29734	-7.113	70	.000
Pair 4	PRETOTAL - POSTTOTAL	-1.80282	3.19651	.37936	-2.55942	-1.04621	-4.752	70	.000

a. group = Experimental

ANCOVA.

With the pre-test score as a covariate and the post test score as the dependent variable and the grouping as a fixed factor, we get the following results:

Descriptive Statistics

Dependent Variable:POSTTOTAL

group	Mean	Std. Deviation	N
Control	27.1549	5.33358	71
Experimental	27.9859	3.86742	71
Total	27.5704	4.66068	142

Levene's Test of Equality of Error Variances[a]

Dependent Variable:POSTTOTAL

F	df1	df2	Sig.
.191	1	140	.663

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + PRETOTAL + group

Tests of Between-Subjects Effects

Dependent Variable:POSTTOTAL

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1862.473[a]	2	931.237	107.839	.000	.608
Intercept	370.158	1	370.158	42.865	.000	.236
PRETOTAL	1837.959	1	1837.959	212.840	.000	.605
group	1.884	1	1.884	.218	.641	.002
Error	1200.322	139	8.635			
Total	111001.000	142				
Corrected Total	3062.796	141				

Descriptive Statistics

Dependent Variable:POSTTOTAL

group	Mean	Std. Deviation	N
Control	27.1549	5.33358	71
Experimental	27.9859	3.86742	71

a. R Squared = .608 (Adjusted R Squared = .602)

Parameter Estimates

Dependent Variable:POSTTOTAL

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval		Partial Eta Squared
					Lower Bound	Upper Bound	
Intercept	8.761	1.363	6.427	.000	6.066	11.456	.229
PRETOTAL	.734	.050	14.589	.000	.635	.834	.605
[group=1]	-.231	.495	-.467	.641	-1.210	.747	.002
[group=2]	0[a]	.	.	.	.	.	.

a. This parameter is set to zero because it is redundant.

It is evident that the group (intervention) does NOT have a significant effect on the English test results.

Explore whether the responses to Q2 (understanding rules of the game) are related to the change in English mark.

English vocabulary improvement is the variable 'Improvement'

We will apply Pearson's correlation to test for correlation between Improvement and the agreement response to Q2 items. Note that the higher the value of the response in Q23, the more the disagreement.

No correlations exist

Appendix M: Post game playing questionnaire analysis

PGP1 [a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	71	100.0	100.0	100.0

a. group = Experimental

PGP2.1[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	64	90.1	90.1	90.1
	Neutral	5	7.0	7.0	97.2
	Disagree	2	2.8	2.8	100.0
	Total	71	100.0	100.0	

a. group = Experimental

PGP2.2[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	54	76.1	76.1	76.1
	Neutral	13	18.3	18.3	94.4
	Disagree	4	5.6	5.6	100.0
	Total	71	100.0	100.0	

a. group = Experimental

PGP2.3[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	61	85.9	85.9	85.9
	Neutral	9	12.7	12.7	98.6
	Disagree	1	1.4	1.4	100.0
	Total	71	100.0	100.0	

a. group = Experimental

PGP2.4[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	53	74.6	74.6	74.6
	Neutral	13	18.3	18.3	93.0

	Disagree	5	7.0	7.0	100.0
	Total	71	100.0	100.0	

a. group = Experimental

PGP2.5[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	51	71.8	71.8	71.8
	Neutral	15	21.1	21.1	93.0
	Disagree	5	7.0	7.0	100.0
	Total	71	100.0	100.0	

a. group = Experimental

PGP2.6[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	55	77.5	77.5	77.5
	Neutral	14	19.7	19.7	97.2
	Disagree	2	2.8	2.8	100.0
	Total	71	100.0	100.0	

a. group = Experimental

PGP2.7[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	56	78.9	78.9	78.9
	Neutral	15	21.1	21.1	100.0
	Total	71	100.0	100.0	

a. group = Experimental

PGP2.8[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	59	83.1	83.1	83.1
	Neutral	10	14.1	14.1	97.2
	Disagree	2	2.8	2.8	100.0
	Total	71	100.0	100.0	

