

Game-based learning and library instruction

by

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Declaration

I Elizabeth Catharina de Kock, declare that the dissertation, which I hereby submit for the degree Master in Information Science at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution.

SIGNATURE

DATE

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SUMMARY

The purpose of this study was to investigate to what extent a game can be used as an instructional tool for library instruction.

In order to determine the effectiveness of the game for library instruction, it was necessary to do literature research that included both subject fields. The research design therefore includes a literature study on information literacy and a literature study on game-based learning. The game was based on the Big6 information literacy model (Eisenberg, 2008).

An in-depth literature review on game-based learning was needed to determine which criteria would be necessary to create a game for instructional purposes. An instructional design process (DODDEL model) was used for the design of the game. The design and layout of the game illustrated the application of the game-based learning criteria.

A single-case study method was used for the purpose of the study. A mixed-methods approach with qualitative and quantitative questions and formative and summative evaluation was used to collect data and evaluate the game.

The data analysis was done in Chapter 6. The data analysis indicates that games can be used in an effective way for library instruction purposes. The comments seem to confirm the findings of the literature review on game-based learning. The rating scale proved that the players were engaged during game play.

The findings of the study were discussed in the concluding chapter. Game-based learning criteria and their application were described. The success and restrictions of the study were indicated and discussed. Recommendations for further research in the subject fields were made.

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LIST OF ACCRONYMS

ACRL	American Council for College and Research Libraries
ALA	American Library Association
ANZILL	The Australian Library and Information Association
CALICO	Cape Library Consortium
CARL	Canadian Academic Research Libraries
CAUL	Council of Australian Librarians
CHELSA	Committee for Higher Education Librarians of South Africa
CILIP	Chartered Institute of Library and Information Professionals
COLD	Council of Library Directors
DODDEL	Document-oriented Design and Development of Experiential Learning
ESAL	Eastern Seaboard Association of Libraries
FRELICO	Free State Library Association
HEILIG	Higher Education Library Interest Group
IFLA	International Federation of Library Associations and Institutions
ILCoPSU	Information Literacy Community of Practice at Staffordshire University
QULOC	Queensland University Libraries Office of Cooperation
ICT	Information and Communication Technologies
IFLA	International Federation of Library Association and Institutions
ILCoPSU	Information Literacy Community Practice at Staffordshire University
ISAGA	International Simulation and Gaming Association
LEAP	Liberal Education and America's Promise
LIASA	Library Association of South Africa
SCONUL	Society of College, National and University Libraries
UNESCO	United Nations Educational, Scientific and Cultural Organisation
USE	User-system-experience Model

CHAPTER 1

1. GENERAL INTRODUCTION

1.1 BACKGROUND TO THE PROBLEM

Over the past few years information literacy has become an essential component for higher education students. “Information literacy (IL) is recognised internationally as an essential competence for participation in education, employment and society” (Corrall, 2008:26). Kavulya (2003:217) and O’Sullivan (2002:10) have confirmed the importance of information literacy in the real world of employment and society.

The American Library Association (ALA) defines information literacy as the ability to “recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information” (ALA, 2004). According to the ALA, “Information literacy forms the basis for lifelong learning”. This illustrates the value that information literacy offers students, not just as a bridging tool, but as a lifelong skill. Furthermore, the ALA suggests that information literacy skills are applicable to all disciplines, learning environments and all levels of education.

The ALA (2004) defines an information-literate individual as one who is able to:

- “Determine the extent of information needed
- Access the needed information effectively and efficiently
- Evaluate information and its sources critically
- Incorporate selected information into his/her knowledge base
- Use information effectively to accomplish a specific purpose
- Understand the economic, legal, and social issues concerning the use of information
- Access and use information ethically and legally.”

Information literacy is important not only in the academic world, but also in the workplace. It can in fact be the first step towards information management in the workplace. O’Farrill (2010:709) refers to the fact that information literacy and knowledge management can be

combined in the workplace to support learning, sense-making and decision-making in the workplace. Oman (2001:43) and O'Sullivan (2002:9) support the suggestion that information literacy is important in the workplace in view of the current information overload. Students should therefore be information literate to be able to find, manipulate and use information in the workplace.

Today's students grow up in a world of computers and the internet and expect information to be immediately available. According to Barefoot (2006:B6), few first-year students can, however, distinguish fact from fiction in sources and even fewer have been exposed to scholarly resources that can be found in a university library. Students do not always know they need information for their assignments or how to evaluate the appropriate information (Bothma, *et al.* 2006:6). These issues point to a gap in the knowledge and skills of students, especially first-year students starting their academic careers. The issues can, however, be addressed by information literacy training, which among others also addresses skills in critical thinking and assessment of information and information sources.

Apart from the issues mentioned, research findings suggest that information literacy training can also have a definite impact on student's successful learning. Craig and Corral (2007:118) found that information literacy training had a positive impact on both skills and confidence: "Key areas of skills development include[d]: identifying journal articles, selecting search terms and evaluating website quality. Factors affecting confidence include[d]: successful 'mastery' experiences in searching for information and the programme itself, especially small-group sessions, handouts and staff support".

Many of the sources students need to use are found in the library. Although "information literacy" is the over-arching term, the term "library instruction" also often features in the subject literature. Library instruction focuses on the use of the library as a means of accessing specific information sources. The term is explained in more detail in section 1.7.2, while the link between information literacy and library instruction is explored in more depth in Chapter 2, section 2.6.

Johnston and Webber (2003:349) refer to the importance of an information-literate campus where university staff and students can become information literate. To ensure information-literate campuses, collaboration between academic departments of Library and Information Science (sometimes also referred to as Library and Information Studies or by a name using only one of the concepts) and library services is essential. Good examples of such

cooperation are reported by Floyd, Colvin and Bodur (2008:375), who have found that library instruction has a positive impact on the use of peer-reviewed articles by students. They furthermore found that guidelines established by faculty improve library instruction and emphasise the importance of collaboration between library and faculty (Floyd, Colvin & Bodur, 2008:368). Emmons *et al.* (2009:142) also echo the importance of collaboration between education colleges and librarians to improve the information literacy of in-service teachers, which can be read with the arguments of Pierce (2009:234) that the expertise of a librarian can enhance student learning, but that training the trainers can be a challenge for librarians, which in turn implies the need to improve collaboration between librarians and departments.

At the University of Pretoria (South Africa) there is cooperation between the academic Department of Information Science and the library; the Department of Information Science initially addressed information literacy skills in a compulsory semester module at first-year level in the second half of the year (Bothma *et al.* 2006:7), but this has now become a year module. In addition, the library is responsible for library instruction of first-year students during their first week on campus, to ensure that they, as library users, are not left behind in their search for academic information. (See Chapter 2, section 2.6.3 for more information about the specific library instruction phases.) The need for librarians to be involved is also evident from statements by Small, Zakaria and El-Figuigui (2004:97), who point out the importance of the role of librarians as teachers, as well as the vital motivational role of librarians in information literacy training. Accepting the importance of information literacy and information literacy training, as well as related training such as library instruction, the next section will discuss the current research on game-based learning as background to the problem statement.

1.1.1 Research on game-based learning

The quest for talent, new thinking and new assumptions is extremely important in the digital age. The learning preferences of students have changed over the years. Organisations therefore invest in technology-enabled learning to keep pace with the needs of global changing audiences. Performance improvement and capturing students' attention are of the utmost importance. Provision therefore has to be made for the learning styles of the net generation or generation D - the generation that has grown up with and is completely at home with digital devices and digital culture. (Buschman & Warner, 2005:15; Carlson, 2005:2; Shih & Mills 2007:4). "Therefore, to interface successfully with Gen-D, librarians, together with teaching faculty and staff, must adopt and become adept at key learning

technologies themselves; in other words, educational facilitators must keep apace technologically with their students” (Shih & Allen, 2007:90).

Game-based learning may potentially be one of the answers to these new demands stated in the previous paragraph (De Azevedo Filho & Latham, 2006:874.) “Games are no longer just for fun: they offer potentially powerful learning environments. Today’s students have grown up with computer games. In addition their constant exposure to the Internet and other digital media has shaped how they receive information and how they learn. There are many attributes of games that make them pedagogically sound learning environments. An increasing number of faculties are using games as enhancements to the traditional learning environment with encouraging results” (Oblinger, 2004:1).

Clark (2006) argues that learners learn from games on three levels, namely:

- Basic skills such as literacy and communication,
- Information technology or hand/eye co-ordination,
- Contemporary tacit skills such as problem-solving and team work, subject-specific knowledge and skills.

According to De Azevedo Filho and Latham (2006:5), game-based learning can accelerate the transfer and application of knowledge. Creativity and interactivity, unpredictability and realism are game elements that can draw on students’ flexibility, competitiveness and emotions to create higher levels of engagement and retention. The word “game” usually refers to entertainment, but at the core of games are challenging practical activities, such as planning, problem-solving, coordinated interaction and analysis (De Azevedo Filho & Latham, 2006:2).

De Azevedo Filho and Latham (2006:3) point out that online gaming can be goal-orientated where the student focuses on the outcome. It can also involve the student emotionally; the learners learn while they are trying and failing. “Yet games seem to clearly motivate and game designers seem to understand more about motivation and sustaining user interest in games; naturally they have to, or the games won’t sell” (Clark, 2006:20).

Grassian and Trueman (2007:87) claim that online gaming can improve collaboration, creativity, learning and global networking with other librarians and educators. This is also the basis on which librarians all over the world are participating in Second Life Library activities

and projects (Grassian & Trueman, 2007:84). Second Life is an internet-based virtual world that enables its users to interact with one another through motion avatars.

1.1.2 Situation at the University of Pretoria

The Merensky Library, which is the main library of the Department of Library Services, is situated on the main campus of the University of Pretoria. If the library instruction sessions yield sustained student capacity and lifelong skills, it will reduce the need for continued support that is currently being given even after initial instruction. A decision was therefore made at the Merensky Library of the University of Pretoria to look at more interesting ways to conduct library instruction sessions, such as an instructional game that can be played during a one-hour library instruction session.

1.2 STATEMENT OF THE PROBLEM

Against the background sketched in the preceding section, this study is an attempt to understand and gain insight into whether online games have the potential to contribute to student learning in higher education (Ebner & Holzinger, 2007:874), and to add value to the learning experiences of the students, especially with regard to library instruction as a component in information literacy training.

Before formulating the problem statement, the following research findings were noted:

- In research they conducted, Collins and Veal (2005:9) found that students often feel incompetent to use the library resources and are very often overwhelmed by the size of the library. Students tend to be embarrassed to ask for assistance from the library staff. Furthermore, they fear that their questions might reveal their incompetence in conducting a library search. Thus library anxiety seems to be an important issue to address during library instruction.
- Research has further shown that traditional lecturing does not always make a difference during information literacy training and library instruction; there is thus a need to explore new methods that can be introduced (Lorenzo, Oblinger & Dziuban, 2007:8; Markey *et al.*, 2009:304).
- Instructors need to design strategies to include in their instruction that enhance learner interest and reduce learner boredom. One of the instruction strategies to reduce boredom might be online gaming (Markey *et al.*, 2008:1; Small, Zakaria &

EI-Figuigui, 2004:98). Long (2007:280) found in a survey that the more autonomy and competence the learner has the more fun the learning process is.

In addition, Connolly and Stansfield (2007:120) argue that the educational field, in this case the library, does not make enough use of the potential of educational technology. Academic libraries can be part of the e-learning initiatives of their institutions, meaning that library instruction sessions can also use e-learning methods to prepare students to survive in an e-learning environment. Using e-learning methods, libraries can enrich their role and cater for the different learning styles of students.

Since good games are highly motivating to a great many people (Gee, 2003:3), playing an online game may be more motivational for students as a method of learning. Perhaps such motivation is what is required in information literacy and especially library instruction.

Considering the background presented in the preceding sections, the research problem is expressed in the following question:

To what extent can a game be used as an instructional tool for library instruction?

To test this, a game will be developed as a case study. To address the research problem, the questions below are asked as representing the sub-problems.

- What are the criteria for designing an educational game?
- Which of these criteria could be implemented?
- What are the restrictions based on the software?
- What are the restrictions based on the content environment?
- To what extent could these criteria be implemented in the design and implementation of the game?
- What is the user experience during the game?
- What is the affective experience?
- What is the learning experience?