a. group = Experimental

PGP2.9[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	61	85.9	85.9	85.9
	Neutral	9	12.7	12.7	98.6
	Disagree	1	1.4	1.4	100.0
	Total	71	100.0	100.0	

a. group = Experimental

PGP2.10[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	45	63.4	63.4	63.4
	Neutral	17	23.9	23.9	87.3
	Disagree	9	12.7	12.7	100.0
	Total	71	100.0	100.0	

a. group = Experimental

For each of these questions, a chi-square goodness of fit test was applied to see if significantly more agreed or disagreed or were neutral.

PGP1 [b]

	Observed N	Expected N	Residual
Yes	71	71.0	.0
Total	71[a]		

a. This variable is constant. Chi-Square Test cannot be performed.

b. group = Experimental

PGP2.1[a]

	Observed N	Expected N	Residual
Agree	64	23.7	40.3
Neutral	5	23.7	-18.7
Disagree	2	23.7	-21.7
Total	71		

a. group = Experimental

PGP2.2[a]

	Observed N	Expected N	Residual
Agree	54	23.7	30.3
Neutral	13	23.7	-10.7
Disagree	4	23.7	-19.7
Total	71		

a. group = Experimental

PGP2.3[a]

	Observed N	Expected N	Residual
Agree	61	23.7	37.3
Neutral	9	23.7	-14.7
Disagree	1	23.7	-22.7
Total	71		

a. group = Experimental

PGP2.4[a]

	Observed N	Expected N	Residual
Agree	53	23.7	29.3
Neutral	13	23.7	-10.7
Disagree	5	23.7	-18.7
Total	71		

a. group = Experimental

PGP2.5[a]

	Observed N	Expected N	Residual
Agree	51	23.7	27.3
Neutral	15	23.7	-8.7
Disagree	5	23.7	-18.7
Total	71		

a. group = Experimental

PGP2.6[a]

	Observed N	Expected N	Residual
Agree	55	23.7	31.3
Neutral	14	23.7	-9.7
Disagree	2	23.7	-21.7

Total	71		

a. group = Experimental

PGP2.7[a]

	Observed N	Expected N	Residual
Agree	56	35.5	20.5
Neutral	15	35.5	-20.5
Total	71		

a. group = Experimental

PGP2.8[a]

	Observed N	Expected N	Residual
Agree	59	23.7	35.3
Neutral	10	23.7	-13.7
Disagree	2	23.7	-21.7
Total	71		

a. group = Experimental

PGP2.9[a]

	Observed N	Expected N	Residual
Agree	61	23.7	37.3
Neutral	9	23.7	-14.7
Disagree	1	23.7	-22.7
Total	71		

a. group = Experimental

PGP2.10[a]

	Observed N	Expected N	Residual
Agree	45	23.7	21.3
Neutral	17	23.7	-6.7
Disagree	9	23.7	-14.7
Total	71		

a. group = Experimental

Test Statistics[c]

	PGP2.1	PGP2.2	PGP2.3	PGP2.4	PGP2.5	PGP2.6	PGP2.7	PGP2.8	PGP2.9	PGP2.10
Chi-Square	103.296[a]	60.028[a]	89.690[a]	55.887[a]	49.465[a]	65.268[a]	23.676[b]	80.479[a]	89.690[a]	30.197[a]
df	2	2	2	2	2	2	1	2	2	2
Asymp. Sig.	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

a. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 23.7.

b. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 35.5.

c. group = Experimental

Perceived impact on English

IMP4.1[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	66	93.0	93.0	93.0
	Neutral	5	7.0	7.0	100.0
	Total	71	100.0	100.0	

a. group = Experimental

IMP4.2[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	57	80.3	80.3	80.3
	Neutral	14	19.7	19.7	100.0
	Total	71	100.0	100.0	

a. group = Experimental

IMP4.3[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	62	87.3	87.3	87.3
	Neutral	9	12.7	12.7	100.0
	Total	71	100.0	100.0	

a. group = Experimental

IMP4.4[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	53	74.6	74.6	74.6
	Neutral	15	21.1	21.1	95.8
	Disagree	3	4.2	4.2	100.0
	Total	71	100.0	100.0	

a. group = Experimental

Test to see which response options are selected significantly more often: chi-square goodness of fit was applied.

	IMP4.1				IMP4.2			
	Category	Observed N	Expected N	Residual	Category	Observed N	Expected N	Residual
1	Agree	66	23.7	42.3	Agree	57	23.7	33.3
2	Neutral	5	23.7	-18.7	Neutral	14	23.7	-9.7
3		0	23.7	-23.7		0	23.7	-23.7
Total		71				71		

	IMP4.3				IMP4.4			
	Category	Observed N	Expected N	Residual	Category	Observed N	Expected N	Residual
1	Agree	62	23.7	38.3	Agree	53	23.7	29.3
2	Neutral	9	23.7	-14.7	Neutral	15	23.7	-8.7
3		0	23.7	-23.7	Disagree	3	23.7	-20.7
Total		71				71		

Test Statistics[b]

	IMP4.1	IMP4.2	IMP4.3	IMP4.4
Chi-Square	114.113[a]	74.563[a]	94.845[a]	57.577[a]
df	2	2	2	2
Asymp. Sig.	.000	.000	.000	.000

a. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 23.7.

b. group = Experimental

Perceived ease of use

PEOU5.1[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	61	85.9	85.9	85.9
	Neutral	7	9.9	9.9	95.8
	Disagree	3	4.2	4.2	100.0
	Total	71	100.0	100.0	

a. group = Experimental

PEOU5.2[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	60	84.5	84.5	84.5
	Neutral	10	14.1	14.1	98.6
	Disagree	1	1.4	1.4	100.0
	Total	71	100.0	100.0	

a. group = Experimental

PEOU5.3[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	54	76.1	76.1	76.1
	Neutral	12	16.9	16.9	93.0
	Disagree	5	7.0	7.0	100.0
	Total	71	100.0	100.0	

a. group = Experimental

Test chi-square goodness of fit results

Frequencies[a]

	PEOU5.1				PEOU5.2				PEOU5.3			
	Category	Observed N	Expected N	Residual	Category	Observed N	Expected N	Residual	Category	Observed N	Expected N	Residual
1	Agree	61	23.7	37.3	Agree	60	23.7	36.3	Agree	54	23.7	30.3
2	Neutral	7	23.7	-16.7	Neutral	10	23.7	-13.7	Neutral	12	23.7	-11.7
3	Disagree	3	23.7	-20.7	Disagree	1	23.7	-22.7	Disagree	5	23.7	-18.7
Total		71				71				71		

a. group = Experimental

Test Statistics[b]

	PEOU5.1	PEOU5.2	PEOU5.3
Chi-Square	88.676[a]	85.380[a]	59.352[a]
df	2	2	2
Asymp. Sig.	.000	.000	.000

a. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 23.7.

b. group = Experimental

Perceived usefulness

PU6.1[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	59	83.1	83.1	83.1
	Neutral	11	15.5	15.5	98.6
	Disagree	1	1.4	1.4	100.0
	Total	71	100.0	100.0	

a. group = Experimental

PU6.2[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	58	81.7	81.7	81.7
	Neutral	11	15.5	15.5	97.2
	Disagree	2	2.8	2.8	100.0
	Total	71	100.0	100.0	

a. group = Experimental

PU6.3[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	59	83.1	83.1	83.1
	Neutral	10	14.1	14.1	97.2
	Disagree	2	2.8	2.8	100.0
	Total	71	100.0	100.0	

a. group = Experimental

PU6.4[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	49	69.0	69.0	69.0
	Neutral	17	23.9	23.9	93.0
	Disagree	5	7.0	7.0	100.0
	Total	71	100.0	100.0	

a. group = Experimental

PU6.5[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	58	81.7	81.7	81.7
	Neutral	8	11.3	11.3	93.0
	Disagree	5	7.0	7.0	100.0
	Total	71	100.0	100.0	

a. group = Experimental

PU6.6[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	62	87.3	87.3	87.3
	Neutral	7	9.9	9.9	97.2
	Disagree	2	2.8	2.8	100.0
	Total	71	100.0	100.0	

a. group = Experimental

Test chi-square goodness of fit results

PU6.1[a]