It is noted that the software may have limitations.

1.3 LITERATURE REVIEW

As background to the study, a brief literature review was conducted. This revealed the importance of information literacy (Craig & Corrall, 2007; Johnston & Webber, 2003;

Rockman, 2007). “The essence of information literacy is a basic ability required by globalization of information. In 1974, the concept of information literacy was put forward by the chairman of the Information Industry Association, Paul Zurkowski” (Peng & Jingjing, 2010:205).

Students are living in an increasingly complex world, where they have an abundance of information. The ability to act confidently despite information overload will be critical to academic success and personal self-directed learning (Emmons *et al.*, 2009:142). Ethical and moral issues in the use of the internet and new technologies are also raised as educational concerns for various approaches to promote information literacy in higher education (Correia & Teixeira, 2002:2).

As part of the study, the literature review will be expanded in Chapter 2 to include the similarities and differences between library instruction and information literacy, the different information literacy standards and models, and the role of game-based learning in library instruction. In Chapter 3 game-based learning as an instruction method, as well as the design and criteria for instructional games, will be explored.

The game to be designed will be based on one of the information literacy models following from the literature review in Chapter 2. Based on the literature review in Chapter 3, a theoretical framework for the criteria of game-based learning as revealed in the literature will be proposed by the researcher.

1.4 THEORETICAL FRAMEWORK

Following the literature review, two separate frameworks will be used in this study to design a game as instructional tool in library instruction, namely an information literacy framework that was developed from an information literacy model and a game-based learning criteria framework.

1.4.1 Information literacy framework

An information literacy model can provide a framework for problem-solving and decision-making (Eisenberg, 2008:41; Kuhlthau, 2007:33). This can enable students to learn information problem-solving skills by using a specific process, as will be explained in more detail in Chapter 2.

After considering various standards and models for information literacy, the Big6 information literacy model (Eisenberg & Berkowitz, 2008a) was selected to guide the study. The combination of analytical, creative and practical activities embedded in the Big6 has been shown to improve students' performance (Eisenberg & Berkowitz, 2008a). The model involves six steps that can be applied to the writing of assignments, which are important to students. For the purpose of addressing the problem statement for this study, the Big6 model will be used as basis for a game developed for library instruction. As will be explained in Chapter 4, the game will be in the form of a learning journey. In the game students will be expected to work through the six scenes representing six steps in order to learn how to use the library and its information sources to write an assignment.

1.4.2 Game-based learning criteria framework

O'Neil and Perez (2008:5) state that a framework for game-based learning can help focus research on factors leading to successful game design. A theoretical framework for key criteria that are embedded in the game can be used for direction and as a guideline for future researchers and game designers focusing on similar library-related educational contexts. Applying appropriate criteria can differentiate commercial games from game-based learning to achieve the desired learning outcomes (Connolly, Stansfield & Boyle, 2009:xviii). The key criteria to be selected for the purposes of this study will be based on research done in game-based learning. More specifically, the criteria will be based on the work of Gee (2004), Gibson, Aldrich and Prensky (2007), Liu and Lin (2009) and Prensky (2006) and other researchers in game-based learning. (See the list of game-based learning criteria in Chapter 3.)

1.5 RESEARCH DESIGN AND RESEARCH METHODOLOGY

The research design for this study will include the following:

- A literature review covering the issues explained in section 1.4. This will form the basis for two frameworks to guide the study, namely:
 - Framework developed from an information literacy model (i.e. the Big6 model)
 - Framework for the criteria for game-based learning
- An operational instructional game designed for library instruction to first-year students at the University of Pretoria. The game will be based on the two frameworks mentioned above.

- An empirical investigation of the experiences of students with the instructional game.

1.5.1 Literature review

Hofstee (2006:91), Struwig and Stead (2001:227) describe the purpose of the literature review as a theoretical basis for the work that the researcher has to do and to compare and ensure that the work is in the context of that specific field. The literature review can provide the necessary information to clarify one's research aims (Pickard, 2007:25). The scope of the literature review was explained in section 1.3. It will stretch over Chapters 2 and 3.

The purpose of this literature review is to ensure that the study is embedded in current research findings and trends regarding library instruction and information literacy and that the game to be developed is based on sound instructional game-based learning principles and criteria (Craig & Corral, 2007; Rockman, 2007). Furthermore, it will form the basis for interpreting findings from the empirical investigation and for making recommendations for further research. The literature review might also help to create new knowledge in the specific field and to improve the significance of the research (Hofstee, 2006:91).

1.5.2 Design of the instructional game

The game will be developed for library instruction for first-year students at the University of Pretoria. Specific software (Thinkingworlds, 2010) will be used to create the game. The rationale for the selection of the software will be explained in Chapter 3. It is admitted that the software may in some aspects restrict the scope of the game design, e.g. in terms of choices of the different worlds that can be used for each scene. Game-based learning criteria will be embedded in the game to be discussed in Chapter 3. The researcher will evaluate the game based on the specific criteria to be discussed in Chapter 4. The evaluation of the game will be discussed in Chapter 5.

1.5.3 Empirical investigation

The final component of the study concerns assessment of students' experiences with the game. This includes affective as well as learning experiences. Both quantitative and qualitative data need to be collected. Data will be collected by means of the following:

- Questionnaires.

- Assessment scores during game play. This will be considered to assess the learning that took place and to determine whether the game is successful in promoting learning. Scoring is important in gaming. The player will realise what is important in the game if he loses a player's life or scores (Chen & Michael, 2005:19). Scoring can also be a mechanism to compare one's own score with that of other players. The scoring in the game will form part of the questionnaire to collect data for assessment purposes.

1.5.4 Target group, research setting and research participants

One of the first tasks in the research process will be to gain access to the research site (Pickard, 2007:72). The first contact or gatekeeper will need to give permission for the researcher to do the research (Creswell, 2007:125; Seale *et al.* 2004:435). Permission was asked from the gatekeeper; in this case the Department of Library Services, to use the facilities. It will be important to outline the time of the research to ensure that the gatekeeper suffers no inconvenience (Pickard, 2007:73). The gatekeeper (Department of Library Services) might benefit from this study for future library instruction sessions (Pickard, 2007:72).

Defining the sample group is important (Creswell, 2007:125; Pickard, 2007:59; Seale *et al.*, 2004:435). Researchers often select cases that are easily reached (Struwig & Stead, 2001:124). "A convenience sample is chosen purely on the basis of availability" (Struwig & Stead, 2001:111). Roberts and Priest (2010:132) refer to convenience sampling as a process where one only samples the shoppers in a certain shop at a certain time. Convenience sampling will be used for the research. The convenience sample group for this study will be first-year students who attend non-compulsory training sessions during a certain period at the beginning of the academic year in the Merensky Library. Although the university has several campuses, the research setting for collecting empirical data on students' experiences with the game will be limited to the library instruction sessions taking place at the Merensky Library on the main campus of the university. The target group will be representative of the student groups on campus (Seale *et al.*, 2004:439).

The time factor and the possible interruption caused by the presence of the researcher will be taken into consideration (Creswell, 2007:125; Flick, 2009:25; Seale *et al.*, 2004:435). Pickard (2007:175) refers to the danger that the researcher can "overstay his welcome" by taking up more of the gatekeeper's time than is strictly necessary. The researcher will not interrupt the normal working procedures of the library because library instruction sessions

form part of an academic library's services. The library instruction sessions take place during the students' first week on campus. They take place on an hourly basis (see Chapter 2 section 2.6.3 for more details) (Creswell, 2007:125; Flick, 2009:25; Seale, *et al.* 2004:435). The sessions consist of a short PowerPoint introduction to the library services and products. After the introduction students have to play the game covering the assignment-writing process, combined with library sources and information.

It was planned that the training sessions would be attended by 60 students per session, each session lasting an hour. At the time when the game on which this study reports was assessed, the sessions took place over four days, namely 26 January to 29 January 2010. A librarian was in charge of each training session. During the game-playing sessions he/she was assisted by two other library personnel members (see Chapter 2 section 2.5.3.) The questionnaires capturing students' affective and learning experiences during game play were completed after each library instruction session. At the time of the study the University of Pretoria had 7 000 first-year students. Since the training sessions were not compulsory, only some of the students attended the training during the four-day period of the empirical research.

1.5.5 Methods of data collection

Since questionnaires were the main means of data collection, this section discusses this method in more detail. Hofstee (2006:122) describes questionnaires as a survey-based research design, where the researcher gets information from individuals that represent a larger group. It was planned that the questionnaires would only be supplemented with focus group interviews if it appeared that the data collected through the questionnaires were insufficient, or if there were comments and feedback that needed to be clarified or supplemented. Focus group interviews would be held only with students who indicated in the questionnaire that they were willing to be interviewed.

"A questionnaire is a method of data collection which is completed by the respondent in written format" (Marshall, 2005:131). For the purpose of this study a questionnaire was selected for data collection for the following reasons:

- People are usually familiar with questionnaires (Barriera-Viruet *et al.*, 2006:263).
- Questionnaires can be a very good mechanism to obtain information.
- One of the benefits of questionnaires is that they give the participant enough time to respond.

- A larger sample group can be used (Pickard, 2007:183).
- Using questionnaires will ensure that the respondents are all asked the same questions (Hofstee, 2007:132).

Since the questionnaires were to be completed by first-year students, the wording in the questionnaires was in everyday language. This followed the advice of Marshall (2005:135) and Pickard (2007:185) to use “user-friendly” formulation to allow the respondents to feel at ease. Furthermore, the questionnaire was formulated in an interactive style so that respondents could feel they were talking to the researcher (Kumar, 2005:126).

Again, following the advice of Marshall (2005:134), two types of questions were used:

- Open-ended questions: Respondents could answer the question in their own words. This allowed students to give their own opinion of the game.
- Ranking scales: A ranked option from a list was used, e.g. a six-point Likert scale (1-6) to indicate the level of agreement of the participants (Pickard, 2007:188). This enabled students to rank their opinion and experiences with the game on a scale from 1-6.

The questions for the questionnaire were formulated to enable the researcher to answer the questions set for the sub-problems, namely whether the game satisfied the criteria for designing an educational game. Answers to the questions also had to enable the researcher to comment on restrictions set by the software used for the game design. The answers to these questions had to flow from the students’ experiences, which were assessed through the questionnaire.

1.6 ETHICAL CONSIDERATIONS

Soliciting the cooperation and commitment of the targeted participants (i.e. first-year students) was very important. Trochim (2006) mentions a number of key phrases that describe the ethical protection the contemporary social research establishment has created in an attempt to protect the rights of research participants:

- Voluntary participation requires that people not be coerced into participating in research. This was very important in this research as the researcher had a captive audience, i.e. students attending the hourly library instruction sessions.
- Informed consent is crucial in any research. This means that prospective research participants must be fully informed about the procedures and risks involved in the

research process. According to the University of Pretoria's requirements, all participants need to sign a form of consent.

- Ethical standards require that participants may not be at risk of harm as a result of their participation.
- Confidentiality in respect of participants is very important. Participants must be allowed to remain anonymous. According to the University of Pretoria's requirements, the researcher must sign a research declaration form undertaking to ensure the protection of confidentiality.

At the University of Pretoria, the Faculty of Engineering, Built Environment and Information Technology Research Ethics Committee must first approve all applications for collecting empirical data. As part of the application, the researcher must agree to the following:

- Information will be handled confidentially and participants will have a right to choose whether or not to participate.
- No conflict of interest or financial benefit is foreseen.
- Inspection may take place at any time.
- Information in the application for approval form of the Faculty of Engineering, Built Environment and Information Technology is correct (University of Pretoria, Faculty of Engineering, Built Environment and Information Technology, Research Ethics, 2008).

1.7 CLARIFICATION OF CONCEPTS

A number of key concepts relevant to the study need to be clarified. These include information literacy, library instruction, game-based learning, game-authoring engine and the net generation.

1.7.1 Information literacy

According to Wallis (2005:219), "Information literacy can be understood as the overarching term to describe the skills needed to use information and communication technologies (ICTs) effectively, and to access appropriate digital information resources". Bruce (2004:10), Hegarty, Quinlan and Lynch (2003:442), Johnston and Webber (2003:335) and Wallis (2005:219) argue that information literacy needs to be considered as a process to find information in any environment and in any discipline.