	Observed N	Expected N	Residual
Agree	59	23.7	35.3
Neutral	11	23.7	-12.7
Disagree	1	23.7	-22.7
Total	71		

a. group = Experimental

PU6.2[a]

	Observed N	Expected N	Residual
Agree	58	23.7	34.3
Neutral	11	23.7	-12.7
Disagree	2	23.7	-21.7
Total	71		

a. group = Experimental

PU6.3[a]

	Observed N	Expected N	Residual
Agree	59	23.7	35.3
Neutral	10	23.7	-13.7
Disagree	2	23.7	-21.7

Total	71		

a. group = Experimental

PU6.4[a]

	Observed N	Expected N	Residual
Agree	49	23.7	25.3
Neutral	17	23.7	-6.7
Disagree	5	23.7	-18.7
Total	71		

a. group = Experimental

PU6.5[a]

	Observed N	Expected N	Residual
Agree	58	23.7	34.3
Neutral	8	23.7	-15.7
Disagree	5	23.7	-18.7
Total	71		

a. group = Experimental

PU6.6[a]

	Observed N	Expected N	Residual
Agree	62	23.7	38.3
Neutral	7	23.7	-16.7
Disagree	2	23.7	-21.7
Total	71		

a. group = Experimental

Test Statistics[b]

	PU6.1	PU6.2	PU6.3	PU6.4	PU6.5	PU6.6
Chi-Square	81.239[a]	76.423[a]	80.479[a]	43.718[a]	74.901[a]	93.662[a]
df	2	2	2	2	2	2
Asymp. Sig.	.000	.000	.000	.000	.000	.000

a. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 23.7.

b. group = Experimental

Appendix N: Correlations

Correlations between Q20 (autonomous English language learning) and pre-post test results

		PRETOTAL	20.1 Watch TV programmes	20.2 Listen to the radio	20.3 Read newspapers and magazines	20.4 Read academic books and articles	20.5 Read novels	20.6 Speak with colleagues/fellow students
PRETOTAL	Pearson Correlation	1	-.041	.065	.054	.248**	-.036	.103
	Sig. (2-tailed)		.627	.443	.520	.003	.672	.220
	N	142	142	142	142	142	142	142

		20.7 Speak with friends	20. 8 Speak with family members	20.9 Surf the Internet	20.10 Watch videos/DVDs/VCDs	20.11 Talk on the phone	20.12 Correspond via emails
PRETOTAL	Pearson Correlation	.087	.057	.116	.098	.136	.017
	Sig. (2-tailed)	.305	.503	.171	.246	.105	.841
	N	142	142	142	142	142	142

There is a significant positive correlation between pre-test total and reading academic books and articles (r=0.248, p=.003).

		POSTTOTAL	20.1 Watch TV programmes	20.2 Listen to the radio	20.3 Read newspapers and magazines	20.4 Read academic books and articles	20.5 Read novels	20.6 Speak with colleagues/fellow students
POSTTOTAL	Pearson Correlation	1	-.012	.110	-.070	.138	-.059	.167*
	Sig. (2-tailed)		.886	.194	.410	.101	.484	.046
	N	142	142	142	142	142	142	142

		20.7 Speak with friends	20. 8 Speak with family members	20.9 Surf the Internet	20.10 Watch videos/DVDs/VCDs	20.11 Talk on the phone	20.12 Correspond via emails
POSTTOTAL	Pearson Correlation	.098	.046	.067	-.042	.140	-.061
	Sig. (2-tailed)	.247	.583	.429	.619	.097	.469

	N	142	142	142	142	142	142

Q18 (time playing educational games) vs pre/post test results

There are no significant associations/relationships/differences between these two variables for any of the game types.

Q17 (time currently playing game types) vs pre/post test results

Analyses NOT possible because of constant responses

Correlations pre/post test results with PI, PEOU and PU

No sig correlations with PI

		PEOU5.1	PEOU5.2	PEOU5.3
POSTTOTAL	Pearson Correlation	-.332**	-.088	-.127
	Sig. (2-tailed)	.005	.467	.290
	N	71	71	71
PRETOTAL	Pearson Correlation	-.241*	-.018	-.023
	Sig. (2-tailed)	.043	.880	.849
	N	71	71	71

		PU6.1	PU6.2	PU6.3	PU6.4	PU6.5	PU6.6
POSTTOTAL	Pearson Correlation	-.233	.079	.104	.152	.021	.128
	Sig. (2-tailed)	.050	.511	.386	.207	.863	.286
	N	71	71	71	71	71	71
PRETOTAL	Pearson Correlation	-.180	.146	.260*	.183	.093	.125
	Sig. (2-tailed)	.132	.225	.029	.127	.441	.297
	N	71	71	71	71	71	71

Appendix O: Observer checklist frequencies

Below are the frequencies for each question in each game chapter

Chapter 1

q1.1Guide consultation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	never	14	50.0	51.9	51.9
	1 - 2 times	10	35.7	37.0	88.9
	3 - 4 times	1	3.6	3.7	92.6
	7+ times	2	7.1	7.4	100.0
	Total	27	96.4	100.0	
Missing	System	1	3.6		
Total		28	100.0		

q1.2 Consultation duration

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<1 min	6	21.4	42.9	42.9
	1 - 2 mins	8	28.6	57.1	100.0
	Total	14	50.0	100.0	
Missing	System	14	50.0		
Total		28	100.0		

q1.3 Locations found

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	none	1	3.6	3.6	3.6
	1	2	7.1	7.1	10.7
	2	13	46.4	46.4	57.1
	4	2	7.1	7.1	64.3
	4+ or all	10	35.7	35.7	100.0
	Total	28	100.0	100.0	

q1.4 Duration to find locations

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<1 min	7	25.0	25.0	25.0
	1 - 2 mins	11	39.3	39.3	64.3
	3 - 5 mins	3	10.7	10.7	75.0
	5+mins	7	25.0	25.0	100.0
	Total	28	100.0	100.0	

q1.5 Game gallery consultation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	never	21	75.0	75.0	75.0
	1 - 2 times	5	17.9	17.9	92.9
	3 - 4 times	2	7.1	7.1	100.0
	Total	28	100.0	100.0	

q1.6 Keeping track of clues

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	2	7.1	7.1	7.1
	no	26	92.9	92.9	100.0
	Total	28	100.0	100.0	

Chapter 2

q2.1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	never	23	82.1	82.1	82.1
	1 - 2 times	4	14.3	14.3	96.4
	5 - 6 times	1	3.6	3.6	100.0
	Total	28	100.0	100.0	

q2.2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<1 min	4	14.3	80.0	80.0
	1 - 2 mins	1	3.6	20.0	100.0
	Total	5	17.9	100.0	
Missing	System	23	82.1		
Total		28	100.0		

q2.3

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	2	7.1	7.1	7.1
	2	14	50.0	50.0	57.1
	3	3	10.7	10.7	67.9
	4+ or all	9	32.1	32.1	100.0
	Total	28	100.0	100.0	

q2.4

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<1 min	5	17.9	17.9	17.9
	1 - 2 mins	7	25.0	25.0	42.9
	3 - 5 mins	7	25.0	25.0	67.9
	5+mins	5	17.9	17.9	85.7
	5	4	14.3	14.3	100.0
	Total	28	100.0	100.0	

q2.5

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	never	22	78.6	78.6	78.6
	1 - 2 times	4	14.3	14.3	92.9
	3 - 4 times	2	7.1	7.1	100.0
	Total	28	100.0	100.0	

q2.6

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	1	3.6	3.6	3.6
	no	27	96.4	96.4	100.0

q2.1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	never	23	82.1	82.1	82.1
	1 - 2 times	4	14.3	14.3	96.4
	5 - 6 times	1	3.6	3.6	100.0
	Total	28	100.0	100.0	