The definition of the ALA will be accepted for the purpose of this study. The ALA defines information literacy as the ability to “recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information” (ALA, 2004). The ALA (2004) defines an information-literate individual as one who is able to determine the extent of information needed, access the required information effectively and efficiently, evaluate information and its sources critically, incorporate selected information into his/her knowledge base, use information effectively to accomplish a specific purpose, understand the economic, legal, and social issues concerning the use of information, and access and use information ethically and legally. There seems to be a very close relationship between library instruction and information literacy. The interpretation of library instruction is therefore explained in the next section before considering the relationship between the two terms.

1.7.2 Library instruction

Library instruction can be seen as the first step towards information literacy to enable learners to become lifelong learners. From the literature it seems as if library instruction teaches people skills while information literacy empowers students to do further research for academic success and lifelong learning in the information society (Breivik, 1999:272; Selematsela & Du Toit, 2007:122; Wallis, 2005:220).

The purpose of library instruction is to train students how to use the library products, e.g. the library catalogue, databases and online journals and to evaluate information to enable them to succeed in their studies. Library instruction can be customised to fit the needs of a specific library and the products and facilities of the library (Lubans, 1974:435).

For the purpose of this study it will be accepted that library instruction is: “Classes taught by librarians to show students valuable resources in the library and how to use them effectively” (Western Carolina University, 2011). Library instruction and information literacy training are complementary to one another and are part of the whole process of information literacy training. Both concepts will be explored in more detail in Chapter 2 section 2.6.

1.7.3 Game-based learning

Game-based learning is designed to transfer knowledge to the player through interaction with objects, characters or environments (Connolly, Stansfield & Boyle, 2009:276). In game-based learning, multimedia and technology are combined to create the experience of goal-directed play. A game can be represented by three different design schemas:

- Rules: The player will have to play within the restrictions of a game. The interactivity of a game will depend on the rules of the game.
- Play: The interactivity, challenges and conflicts of a game will represent the playing experience in the game.
- Culture: Storytelling, characters and worlds will display a certain culture to the player.

Instructional or educational games involve an activity performed by the player to learn about a certain subject. Entertainment games, on the other hand, focus on the play aspect defined by the rules of a game (Connolly, Stansfield & Boyle, 2009:3).

Miller (1990:S63) refers to the fact that educators do not have a clearly defined concept of serious game-based learning. The definition of Tang, Hanneghan and Rhalibi (2009:1) will be accepted for the purpose of this study: “Game based learning takes advantage of gaming technologies to create a fun, motivating and interactive virtual learning environment that promotes situated experiential learning”.

1.7.4 Game-authoring engine

A game-authoring engine allows the user to create a game based on the software provided in the system. The author can choose his/her own world, non-player characters and objects (Prensky, 2007). Thinkingworlds is an example of an instructional game-authoring engine that will be used for the purposes of this study (Thinkingworlds, 2010).

1.7.5 Net generation

Different generations need different training approaches and training material (El-Shamy, 2004:xiii.) It is important to define the characteristics and training needs of the different generations, in this case the net generation. Core traits of the net generation are that they have higher levels of self-esteem, but are often under more pressure than other generations. The anxiety rates of the net generation on campus have gone up because they are often put under pressure to achieve success. Students from the net generation lead more focused and regulated lives because they want to achieve their goals (Gibbons, 2007:16). The different generations can be defined as follows:

- The baby boomers were born between 1946 and 1964 during prosperous years. The boomers value health and wealth and have influenced the working environment and the training environment (El-Shamy, 2004:3).
- Generation X was born between 1965 and 1976. Members of the second half of Generation X are comfortable with technology and are creative and adaptable (El-Shamy, 2004:4).
- The net generation was born after 1977. Members of the net generation are good at multi-tasking and technology astute (El-Shamy, 2004:5).

People belonging to the net generation often exhibit different characteristics from people who were born just a few years before (Oblinger, 2004:12; Prensky, 2006:28). They are also referred to as digital natives. The net generation is used to the digitally rich world of the web and is very easily underwhelmed by traditional training methods (Clark, 2006:3; Shih & Mills, 2007:3). Van der Walt (2008:3) refers to the challenge that not all members of the net generation have had access to technology. No assumptions must be made that all people who belong to the net generation will necessarily have the same characteristics.

1.8 DIVISION OF CHAPTERS

This section gives an overview of the chapters to follow in this dissertation.

- Chapter 2 will provide a general literature review of information literacy, information literacy standards and information literacy training and library instruction. The importance of catering for the net generation's learning needs will be analysed. The general use of games during library instruction and information literacy training will also be discussed.
- Chapter 3 provides a literature review of game-based learning and the pedagogical reasons and principles of game-based learning. The examples will therefore mostly focus on game-based learning, with special attention being paid to the motivational and engaging factors of game-based learning.
- Chapter 4 will focus on the instructional design method to create and implement the game. An overview will be given of the criteria of game-based learning and the application thereof in the game developed for the purpose of this study. An overview will also be given of the evaluation and implementation of the game.
- Chapter 5 will report the empirical findings of the study. The data will be collected using a questionnaire that will be designed for the purpose of the study. The questionnaire will include open-ended and rating scale questions. The empirical

results on the affective experiences and the learning experiences of the students will be presented. Student's comments and statistical results will also be reported in this chapter.

- Chapter 6 will conclude the study by providing a summary of the research findings. Recommendations and suggestions for future studies and game design and creation will be given.

CHAPTER 2

2. INFORMATION LITERACY AND LIBRARY INSTRUCTION

2.1 INTRODUCTION

“The key characteristic of the post-industrial 21st century is that it is information abundant and intensive. Information literacy is thus required because of the ongoing proliferation of information resources and the variable methods of access. Individuals are faced with diverse information choices – in their studies, in the workplace, and in their lives” (Bundy, 2004:3). In addition, information is often unfiltered. That can raise the question of authenticity, validity and reliability (Bundy, 2004:3). The task of information seeking may therefore become more daunting and important. Different viewpoints about information seeking exist; the activity of information seeking may be considered trivial in the sense that it is seen as something everyone masters, or it may be considered a difficult activity worthy of serious investigation (Anderson, 2008:213). According to Pierce (2009:233), a point-of-need information literacy training session might be the solution to the problem that not everyone realises the importance and difficulty of information seeking.

The purpose of this chapter will be to give an overview of the concept of information literacy, the nature of information literacy skills and the importance of information literacy training and library instruction. The importance of information literacy as a form of literacy to support the information skills that will be needed for different literacies will be described. Information literacy standards and models of information literacy and information seeking will also be outlined in this chapter. The information literacy standards stress information literacy as a lifelong skill that is important to lifelong learning, which again is important to the information society (Bundy, 2004:9). Before exploring the role of different types of libraries with regard to information literacy, the importance of information literacy in lifelong learning in the information society will therefore be discussed. Although the role of public and school libraries with regard to information literacy is explored, the emphasis is on institutions of higher education and more specifically on library instruction as a component of information literacy training.

Reports on information literacy in the academic context often refer to the net generation and the changes in their needs and information behaviour. The characteristics of the net generation and how they link to information literacy training will therefore be discussed in Chapter 3.

2.2 CONCEPTS OF INFORMATION LITERACY

An operational definition of the concept of information literacy has been given in Chapter 1, where the definition of the ALA (ALA, 2004) was accepted for the purpose of this study. The ALA defines information literacy as the ability to “recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information” (ALA, 2004).

In this section the aforementioned definition of information literacy will be compared with other core definitions from the key subject literature. In this regard it is noted that some experts define information literacy as a concept, while others prefer to describe the abilities or characteristics of an information-literate person. The ALA both defines the concept and describes the abilities of the information-literate person.

Although other definitions show marginal differences from that of the ALA, it is worth comparing the ALA definition with others and to highlight words of emphasis and minor differences. This is done in Table 2.1 for a few selected definitions that seemed relevant to the purpose of the study.

Key definitions from the information literacy subject field - words of emphasis are given in italics by the researcher (Author’s emphasis)	Differences in emphasis
Chartered Institute of Library and Information Professionals (CILIP) “Information literacy is knowing when and why you need information, where to find it, and how to evaluate, use and communicate it in an <i>ethical manner</i> ” (CILIP, 2011).	The use and communication of information in an ethical manner are stressed.
Kuhlthau’s definition of information literacy Kuhlthau (2006:71) refers to the quantities of information in the global society and the ability to locate, <i>evaluate and use information wisely</i> . She	The importance of using information wisely is highlighted.

<p>adds, "Information literacy is at the core of what it means to be educated in this century" (Kuhlthau, 2006:71).</p>	
<p>Eisenberg's definition of information literacy</p> <p>Eisenberg (2008:39) describes information literacy as "the set of skills and knowledge that allows us to find, evaluate and use the information we need, as well as <i>to filter out</i> the information we don't need."</p>	<p>The emphasis is on filtering out information that is not needed.</p>
<p>Dorner and Gorman's definition of information literacy</p> <p>The definition of Dorner and Gorman (2006:284) is aimed at developing countries, and is therefore cited here since it may have value for South Africa as a developing country. They define information literacy as:</p> <p>"...to understand when <i>information can be used</i> to improve their [i.e. information literate people and/or people receiving information literacy training] daily living or to contribute to the resolution of needs related to specific situations, such as work or school</p> <p>to know how to locate information and to critique its relevance and appropriateness to their context</p> <p>to understand how to integrate relevant and appropriate information with what they already know to construct knowledge that increases their capacity to improve their daily living or to resolve needs related to specific situations that have arisen".</p>	<p>The definition stresses the creation and control of information, and the fact that information can improve daily living in a world where survival is difficult.</p>

Table 2.1: Brief analysis of selected definitions of information literacy in terms of differences from the ALA definition

Although the definition of Dorner and Gorman (2011) holds much potential for information literacy training programmes in developing countries, adopting the less detailed approach of the ALA, while acknowledging the emphasis other definitions place on specific aspects, seems more suitable for a training programme in library instruction. It focuses more specifically on orientation to the use of library resources, which is the focus of this study. However, in the development of the proposed game for this study, issues emphasised by other definitions, such as the ethical use of information, will also be considered.

In addition to its definition of information literacy, the ALA (2004) also defines an information-literate individual in terms of what such a person is able to do, namely:

- “Determine the extent of information needed
- Access the needed information effectively and efficiently
- Evaluate information and its sources critically
- Incorporate selected information into his/her knowledge base
- Use information effectively to accomplish a specific purpose
- Understand the economic, legal, and social issues concerning the use of information, and access and use information ethically and legally.”

The ALA is not the only organisation to focus on the characteristics or abilities of an information-literate person. Bundy (2004), Corral (2009:26) and Probert (2009:25) follow a similar trend. Bundy’s (2004:4) description of what an information-literate person can do reads as follows:

- “Recognise a need for information
- Determine the extent of information needed
- Access information efficiently
- Critically evaluate information and its sources
- Classify, store, manipulate and redraft information collected or generated
- Incorporate selected information into their knowledge base
- Use information effectively to learn, create new knowledge, solve problems and make decisions
- Understand economic, legal, social, political and cultural issues in the use of information
- Access and use information ethically and legally
- Use information and knowledge for participative citizenship and social responsibility
- Experience information literacy as part of independent learning and lifelong learning.”

Bundy (2004) thus repeats what has been noted in the definitions, but also, when focusing on abilities, adds other issues of importance, such as classifying and storing information, as

well as related issues such as legal, social, political, economic and cultural issues and lifelong learning.

When exploring the information literacy concept further, there seems to be different categories when analysing and portraying the concept, namely:

- Information literacy as a process
- Information literacy as an overarching literacy
- Information literacy as more than the printed word
- Information literacy in parallel with other literacies
- Information literacy as offering an intellectual framework
- Information literacy as a critical reasoning and thinking skill
- Information literacy as a skill associated with information retrieval and decision-making.

The aforementioned approaches will be briefly fleshed out in the next few paragraphs.

(a) Information literacy as a process

The notion that information literacy is a process is supported by Bruce (2004:2), Hegarty, Quinlan and Lynch (2003:442) and Wallis (2005:219), who argue that information literacy needs to be considered as a process to find information in any environment and in any discipline. Information literacy courses focus on processes such as finding and searching, organising, producing and distributing information (Green, 2010:314; Mackey & Jacobson, 2010:13; Ward, 2006:397).

(b) Information literacy as an overarching literacy

Information literacy is essential for 21st century living because information users must be confident to use and find information for their own benefit in any literacy (Bruce, 2004:1; Van de Vord, 2010:173). One of the approaches in defining information literacy is that information literacy is an overarching literacy.

According to Wallis (2005:218), “Information literacy can be understood as the overarching term to describe the skills needed to use information and communication technologies (ICT) effectively, and to access appropriate digital information resources”.

Bawden (2001:233) and Breivik (2005:21) describe information literacy as an umbrella term that covers different literacies such as computer literacy, library literacy, media literacy,

network literacy and visual literacy. Different literacies can be used during information literacy training, for example tool literacy to use information tools, resource literacy to understand the form, format and location of information, social and structural literacy, research literacy to understand the work of researchers, emerging technology literacy to keep up with new developments and critical literacy to evaluate information critically (Singh, 2008).

The influence of library websites and a mobile library catalogue will have to be taken into consideration for the net generation's library literacy (Leung, 2004:335).

(c) Information literacy as encompassing more than the printed word

Eisenberg, Lowe and Spitzer (2004:6) argue that information literacy encompasses more than the printed word and can be used in different media and literacies. Blair (2010:2) states that new attempts to achieve information literacy must meet the different generations in their own learning media, such as the learning media of teenagers that do not always fit the traditional educational styles. These media may include social media, videos, games and images (Blair, 2010:4). Bawden (2001:2) and Elmborg (2000:194) support the fact that information literacy can be applied in different media and not only to the printed word.

(d) Information literacy in parallel with other literacies

Various authors have described information literacy in parallel with other literacies. Eisenberg, Lowe and Spitzer (2004:7) refer to multiple literacies such as visual literacy, media literacy, computer literacy, digital literacy and network literacy. According to them different information literacy skills will be used with the different other literacies (Eisenberg, Lowe & Spitzer, 2004:10). Braden and Hortin (1981) relate information literacy to the ability to understand and use images, as well as the ability to think, learn and express oneself in tunes and images. According to Eisenberg, Lowe and Spitzer (2004:10), media literacies entail the ability to access, analyse and produce information for specific outcomes – all skills closely related to information literacy. For network information literacy, for example, successful search strategies, accessing of source information and understanding the system by which networked information is generated and managed are important (Eisenberg Lowe & Spitzer, 2004:210).

Digital resources can be used in multiple formats to combine and present them via computers. Information can be organised for practical applications to create and manipulate documents from a wide range of sources by combining them with other resources (Eisenberg, Lowe & Spitzer, 2004:10; Gilster, 1997:4). Bawden (2001:218) prefers the idea of digital literacies, which will include information literacy, and describes information literacy and technology literacy as sets of specific literacies and competences to find and sort information.

Hugo (2003:46) and Bruce (2003) describe different literacies, such as alphabetic literacy, functional literacy, social literacy and digital literacy, along with information literacy. According to Hugo (2003:48), literacies are determined by cultural forces at work within a society as basic literacy to read and write, scientific literacy to think scientifically, technological literacy to use computers, visual literacy to interpret ideas, information literacy to find and evaluate information and cultural literacy to recognise diversity.

(e) Information literacy as an intellectual framework

According to Bundy (2004:4), information literacy can be described as “an intellectual framework for recognising the need for, understanding, finding, evaluating and using information”. Grafstein (2007:54) and Wong (2010:115) describe information literacy as an intellectual framework for deeds such as understanding, evaluating and using information that can require critical reasoning and investigating methods. The framework can be used as a scaffold in any educational environment and any work environment (Breivik, 2005:22; Bundy, 2004:3; Corral, 2008:27). Models and standards such as the Big6, American Association of College and Research Libraries (ACRL) and Society of College, National and University Libraries (SCONUL) can be used as a framework for information literacy training (Corral, 2008:27; Eisenberg, 2008:41).

(f) Information literacy as a critical reasoning and thinking skill

In addition to the arguments that information literacy actually includes different types of literacy, information literacy skills can also be approached as an amalgam of skills, attitudes and knowledge (Anderson, 2008:212; Lloyd, 2006:572). The amalgam of skills can include critical reasoning and thinking skills. In this regard, information literacy training can enable scholars to use critical reasoning and thinking skills such as the ability to analyse academic information for possible biased opinions and

assumptions. It would then enable scholars to acquire the skills to draw valid, conclusions from scientific articles (Donham & Steele, 2007:15).

(g) Information literacy as a skill associated with information retrieval

The skill to retrieve information is central to learning and decision-making. According to Bundy (2004:4) the skills needed to retrieve information are, however, quite different from the skills to make an informed decision. New innovations exist for information retrieval in all formats and different media types (Foster & Rafferty, 2010:3).

Saunders (2008) combines information retrieval skills with the framework set by the ACRL standards. Competency two of the ACRL indicates that an information-literate person must be able to identify keywords to access and retrieve information. Competency three of the ACRL defines the importance of incorporating new knowledge into a private knowledge system. Databases are now refined to remember previous searches and to combine those with new searches to assist the user with his searches. The librarian of today will still have to support and train users to retrieve relevant information in spite of very well-designed databases (Saunders, 2008:86).

From the above brief exploration of definitions of the concept of information literacy, the characteristics of an information-literate person and the different views of what the concept entails and how it relates to other literacies, it is clear that information literacy is a complex skill that individuals develop over time, where especially the process of defining information needs is very complex (Stevens & Campbell, 2006:540; Wallis, 2005:218).

2.3 ORGANISATIONS THAT PROMOTE INFORMATION LITERACY

The International Federation of Library Associations and Institutions (IFLA) represents the library and information profession worldwide. Various organisations exist in different countries to improve information literacy and information literacy training. The IFLA has a special section on information literacy to develop information literacy skills among different libraries (IFLA, 2009).

Different countries will be used as examples for the purpose of this study. The emphasis will be on organisations that strive to improve information literacy at higher education institutions. South Africa, the United States of America (USA), United Kingdom and Australia and New

Zealand will be used as examples. The information literacy standards and models that were developed by these countries will be described in section 2.4.

2.3.1 South Africa

Efforts have been made in South Africa to improve the status of information literacy (Jiyane & Onyancha, 2010:11; Martin & Rader, 2003:36; Nassimbeni, 2008:262). The world report series of IFLA gives a global perspective of libraries and library services. The Senn Breivik Report (1992) addressed the academic planning problems of higher education institutes in the Western Cape (Underwood, 2000:16). The report indicates the importance of information literacy to the strategic values of academic libraries. One of the strategies of the Western Cape Library Cooperative Project, which was started in 1992, was to promote information literacy (Underwood, 2000:16). Projects with similar goals were the INFOLIT project, which was started in 1995 to promote information literacy in South Africa (De Jager, Nassimebeni & Underwood, 2007:159; Jiyane & Onyancha, 2010:12;) and information literacy courses that have been developed by academic libraries in South Africa with dedicated librarians for information literacy training.

The Cape Peninsula University of Technology, Rhodes University, University of Cape Town, University of Johannesburg, University of the Western Cape, University of South Africa and University of Pretoria all have general information literacy training courses on their library websites (Lau, 2007:113). Information literacy training is given by the University of Pretoria, University of Cape Town and the University of KwaZulu-Natal (Ocholla & Bothma, 2007:58). A compulsory credit-bearing course in information literacy is offered by the Department of Information Science at the University of Pretoria (Ocholla & Bothma, 2007:59).

Thomas and Fourie (2006) discuss the establishment of five library consortiums in South Africa: the Cape Library Consortium (1992), Eastern Seaboard Association of Libraries (1997) Free State Library and Information Consortium (1996), Gauteng and Environs Library Consortium (1996) and South Eastern Alliance of Library Systems (1997). One of the purposes of the organisations is to improve information literacy and share information literacy training resources (Thomas & Fourie, 2006:7).

The Committee for Higher Education Librarians of South Africa (Chelsa) was launched in June 2004. Chelsa's mission is to develop a national framework for information literacy training at higher education institutions in South Africa (Esterhuizen & Kuhn, 2010:84). Data were gathered from different university libraries to be combined for a national framework for

information literacy in South Africa. The proposed framework was discussed at the conference of the Library and Information Association of South Africa (LIASA) in Bloemfontein in 2009 (Esterhuizen & Kuhn, 2010:94).

LIASA aims to empower all South Africans who are working in libraries (LIASA, 2011). The Higher Education Library Interest Group of LIASA aims to improve information literacy at higher education institutes.

2.3.2 United States of America and Canada

For many years efforts have been made in the USA and Canada to improve the status of information literacy. American librarians held their first meeting in 1853 and the ACRL was established in 1876. The ACRL information literacy model provides a framework for information literacy training and standards (ACRL, 2011).

The American Library Association Presidential Committee on Information Literacy was created in 1980 (ALA, 2011; Lau, 2007:106).

Leaders such as Beverick and Kuhlthau (Lau, 2007:107) played an important role in the establishment of information literacy in the USA. Kuhlthau states in her book, *Information skills for an information society* that educators have to consider the importance of information literacy on a national basis in order to support learners to develop the skills to find information (Kuhlthau, 1988:421).

Initiatives to achieve information literacy were established by American universities in 1993 by the Council of Library Directors (COLD, 2011) in order to establish information literacy and training among American universities and academic libraries. Information skills are regarded as critical for higher education students.

Some of the associations that were established in the USA and Canada were the ACRL, the Canadian Academic Research Libraries and the Canadian Association of Research Libraries (CARL) (Lau, 2007:108). The ACRL serves the information needs of higher education communities and aims to improve the services of academic libraries and professionals. The ACRL formulated a guideline for the improvement of information literacy (ACRL, n.d.). The CARL takes the lead in advancing research libraries and their purposes in Canada (CARL, n.d.).

The Liberal Education and America's Promise (LEAP) initiative was launched in 2005 to develop liberal education. One of the important skills of outcomes-based education is critical thinking skills to prepare students for the global working world. One of the aims of LEAP is to promote information literacy as an intellectual and practical skill (LEAP, 2011).

The National Forum on Information Literacy was established in 1989; it has joined forces with 93 organisations to promote information literacy as a 21st century skill (NFL, 2011).

President Barack Obama, president of the USA, declared October 2009 as National Information Literacy Awareness Month. He called upon educators to recognise the importance of information literacy to be able to seek, find and decipher information (Presidential Proclamation National Information Literacy Awareness Month, 2012).

2.3.3 United Kingdom

Efforts have been made in the United Kingdom to promote the status of information literacy. "SCONUL was founded in 1950 (as the Standing Conference of National and University Libraries)" (SCONUL, 2011). In 2001 SCONUL changed its name to the Society of College, National and University Libraries. United Kingdom and Irish universities are members of SCONUL (SCONUL, 2011). In 1989 SCONUL created a task force to develop a statement for information literacy for higher education (SCONUL, 2011).

The CILIP was formed in 2002 to be the voice of library and information professionals. The information literacy group of the CILIP provides a network to encourage information literacy. Several higher education institutes in the United Kingdom developed information literacy training courses for students. Universities such as the Manchester Metropolitan University, Leeds University and the University of Sheffield pay special attention to information literacy (Lau, 2007:93).

Hepworth and Smith, (2008:220) identified the information literacy needs of non-academic staff at Loughborough and Leeds Universities. Information literacy skills were a new concept for most of these staff members. The non-academic staff needed different approaches to information (Hepworth & Smith, 2008:224).

Efforts have also been reported to offer user education, address information technology in education, integrate information literacy into the curriculum and emphasise the importance of models of information literacy to support such efforts (Bruce, 2000:209; Horton, 2008:10; Martin & Rader, 2003:38; Matthews, 2005:23; Weiner & Jackman, 2010:115).

Especially in the academic environment, concerted efforts have been made in this regard. The Higher Education Academy Information and Computing Sciences (2012), for example, has a keen interest in information literacy in higher education and runs workshops to improve information literacy training (IL, 2010). At Staffordshire University, the Information Literacy Community of Practice shares information literacy training ideas and improves the status of information literacy in general in the United Kingdom (IL, 2010). These initiatives are supported by the Joint Information Services Committee, which develops and assesses the information literacy skills of information and library personnel.