Chapter 3

q3.1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	never	25	89.3	89.3	89.3
	1 - 2 times	3	10.7	10.7	100.0
	Total	28	100.0	100.0	

q3.2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<1 min	1	3.6	33.3	33.3
	1 - 2 mins	1	3.6	33.3	66.7
	3 - 5 mins	1	3.6	33.3	100.0
	Total	3	10.7	100.0	
Missing	System	25	89.3		
Total		28	100.0		

q3.3

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	2	7.1	7.1	7.1
	3	15	53.6	53.6	60.7
	4	1	3.6	3.6	64.3
	4+ or all	10	35.7	35.7	100.0
	Total	28	100.0	100.0	

q3.4

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<1 min	7	25.0	25.0	25.0
	1 - 2 mins	7	25.0	25.0	50.0
	3 - 5 mins	7	25.0	25.0	75.0
	5+mins	6	21.4	21.4	96.4
	5	1	3.6	3.6	100.0
	Total	28	100.0	100.0	

q3.5

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	never	22	78.6	78.6	78.6
	1 - 2 times	4	14.3	14.3	92.9
	3 - 4 times	2	7.1	7.1	100.0
	Total	28	100.0	100.0	

q3.6

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	1	3.6	3.6	3.6
	no	27	96.4	96.4	100.0
	Total	28	100.0	100.0	

Chapter 4

q4.1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	never	19	67.9	100.0	100.0
Missing	System	9	32.1		
Total		28	100.0		

q4.2

		Frequency	Percent
Missing	System	28	100.0

q4.3

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	2	7.1	10.5	10.5
	3	3	10.7	15.8	26.3
	4	7	25.0	36.8	63.2
	4+ or all	7	25.0	36.8	100.0
	Total	19	67.9	100.0	
Missing	System	9	32.1		
Total		28	100.0		

q4.4

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<1 min	6	21.4	31.6	31.6
	3 - 5 mins	7	25.0	36.8	68.4
	5+mins	6	21.4	31.6	100.0
	Total	19	67.9	100.0	
Missing	System	9	32.1		
Total		28	100.0		

q4.5

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	never	15	53.6	78.9	78.9
	1 - 2 times	1	3.6	5.3	84.2
	3 - 4 times	2	7.1	10.5	94.7
	5 - 6 times	1	3.6	5.3	100.0
	Total	19	67.9	100.0	
Missing	System	9	32.1		

q4.1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	never	19	67.9	100.0	100.0
Missing	System	9	32.1		
Total		28	100.0		

q4.6

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	1	3.6	5.3	5.3
	no	18	64.3	94.7	100.0
	Total	19	67.9	100.0	
Missing	System	9	32.1		
Total		28	100.0		

Chapter 5

q5.1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	never	12	42.9	100.0	100.0
Missing	System	16	57.1		
Total		28	100.0		

q5.2

		Frequency	Percent
Missing	System	28	100.0

q5.3

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4+ or all	12	42.9	100.0	100.0
Missing	System	16	57.1		
Total		28	100.0		

q5.4

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<1 min	1	3.6	8.3	8.3
	3 - 5 mins	5	17.9	41.7	50.0
	5+mins	6	21.4	50.0	100.0
	Total	12	42.9	100.0	
Missing	System	16	57.1		
Total		28	100.0		

q5.5

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	never	6	21.4	50.0	50.0
	1 - 2 times	1	3.6	8.3	58.3
	3 - 4 times	2	7.1	16.7	75.0
	5 - 6 times	2	7.1	16.7	91.7
	7+ times	1	3.6	8.3	100.0
	Total	12	42.9	100.0	
Missing	System	16	57.1		
Total		28	100.0		

q5.6

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	1	3.6	8.3	8.3
	no	11	39.3	91.7	100.0
	Total	12	42.9	100.0	
Missing	System	16	57.1		
Total		28	100.0		