2.3.4 New Zealand and Australia

In Australia and New Zealand, where efforts have been made to promote information literacy, several organisations and associations for information literacy exist. Some of these organisations are the Australian Library and Information Association (ALIA - 2011), Australian and New Zealand Institute for Information Literacy (ANZIIL) (2011) and Council of Australian Librarians (CAUL) (2011). ALIA was established in 1937. A special group of ALIA pathways exists to promote information literacy in the Australian community.

Australian and New Zealand libraries have created the ANZIIL (2011). ANZIIL supports organisations, institutions and individuals in the promotion of information literacy and, in particular, the embedding of information literacy within the total educational process. The institute identifies, facilitates, fosters and supports best practice in information literacy through professional development, promotion, marketing and advocacy and research (ANZIIL, 2001). The ANZIIL professional development group provides train the trainer facilities and professional development for information workers (ANZIIL, 2001).

Australia has received recognition for its development of information literacy and lifelong learning (Bruce, 2004:30; Lau, 2007: 8; Weiner & Jackman, 2010:116). Information literacy is embedded in Australian universities. Bundy, the president of the ALIA, initiated several information literacy activities, such as the ANZIIL information literacy standards for Australia and New Zealand. Research by Bruce into the capabilities of undergraduates was also important for the development of information literacy (Peacock, 2001:21).

The CAUL (n.d.) supports information literacy in academic context. The Pilot (Lau, 2007:10) information literacy navigator has been used by several universities, including the Australian National University, University of Sydney, Victoria University of Technology, University of South Australia, James Cook University, Leeds Metropolitan University, University of South

Australia, Queen Margaret University College Library, University of Windsor, University of Wollongong, Southbank Institute and Brisbane North Institute of the New South Wales Technical and Further Education Commission (Lau, 2007:10).

Queensland University Libraries Office of Cooperation (n.d.) provides help with best practice development, information exchange and cooperative activities.

Already at an early stage of attempts to promote information literacy skills, the need for standards became clear. Over time, various models of information seeking were developed and linked to such standards.

2.4 INFORMATION LITERACY STANDARDS, MODELS OF INFORMATION LITERACY AND THE INFORMATION-SEEKING PROCESS MODEL

This section will give a brief overview of selected standards accepted in various countries. To put the discussion in context and to form a bridge to the decisions that need to be taken for the development of a game for library orientation, two key models of information literacy and information-seeking, which have been linked to standards of information literacy, will also be considered. Information literacy skills are embedded in information literacy standards and models, and therefore such standards and models can provide the necessary steps to guide the learner through a problem-solving process, and serve as essential resources in the planning of information literacy training (Eisenberg, 2008:41). Such standards can also serve as frameworks for assessment for information-literate individuals (ALA, 2000).

The information literacy skills embedded in information literacy standards and models are described in the paragraphs below. For the purpose of discussion the following standards and models, adopted by many countries around the world and specifically applied to higher education, were selected to guide this study:

1. The ACRL
2. The ANZIIL
3. SCONUL
4. Big6 information literacy model
5. Kuhlthau's information-seeking process (ISP) model.

2.4.1 Association of College and Research Libraries

The ACRL is a division of the ALA and is responsible for propagating standards and guidelines for libraries. The standards include the following (ACRL, n.d.):

Standard One

“The information-literate student determines the nature and extent of the information needed.”

Standard Two

“The information-literate student accesses needed information effectively and efficiently.”

Standard Three

“The information-literate student evaluates information and its sources critically and incorporates selected information into his or her knowledge base and value system.”

Standard Four

“The information-literate student, individually or as a member of a group, uses information effectively to accomplish a specific purpose.”

Standard Five

“The information-literate student understands many of the economic, legal, and social issues concerning the use of information and accesses and uses information ethically and legally.”

Librarians can use the ACRL standards as a guideline to develop their training material. Emmett and Emde (2007:211) used the ACRL standards as an assessment tool for information literacy training; they found that using the ACRL standards added value to the curriculum of chemistry students over a three-year period. They observed evidence of skills gained by the students (Emmett & Emde, 2007:223).

Maybee (2007:454) used the ACRL standards as a guideline to provide training that was appropriate for students' needs, in order to ensure that students satisfied the definition of an information-literate person after the training. The ACRL standards served as a guideline to formulate certain questions:

- “How do you use information to complete class assignments?”
- How do you use information outside of your coursework?

- Tell a story of a time when you used information well.
- Describe your view of someone who uses information well.
- Describe your experience using information” (Maybe, 2007:83).

The experience of the students was reflected in the results of the case study, namely their experience with information, specifically the location of information in different sources, the information search process as the initiating process and information use as a personal knowledge base. The recommendation of the case study was that information literacy values must be embedded in information literacy training to cater for the real information needs of students.

2.4.2 Australian and New Zealand Information Literacy Standard for Higher Education

The ANZIIL standard for higher education originated from the ACRL information literacy standard. The framework supports the principles and standards of information literacy in general (Bundy, 2004a:7). The second edition of the ANZIIL standard for higher education was developed by librarians and academics (Bundy, 2004:4). It consists of six standards, which are explained below.

Standard One

“The information literate person recognises the need for information and determines the nature and extent of the information needed. Identify information needed” (Bundy, 2004b:12).

Standard Two

“The information literate person finds needed information effectively and efficiently” (Bundy, 2004b:14).

Standard Three

“The information-literate person critically evaluates information and the information seeking process” (Bundy, 2004b:14).

Standard Four

“The information literate person manages information collected or generated” (Bundy, 2004b:14).

Standard Five

“The information literate person applies prior and new information to construct new concepts or create new understandings” (Bundy, 2004b:15).

Standard Six

“The information literate person uses information with understanding and acknowledges cultural, ethical, economic, legal and social issues surrounding the use of information” (Bundy, 2004b:16).

ANZIIL standards were used as a framework in the information literacy training of undergraduate business students at the Faculty of Business at Queensland University of Technology. The information literacy training proved to be successful after pre- and post-testing had been done (Price *et al.*, 2011:709).

The case study done by Gunasekara and Collins (2008) proved the value of the ANZIIL standards. Students of the subject Operations and Management at the Queensland University of Technology, Australia completed a weekly task that was based on the ANZIIL standards. Tutorial activities were combined with ANZIIL standards related to learning outcomes. The first standard recognising the need for information was combined with the identification of management processes and sources, with the related outcome that students understood the value of sources. The second standard, the finding of effective information sources, was combined with effective searching of relevant sources. The outcome was the relevant retrieval of information. The critical evaluation of information was combined with the evaluation of the search criteria. The outcome was that the information-seeking process became evolutionary. The fourth step was the management of information, combined with the recording or management of the information. The outcome was use of the correct referencing methods by the students. This led to application of the principle that an information-literate person applies prior and new information, which enables the person to identify gaps between primary and secondary information sources, improving knowledge and understanding of the subject matter. The sixth standard is the use of information with understanding. The tutorial activity entailed reflection on the information-seeking process and the recognition of multiple sources. The applications of the standards were contextualised. The researchers hoped to foster lifelong learning by using the ANZIIL standards as a guideline (Gunasekara & Collins, 2008:4).

2.4.3 Society of College, National and University Libraries

SCONUL developed the seven pillars information literacy model to assist practitioners in the field (SCONUL, 2007).

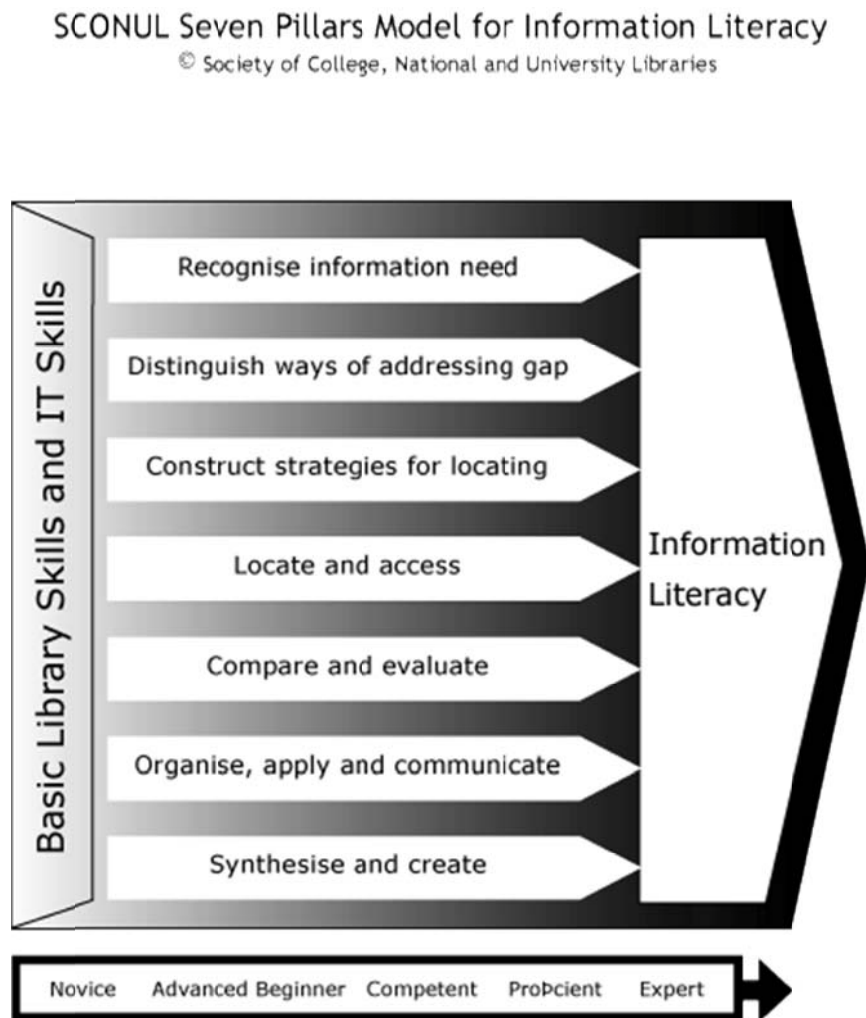


Figure 2.1: The seven pillars of information literacy as developed by SCONUL (SCONUL, 2007)

Loughborough University conducted research to improve the information literacy training of students. Information literacy training was embedded into the curriculum. The information literacy training incorporates the seven pillars of the information literacy standards developed by SCONUL. Research findings proved that students' skills improved when they attended these courses (Stubbings & Franklin, 2006). The possibility of a credit-bearing information literacy course at Strathclyde Business School was analysed. The researchers found that information literacy can be a credit-earning subject with a curriculum based on the SCONUL standard (Johnston & Webber, 2008:335).

2.4.4 The Big6

The Big6 is an information literacy model developed by Eisenberg and Berkowitz (2008a) and is aimed at teaching information and technology skills. The groundbreaking publication of Eisenberg and Berkowitz (1988), *Curriculum initiative: An agenda and strategy for library media programs*, indicates the importance of linking problem-solving and critical thinking. The six-stages approach is presented in this book. Eisenberg and Berkowitz (1988:6) suggest that the school curriculum and information literacy training can be a systematic approach to help students with their specific needs, and that problems with the curriculum can be seen as challenges to be solved by information literacy training (Eisenberg & Berkowitz, 1988:7).

As developers of the model, Eisenberg and Berkowitz argue that students are able to handle any problem, assignment, decision or task if based on the Big6 approach (Eisenberg, 2008:163). The Big6 model consists of six stages, which are not based on a linear process, and certain steps can be repeated. The purpose of the six stages is to help define the meta-cognitive processes required in the research process. Eisenberg (2008:42) describes the six stages of the Big6 as follows:

“Stage 1: Task Definition

Define the information problem
Identify information needed

Stage 2: Information-seeking Strategies

Determine all possible sources
Select the best sources

Stage 3: Location and Access

Locate sources (intellectually and physically)
Find information within sources

Stage 4: Use of Information

Engage (e.g. read, hear, view, touch)
Extract relevant information

Stage 5: Synthesis

Organise from multiple sources

Present the information

Stage 6: Evaluation

Judge the product (effectiveness)

Judge the process (efficiency)"

In support of the model, Eisenberg (2008) and Singh (2008:14) argue that students who use the Big6 gain powerful skills to apply to their studies. Lecturers can apply the Big6 in subject area content and assignments. The impact of the Big6 on student achievement became evident in a report on a case study on the Big6 (Berkowitz, 2000) done at the Wayne Central High School in 1997 and 1998. Only 53% of the candidates passed the examination the year before. The students in the case study did the same test for the American History Regents examination with better results: in a class of 59, only five did not pass the examination.

Brand-Gruwel, Wopereis and Vermetten (2005:489) point out that information problem solving is a complex issue that needs scaffolding and training. The Big6 was chosen because it fits into an information-seeking framework. Regulation was added as an extra component to the Big6 to scaffold the metacognitive process. Five experts (doctoral students) and five novices were asked to think aloud about their information problem. The results proved that the participants defined a problem, searched for information, scanned information, processed information and organised and presented information. The complex information-seeking process was analysed to observe the main differences between novices and experts. Experts looked more closely at the contents of the information than novices. Results proved that experts spent time on the main skill to define the problem and used their experience to elaborate on the content.

2.4.5 Kuhlthau's Information-seeking Process Model

In 1985 Kuhlthau did research that led her to suggest an ISP model, which was tested in several subsequent projects over several years. The progression and development took place from 1985 to 2008 (Kuhlthau, Maniotes & Caspari, 2007). The model was created with the thoughts, actions and feelings of the information seeker in mind. The information seeker starts with confusion and incompatibilities between new information and existing information (Kuhlthau, 2007:33).

Her experience with the model led Kuhlthau to suggest an inquiry-based learning approach in information literacy training. Information technology increases the complexity of people's daily lives with an overwhelming amount of information. This can have a negative influence on the next generation of innovators (Kuhlthau, 2007:1). For this reason, Kuhlthau (2007) suggests an inquiry-based learning approach that can have a positive influence when students are asked to use many different information sources to understand more about a certain topic. In an inquiry-based learning approach, students can be guided by librarians in the quest for new knowledge and information. According to Kuhlthau (2007:5), information seeking can then be described as a constructivist process that requires construction and learning.

Kuhlthau's ISP model, which was developed over time, is one of the models that can be used for information seeking. The initial model was developed in 1983. The inquiry-based learning approach, as suggested by Kuhlthau (2007:1), follows her information search model, which is described below. The ISP is presented in six stages:

Initiation

Person realises he has a lack of knowledge

Selection

A topic to research is identified

Exploration

Incompatible information is encountered

Formulation

A focused perception is realised

Collection

Information is gathered

Presentation

The search is completed with new understanding and ability to explain (Kuhlthau, 2007:35).

In 2006, a case study was done involving 574 students in Grades 6 to 12, in ten diverse public schools in New Jersey, USA, undertaking guided inquiry projects (Heinström, 2006). Results from this project proved that students' *surface* information seeking remained on a factual level, the *deep*-seeking students developed skills of more depth, and students with a *strategic* approach managed the information on a higher level (Heinström, 2006). The use of

the guided inquiry process has also been reported by Steinerová (2008). The importance of focus on human information behaviour was part of the research process.

Standards and models such as the above also suggest objectives and outcomes that reflect what students are able to do after completing an information literacy training course, and can therefore offer excellent guidelines on the skills to be considered for information literacy training, which would include library orientation.

2.4.6 Comparison of different information standards and models

Eisenberg (2008:41) compared the different standards and models in a side-by-side view and found that there were more similarities than differences. The application of information skills does not occur as isolated incidents, but connected activities (Eisenberg, 2008:41). The researcher compared the ACRL, ANZIIL, SCONUL, Big6 and Kuhlthau's ISP to reflect the different processes and values of the standards and models.

ACRL Information Literacy Standards	ANZIIL Information Literacy Standards for Higher Education	SCONUL (UK) Information Literacy Pillars	Big6	ISP process
Standard One "The information-literate student determines the nature and extent of the information needed" (ACRL, 2011)	Standard One "The information-literate person recognises the need for information and determines the nature and extent of the information needed. Identify information needed" (Bundy, 2004:12).	"Recognise information need" "Distinguish ways of addressing gap" (SCONUL, 2007) "Construct strategies for locating"	Stage 1: Task "Definition Define the information problem Identify information needed" (Eisenberg, 2008)	"Initiation Person realises he has a lack of knowledge" (Kuhlthau, 2007) "Selection A topic is identified to do research"
Standard Two "The information-literate student accesses needed information effectively and efficiently" (ACRL,	Standard Two "The information literate person finds needed information effectively and efficiently" (Bundy, 2004:14).	"Locate and access" (SCONUL, 2007) "Compare and evaluate" (SCONUL,	Stage 2: "Information-seeking strategies Determine all possible sources.	"Exploration Incompatible information is encountered" (Kuhlthau, 2007) "Formulation

<p>2011)</p> <p>Standard Three “The information-literate student evaluates information and its sources critically and incorporates selected information into his or her knowledge base and value system” (ACRL, 2011)</p> <p>Standard Four “The information-literate student, individually or as a member of a group, uses information effectively to accomplish a specific purpose” (ACRL, 2011)</p> <p>Standard Five “The information-literate student understands many of the economic, legal, and social issues surrounding the use of information and accesses and uses information ethically and legally” (ACRL, 2011)</p>	<p>Standard Three “The information-literate person critically evaluates information and the information seeking process” (Bundy, 2004:14).</p> <p>Standard Four “The information literate person manages information collected or generated” (Bundy, 2004:14).</p> <p>Standard Five “The information literate person applies prior and new information to construct new concepts or create new understandings” (Bundy, 2004:15).</p> <p>Standard Six “The information-</p>	<p>2007) “Organise, apply and communicate” (SCONUL, 2007) “Synthesise and create” (SCONUL, 2007)</p>	<p>Select the best sources” (Eisenberg, 2008) Stage 3: “Location and Access Locate sources (intellectually and physically) Find information within sources” (Eisenberg, 2008) Stage 4: “Use of Information Engage (e.g. read, hear, view, touch) Extract relevant information” (Eisenberg, 2008) Stage 5: “Synthesis Organise from multiple sources Present the information” Stage 6:</p>	<p>A focused perception is realised” (Kuhlthau, 2007) “Collection Information is gathered” “Presentation The search is completed with new understanding and ability to explain” (Kuhlthau, 2007:35).</p>
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	literate person uses information with understanding and acknowledges cultural, ethical, economic, legal and social issues surrounding the use of information” (Bundy, 2004:16).		“Evaluation Judge the product (effectiveness) Judge the process (efficiency)” (Eisenberg, 2008).	
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Table 2.2: Side-by-side view of information literacy standards and models

Eisenberg (2008:41) argues that the driving force in all the models is the processes that show that information literacy skills are connected activities that include a way of thinking and using information (Eisenberg, 2008:41). The ANZIIL standards concentrate on the management of the information and the creation of new understanding. SCONUL concentrates more on information transfer to others.

The models developed by Kuhlthau and Eisenberg are more inclusive of the whole research process. Kuhlthau concentrates more on the feelings of the students, while Eisenberg concentrates more on the metacognitive aspects. ACRL concentrates on the wider concept of information-seeking and its influence on the information society to provide a scaffold for developing and measuring the abilities of the information-literate individual (Eisenberg, 2008: 41).

COMBINED MAP REFLECTING ACTIVITIES FROM THE INFORMATION LITERACY STANDARDS AND MODELS		
1	Identify topic	Big6
2	Information problem	ISP
3	Awareness of lack of knowledge (<i>uncertainty</i>)	ISP
4	Determine need	ACRL
5	Determine sources	ACRL
6	Gather information pertinent to focussed perspectives	ISP
7	Evaluate sources	ACRL
8	Extract relevant information	Big6
9	Awareness of increased confidence	ISP
10	Information gap	SCONUL

11	Use information effectively	ACRL
12	Manage and organise information	Big6
13	Judge the products effectiveness	Big6
14	Present the information with new understanding	ISP
15	Apply and communicate information to others	SCONUL
16	Understand cultural ethical economic, legal and social issues (of information sharing)	ANZIIL

Table 2.3: Map of information literacy standards and models identified by researcher

The combined view of the information literacy models and standards reflects a very interesting view of the information literacy process. The information map might be used to gain all the advantages of the different models and standards. Combining the metacognitive processes of the Big6 with the feelings and emotions of the ISP model and the management of information of the ANZIIL model, as well as ACRL's wider concept of information seeking and the influence of information on society, might be beneficial for the information society.

It has been noted that various innovative ways can be applied to information literacy standards to make them more acceptable in the teaching environment. The researcher decided to use the Big6 because it can be used with any curriculum and can be applied to the assignment-writing process. The Big6 as a guide can lead a student to identify information needs, seek information, locate relevant information, synthesise and evaluate information (Eisenberg, & Berkowitz, 2008 b).

Especially the first three steps in the Big6 seem relevant to library instruction, which is the focus of this study. For library instruction in specific contexts, additional steps or issues can be added, such as tips on the writing procedure, constructing and evaluating the assignment. The different steps will be part of a game for first-year students.

Many examples of the innovative use of information literacy standards exist. Interactive library research games have been developed (Karshmer & Bryan, 2011:257). Library 2.0 services can also be used as an innovative way to teach information literacy (Jayasuriya & Brillantine, 2007:40). (See section 2.8.2 for more innovative ideas to use information literacy standards during training.) A "nuts and bolts" game based on the Big6 was developed by Eisenberg and Berkowitz (Big6, 2011). The game encourages the learning-made-fun concept and provides instructional support with pace and tone. The researchers created a 3D game based on the Big6 concept. The target group for this game was higher education

students and the game was based on the principles of serious game-based learning. Using the standards and models can help to enable self-directed learners, which can lead to lifelong learning.

2.5 IMPORTANCE OF INFORMATION LITERACY FOR LIFELONG LEARNING

Lifelong learning includes all formal, non-formal and informal learning, whether intentional or unanticipated, which occurs at any time across the lifespan (Bundy, 2004:8). Information literacy is considered to form the basis of lifelong learning and is often argued to be an enabler for self-directed learners, in all learning environments and all disciplines (Johnston & Webber, 2003:337; Rockman, 2007). J. Singh (2008:19) claims that information-literate people can stay ahead when they know what to do.

Information literacy plays an important role in everyday life because it involves a combination of education, work-related tasks, social associations and sociotechnical practice. There is a link between information technologies, workplace learning and knowledge. Knowledge of processes is necessary to advance information literacy (Tuominen, Savolainen & Talja, 2005:340).

Change in the workplace, environment and education is a constant force. Learning how to adapt to change is a generic skill that everyone should acquire (Lonsdale, 2003:21). It is important that people adapt to change in society and in the educational area. It has been shown, for example, that learning style preference fluctuates during lifetimes and in changing environments. Different generations will therefore need different approaches when teaching information literacy skills and to accommodate differences, those responsible for information literacy training (e.g. librarians) will have to cope with variations in different generations in their quest to offer information literacy training and address information needs. Digital scholars have turned into digital consumers and seem to portray the behaviour trends of digital buyers. There is a generational difference between information seekers. Digital immigrants may use different techniques in their information-seeking processes (Rowlands *et al.*, 2008:295).

Bawden (2000:233) and Breivik (2005:21), as stated earlier, describe information literacy as an umbrella term that covers different literacies. Lifelong learning can also be seen as an umbrella term that covers different aspects of learning (Wilcox, 2005:43). The spokes of the umbrella can be seen as the processes of living, career development, learning to cope with financial matters and others (Brendle-Moczuk, 2006:499; Wilcox, 2005:43).

Brendle-Moczuk (2006:501) defines clearly that a lifelong learner must have intellectual ability, the right attitude and information skills. Information literacy training can connect information literacy with lifelong learning (Bundy, 2004:50; Brendle-Moczuk, 2006:437). According to Bundy (2004:3), helping individuals to think critically and to construct a framework for learning to learn enables them to become lifelong learners. Library instruction can be used to compare and evaluate resources and to compare and evaluate search tools to increase the critical thinking skills of students. Perhaps more interesting library instruction sessions will enable students to become curious, show initiative and become more motivated (Brendle-Mozuk, 2006:499).

Figure 2.2 depicts information literacy as a subset of independent learning, because the student will know how to learn and independent learning is a subset of lifelong learning because the learner will know how to find information (Bundy, 2004:9; J. Singh, 2008:23).

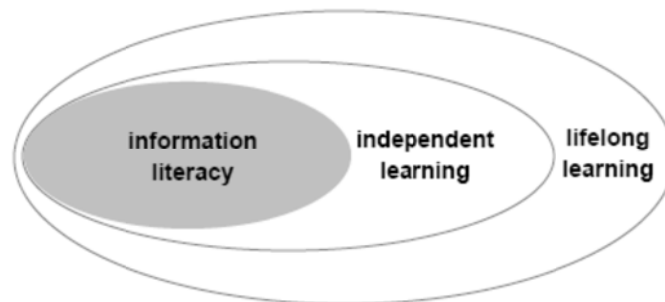


Figure 2.2: Information literacy and lifelong learning (Bundy, 2004:9).

Bundy (2004:9) describes the profile of a lifelong learner as having the ability to frame researchable questions and having knowledge of information sources, retrieving, locating, evaluation and management of information sources, and decoding of information sources. Information literacy and its role in lifelong learning can also be seen as an economic enabler (Brendle-Moczuk, 2006:498). The New Zealand curriculum emphasises the importance of lifelong learning: Such learners are “literate and numerate, critical and creative thinkers, active seekers, users and creators of knowledge and information decision makers” (Probert, 2009:25).

The advantages of information-literate individuals throughout their whole life can be seen on individual level and on societal level. There are several advantages to being information literate, which will be discussed in this section.

Based on the work of the ALA (2004) and Feast (2003:81), it can be argued that an information-literate person can determine and retrieve the information needed, which can lead to personal empowerment. Information literacy can enable a person to interpret information, question its validity and apply information to the workplace and real world environments (Bundy, 2004:21; Higgins & Face, 1998:2). Information literacy can be the driving force for personal empowerment and lifelong learning (Bruce, 2004:211).

It has also been argued that an information-literate person will understand the economic, legal and social issues concerning the use of information, and access and use information ethically and legally (ALA, 2004). Sorting and filtering out relevant information are also important skills of an information-literate person (Anderson, 2008:5). O'Sullivan (2002:9) finds that if people do not know where to look for information, they can spend hours per week obtaining, reviewing and analysing information and still not find the right information they need. Lack of information literacy skills could cost their companies millions. Apart from this, the lack of timely and accurate information can also be costly. Companies nowadays rely on accurate literature reviews before they make patentable inventions (Oblinger, 2004:11). A society rich in information, as is currently the case, therefore requires analysis and evaluation of existing information and not only information gathering (Heinström, 2006). Information literacy can also be the link between lifelong learning and knowledge management (Singh, 2008:13). By implication, many of the skills underlying these attributes of lifelong learners are information literacy skills. It can be argued that information literacy skills are directly relevant to lifelong learning.

In the following section the focus will be specifically on the advantages of information literacy on societal level, since information is an essential component for society.

In some of the previous sections, it has been argued that information literacy is an essential competence for the information society, because it extends beyond information-gathering skills (Corrall, 2008:37). "Information and knowledge have become the most important assets of society" (Boekhorst & Britz, 2004:63). Information literacy is also regarded as one of the most important skills in the information society. Leaders in the different spheres of life will have to embrace the opportunity to enable an information literacy society (Boekhorst & Britz, 2004:70).

Information literacy and its influence on lifelong learning can lead to the following advantages for society (Boekhorst, 2003:298; Bundy, 2004:2; Rodrigues & Sedo, 2008; Stevens & Campbell, 2006:537):

- Future well-being: Information literacy skills and their influence on lifelong learning can have benefits for the individual because “relatively small improvements in the skills of a nation’s labour force can have very large impacts on future well-being” (Sloep *et al.*, 2011:206). Information literacy and its effect on lifelong learning can be central to economic inequities.
- Participative citizenship: Lifelong learning can have the benefits of participative citizenship and democratic values. Education can have a positive influence on political autonomy (Bundy, 2004:5; Sloep *et al.*, 2011:206).
- Communities of professionals: Lifelong learning can lead to a learning society and a community of professionals, which can lead to the creation of new knowledge (Bundy, 2004:4; Sloep *et al.*, 2011).
- Social capital: The contribution of information literacy to formal education is widely recognised, but it is now also acknowledged as a critical enabler of personal, economic, social and cultural development that is relevant for lifelong learning. Participating in face-to-face networks and virtual networks can be a natural outcome where lifelong learning is concerned (Bundy, 2004:5; Sloep *et al.*, 2011:220).

In comparison to the advantages of an information-literate person, the disadvantages of an information-illiterate person and the necessity for lifelong learning become clear in the description of O’Sullivan (2002) and Swanson (2011) who argue that:

- An information-illiterate person does not know what information is available (Swanson, 2011:889).
- An information-illiterate person finds it difficult to determine the quality, credibility and accuracy of information (O’Sullivan, 2002:10; Swanson, 2011:885).
- An information-illiterate person is unable to compare information alternatives (O’Sullivan, 2002:10).
- Illiterate information creators might produce information that is not based on research (Emmons Martin, 2002:545; Swanson, 2011:885).
- An information-illiterate person might plagiarise and produce illegal information (Swanson, 2011:885).

- An information-illiterate person can feel alienated because he does not have access to important information (Boekhorst & Britz, 2004:195).
- Information illiteracy can lead to information poverty because the person does not have the means and skills to access information (Britz, 2004:194).

Further arguments on the disadvantages of information illiteracy include that the information-illiterate person tends to use the first available information, because an information-illiterate person may find it difficult to evaluate information correctly (Emmons & Martin, 2002:546; Swanson 2011:891; 2000:1; Weiber & Kollmann, 1998:603).

2.6 INFORMATION LITERACY COMPARED WITH LIBRARY INSTRUCTION

In presenting the concept of information literacy, its importance and the contribution it can make to society have been argued. Disadvantages of being information illiterate have also been highlighted.

In academic contexts such as schools and institutions of tertiary education, libraries are important in providing access to information resources. Libraries, however, have their own means and rules to prepare students to use a specific library. Many research reports refer to library anxiety inhibiting students from successfully using the library resources and thus also having an impact on the successful application of information literacy skills. This emphasises the need to introduce their services and the way in which libraries have been offering library instruction over many years (Dewald *et al.*, 2006:33).

“Although the expression IL did not come into use until 1974 the role of librarians as instructors is not new. In the United States, librarians have been offering library, or bibliographic, instruction in various forms since before the Civil War” (Grafstein, 2002:197).

Many librarians, however, have a problem with understanding the difference between library instruction and information literacy training. It has been argued that library instruction teaches people skills, while information literacy empowers students to do further research for academic success and lifelong learning in the information society (Breivik, 1999:2; Lenox & Walker, 1993:314; Palmer & Tucker, 2011:321; Selematsela & du Toit, 2007:122).

The purpose of library instruction is to train students in using the library products, e.g. the library catalogue, databases and online journals, and to evaluate information to enable them to succeed in their studies. Library instruction can be customised to fit the needs of a specific

library and the products and facilities of the library. Library instruction has become more important than ever to interpret the information sources to students and to teach them how to find what they want (Lubans, 1974:435).

In academic contexts library instruction can also offer support for the competencies associated with e-learning, which are sometimes addressed under the umbrella concept of information literacy (Andretta, 2004:183). Since libraries are important resources for assignments that encourage students to go beyond their course syllabus (Lippincot, 2005:56), library instruction can lead to a change in students' attitude to information sources and improve their performance. It has been shown that the anxiety level of students can be decreased by providing library instruction (Walker, 2006:118), once they have acquired the skills of effective use of library tools; information literacy skills require problem-solving and information literacy implies cognitive creation (Johnston & Webber, 2003:343). The variety of information available in specific libraries has a direct influence on library instruction and information literacy training.

Library literacy as one of the literacies under the umbrella of information literacy is important for the purpose of the study and will be emphasised in this section. Library literacy can be described in different phases (Bawden, 2001:218; Corral, 2008:27; Gilton, 2005:430), namely

- pre-library literacy: library user will have difficulty in finding a book on a shelf;
- semi-library literacy: a library user will be able to find books and articles;
- library-literate user: the user will be able to search and locate valuable information, and
- library-fluent user: this library user is able to generalise to meet information needs.

Traditional library instruction does not teach students beyond the specific tools; information literacy, on the other hand, is not medium-related, can be taught over time and is not restricted to the library walls (Grafstein, 2002:197). "Information literacy could stand alone as a subject for learning and teaching" (Johnston & Webber, 2003:344).

Breivik (1999:2) advocates that students' experience with information literacy taught by faculty and library instruction taught by the library will help them to become information literate. The goal of information literacy training will be to enable students to evaluate information with critical thinking skills for lifelong learning (Grafstein, 2002:198).

Stevens and Campbell (2006:540) argue that information literacy has emerged as an instructional framework through which librarians and faculty can collaborate to enhance students' research, critical thinking and writing competencies. In similar fashion Breivik (1999:273) supports cooperation between departments and the library. The role of the library has changed with the change in technology. Librarians can support knowledge management of higher education institutes (Breivik & Gee, 2006:71).

A comparison between library instruction and information literacy training clearly shows that both have a significant role to play. The different aspects of information literacy and library instruction are depicted in the tables below:

Library instruction teaches skills to people
Skills to be self-directed learners
Skills to use the library products
Skills and information to use a specific library
Skills to locate information in the library
Skills to search information
Skills to use a variety of online resources
Skills to use different learning platforms
Skills to make assessments
Skills to accommodate learning styles
Skills to search to go beyond course syllabus
Breivik (1999:2); Grafstein (2002:197); Lippincot (2005:56); Lubans (1974:435); Run Run Shaw Library (2011); Selematsela & du Toit (2007:122); Walker (2006:118)

Table 2.4: Library instruction and skills identified by researcher from a selection of sources

Information literacy training develop competencies
Competency to be aware that one needs information
Competency to realise what type of information is needed
Competency to organise information
Competency to be aware of the ethical and legal issues of information
Competency to evaluate information
Competency to do problem solving
Competency to acknowledge trends in information and technology
Anderson (2008:5); Bothma <i>et al.</i> (2011:10); Bundy (2004); Grafstein

(2002:198); Johnston & Webber (2003:344); Stevens & Campbell (2006:537)

Table 2.5: Information literacy competencies identified by researcher from a selection of sources

For the purpose of this study, it will be accepted that library instruction and information literacy training are complementary to each other and are part of the whole process of information literacy in its broader interpretation. Library instruction can be seen as the operational part of information literacy and information literacy training as the teaching of critical thinking skills to become information literate. An information-literate person will have to be able to think critically and be able to manipulate information to become a successful student and lifelong learner (Bothma *et al.*, 2011:12).

2.7 INFORMATION LITERACY IN DIFFERENT TYPES OF LIBRARIES IN SOUTH AFRICA

Although the focus of this study is on the academic context, a brief overview will be given of library instruction in public libraries and school libraries. An overview of what is being offered and how it can influence academic library instruction will be given.

2.7.1 Public libraries

The circumstances of library instruction in public libraries and school libraries have an influence on academic libraries in South Africa. It is therefore important to look at the circumstances in the libraries in South Africa.

Even though apartheid ended in 1994, the results of the previous regime's policies are still felt by the citizens of South Africa. Public libraries in South Africa are challenged by the apartheid past of the country. Urban white South Africans had the best public libraries while the underprivileged communities were not so fortunate (Meyer, 2010:141). Since many students do not have the privilege to receive information literacy training at schools or enter post-secondary education where they will probably receive information literacy training; public libraries can play a significant role in creating information-literate citizens. There is an urgent need for public libraries in South Africa to play an important role in library instruction and information literacy training in order to promote lifelong learning. However, this implies that library workers must have the competence and skills to train and educate library users. This task is hampered by lack of personnel, which makes it difficult to provide trained staff for public libraries. The closure of technikons that provided training for public library workers makes the problem significantly worse (Meyer, 2010:151). Hart (2006:175) is furthermore concerned that some public librarians believe that it is their job to search for information on

behalf of their users and do not always realise that library instruction and information literacy training is part of the role of the public librarian. Public libraries need more staff and sufficient book budgets to cater for their needs (Anderson, 2005:12).

In South African public and community libraries, the Public and Community Libraries Inventory of South Africa were undertaken between 2000 and 2004. The task group found that more public and community libraries in South Africa were needed to play a key role in creating information-literate citizens (Lor, Van Helden & Bothma, 2005:71).

In South Africa the lack of adequate school libraries and the fact that illiteracy is seen as a serious socio-economic problem put a lot of additional pressure on public libraries to help adults to become information literate (Nassimbeni, 2008:85).

2.7.2 School libraries

Research on school libraries and library instruction has shown that learners can become more responsible for their own learning process owing to the presence of a school library. Library instruction can have an impact on learners' reading behaviour; improve information-seeking skills and the content of assignments (Hamilton-Pennell *et al.*, 2000:8; Lonsdale, 2003:5).

Considering such benefits, it is important for more research to offer an evidence base for library instruction in school libraries. Parents do not always interact with teacher librarians. Minimal contact again may have an influence on the parent's idea of the impact that a teacher librarian can have on their child's learning (Lonsdale, 2003:5).

Racial discrimination in South Africa had a huge impact on the education system and school libraries (Darch & Underwood, 1999:290). According to Ocholla and Bothma (2007:1), circumstances have improved since the 1994 election but there are still huge inequalities in South Africa.

Schooling in South Africa comes with an additional disadvantage. Racial groups were separated in daily life before the end of apartheid in 1994. Segregation and inadequate schooling were part of the South African educational system. Schools designated for white people had good school libraries while others did not have these benefits. Only 10% of schools had good school libraries, while the traditional black schools did not have libraries (Hart & Zin, 2007:91).

The blend of third and first worlds in South Africa had a serious effect on the provision of information and communication technology in the country. Although much has changed during the years since the end of apartheid, there is still a huge difference between former wealthy schools and township schools. School libraries are therefore limited to schools with enough resources (Boekhorst & Britz, 2004:68; De Vries & Van Der Merwe, 2004:122). Many schools in the Cape Province have received books in boxes or by means of book wagons and schools are dependent on their own initiative to develop school libraries. Teachers in charge of school libraries are not always trained librarians and can therefore not assist properly with library instruction. According to De Vries and Van Der Merwe (2004:125), it is important that school library advisors should be appointed to help with the development of information skills.

Although, as explained previously, efforts are being made to establish libraries at South African schools, there are still serious shortcomings, which influence the training and other efforts required at institutions of higher education and their libraries.

Equal Education (EE) is an organisation that campaigns for a better school system in South Africa. One of the demands of EE is a national policy on school libraries (*Newsletter for School Libraries and Resource Centers*, 2010:10).

High school learners marched in April 2010 to start the 'one school one library' campaign (Bloch & Ndebele, 2010; Equal Education, 2011). They demanded more books and one school library per school. "One School, One Library, One Librarian" is a simple demand with profound implications. Among all the other needs in teaching, a school library can help improve performance by between 10% and 20% (Bloch & Ndebele, 2010).

To place the problem in perspective, an indication of the size of the school-going population in the country is that approximately 21% of the total population of 43 000 000 is younger than 19 years (StatsSA, 2006). South Africa has 26 292 public schools serving 12 302 236 learners (South Africa, 2006a), of which only 22% are high schools (Hart & Zinn, 2007:90). The IFLA World Report 2010 stated that there were only 4 000 school libraries in South Africa (Bothma, 2010:335). Internet access in school libraries in Africa has not improved since 2007-2009.

The lack of adequate school libraries and the fact that students are often not introduced to library instruction and the benefits of school libraries therefore have a huge impact on

academic libraries in South Africa, as well as the role of academic librarians. They are under more pressure to address library instruction adequately at tertiary level.

2.7.3 Academic libraries

The lack of sufficient school libraries and public libraries has a huge influence on the digital divide and information literacy, with consequences for academic libraries.

Apartheid in South Africa had a huge influence on academic libraries. Universities were divided into two groups. One group was for the privileged white students and the other group was for non-whites (Darch & Underwood, 1999:288).

Fourie and Bothma (2006:470) described the digital divide as the difference between the haves and have nots. There are students who come from backgrounds where an abundance of information and technology is not always available.

The current non-segregated universities in South Africa will now have to make provision for the school students who come from disadvantaged communities. Academic libraries and departments will have to cater for information literacy training and resources to make provision for these students' needs, since libraries have the responsibility to serve all communities (Arko-Cobbah, 2004:265; Bothma, 2010:50). "As observed in 2007 (IFLA/FAIFE World Report, 2007:413) it is evident that universities in Africa are considerably better off in terms of Internet access than public and school libraries: approximately 60% of the countries offer Internet access at the two highest levels, which, in numbers, is approximately the same as in 2007, viz. 14 compared to 13. However, a third of countries still offer Internet access in university libraries at the lowest level (the same as in 2007)" (Bothma, 2010:10). The lack of internet access and sufficient information will have a huge impact on information literacy training and information resources.

Student-centred learning in the new South Africa requires that students are provided with more job skills to fulfil their roles in society. Librarians can play a positive role to train students from disadvantaged communities to use these new learning resources. Libraries are expected to fit into a new role of teaching and learning to enhance student-based learning (Arko-Cobbah, 2004:267).

According to Bundy (2004:6) the role of universities in assisting students to become information literate has received increasing attention. The academic library can be more than

just a store-place and should partner with academic departments to create an information-literate university (Breivik, 1999:71).

2.8 IDEAL OF AN INFORMATION-LITERATE CAMPUS

In conclusion, information literacy is a critical issue in developing countries, especially in tertiary education. “More than ever, in Kenya as in the rest of the developing world, with the increasing recognition throughout the world that proper use of information is a prerequisite for progress, library services should be regarded as an integral resource, and not merely an optional part of higher education. All university students, as well as the community at large, should be able to effectively obtain and use information whatever the source, location or format. For this to be possible they need to understand how information is structured and organised” (Kavulya, 2003:216).

Moreover, librarians need to collaborate with faculty, students and computer personnel in planning, designing and evaluating courses to ensure that the courses are customised to individual learners' ability to manage their own studies. It is also the responsibility of the library to ensure that the necessary information resources are available and can be accessed to aid the learning process (Arko-Cobbah, 2004:271).

The library instructor should look at the needs of students to enhance the learning experience of all students and to make students comfortable to use the library (Holiday & Qin, 2004:357; McMillen, Miyagishima & Maughan, 2002:389; Selematsela & Du Toit, 2007:121). In order to meet students' needs, it will be important to develop a variety of instructional programmes and to promote, market and manage different instruction manuals to fit the needs of the different library users.

The efforts of librarians need not only pertain to students, but can include campus-wide efforts to involve administrators and researchers. According to Stone *et al.* (2003:256) administrators, researchers and students should become information literate, which could result in an information-literate university. Librarians who are responsible for library instruction should also play a role in the attempt to achieve campus-wide information literacy (Johnston & Webber, 2003:3; Owusu-Ansah, 2005:368; Skow & Skcerbak, 2003:330). Attention should be paid to information-literate research, management for information literacy, the information-literate curriculum, information-literate students and graduates and staff development for information literacy (Johnston & Webber, 2003:3).

The concept of an information-literate university, as seen by Johnston and cited in Johnston and Webber (2003:348), is depicted in Figure 2.3.

Information literate campus



Figure 2.3: Johnston's visualisation of an information-literate university (as cited in Johnston & Webber, 2003:348)

An information-literate campus can lead to an information-literate university (Johnston & Webber, 2003:348). The following aspects will contribute to an information-literate campus: information-literate research, management of information literacy, information-literate staff, information-literate students and an information-literate curriculum in which the different teaching and learning methods are applied. Information literacy training is recognised as an integral part of undergraduate studies and can serve as the scaffold to higher graduation rates and effective research (Arko-Cobbah, 2004:270; Bothma *et al.*, 2011:12; Parker, 2003:326). Learning and teaching methods must be adapted to support the information economy. Student-based learning can facilitate an information-literate campus by creating knowledge workers rather than passive information seekers. Information and knowledge management can be applied in curricula to allow students to become knowledge managers, strategic planners and auditors in the information economy (Mearns & Du Toit, 2007:165; Ocholla & Bothma, 2007:154).

Concepts of information literacy clearly show that the information-literate person will have to be able to evaluate information, find information and search for relevant information. Information literacy is especially important to people in developing countries to create sustainable development in the knowledge economy.

2.9 CONCLUSION

Information literacy as a process has been reflected in this chapter. The process of information literacy is a complex series of events that is relevant to finding the right information at the right time. Certain models and standards exist to sustain the information-seeking process. The evaluation of different models and standards emphasises the importance of these models and standards as guidelines for the information seeker. Combining the different models and standards in a side-by-side view reflects the complex process of information seeking.

The added value of the combined standards and models might offer the information seeker new perspectives. It is clear that information seeking is not only an intellectual process but also an emotional one, with different levels of uncertainty. The uncertainty levels might decrease if the information seeker has a specific guideline to follow.

Knowing how to find relevant information and the combined critical thinking skills of an information-literate person will have a huge effect on students from school level to tertiary level. The circumstances of public libraries and school libraries in South Africa have an influence on the academic success of students. The combined skills of a fluent library user and information-literate person might lead the students to become lifelong learners with all the benefits of lifelong learning.

IFLA and the United Nations Educational, Scientific and Cultural Organisation are putting forward a strong case for information literacy to be recognised as a universal human right because of the empowering role that it plays in the lives of individuals (Britz & Lor, 2010:17). Academic libraries in South Africa will now have to cater for possible gaps in information literacy training and library instruction. The purpose of this study is to look at appropriate ways to give library instruction at academic libraries. One of the methods might be to cater for the different learning styles of students from the net generation. The purpose of the next chapter will be to look at game-based learning and its use for library instruction.

CHAPTER 3

3. GAME-BASED LEARNING

3.1 INTRODUCTION

In introduction it can be stated that the purpose of the study is to investigate whether a game can be used as an instructional tool during library instruction.

The literature study in chapter 2 focused on the importance of information literacy and information literacy training. The researcher deemed it important to investigate whether games can be pedagogically sound learning environments. This chapter will focus on a literature review of game-based learning and the pedagogical reasons for and principles of game-based learning.

A brief overview of game-based learning as an emerging technology will be given as an introduction to the topic. It will be important for the purpose of this study to look at examples of library games and library instruction in this chapter.

3.2 EMERGENCE OF GAME-BASED LEARNING

The emphasis of this study will be on computerised games, although game-based learning does not differentiate between games and can include a vast array of games such as simulation games, computerised games, role play and card games (Crookall, 2012:899; Klabbers, 2009:30).

Games for training have been around for centuries. Military games have been used as far back as the Roman Empire to plan for battles (McLeroy, 2008; Shubik, 2009:587; Smith, 2010:1). The use of military games 5 000 years ago has developed into computerised war games to train military personnel.

Flight simulators were used as far back as 1910 and their use increased in World War I and even more so in World War II (Clark, 2007). During the late 1960s hydraulics and digital computers came into play and were improved during the 1970s and 1980s. Flight simulators are now part of the games industry (Clark, 2006:5). Simulation games have the ability to

simulate the real world to players in academic context and in entertainment context (Magee, 2006:9; Squire & Patterson, 2010:13).

The use of simulation games as a new concept for training in the classroom started during 1960 (Klabbers, 2009:29; Mayer, Bekebrede & Wamelink, 2009:12; Ruben, 1999:498; Twelker, 1994:266). Simulation games were a novel idea for educational institutions that were used to one-way concepts of training. The concept sparked the interest of trainers as a new way to engage students (Ruben, 1999:501).

The *Horizon Report* (2011) stated that game-based learning was one of the emerging technologies of the next two to three years (*Horizon Report*, 2011). According to the *Horizon Report* (2011), game-based learning will have an effect on teaching and learning around the world. The fact that educational game-based software is not as far developed as commercial games might be a constraint on the use of educational games in the classroom (De Aguilera & Mendiz, 2003:4; *Horizon Report*, 2011; Rabin, 2005:35).

Several initiatives were started to develop the concept and research of game-based learning. The International Simulation and Gaming Association was founded in 1970 to support game developers and designers. Several international conferences have been held since 1970 (Klabbers, 2009:30; Mayra, 2008:5). Training and design are some of the focus areas of the International Simulation and Gaming Association.

The Association for the Study of Play (2012) was founded in 1973. The association is primarily for academia to do research on the effect of play and play behaviour and learning. The Digital Games Research Association supports researchers in games studies. Special interest groups are looking at the experience of game players, role playing and accessibility of games.

The Woodrow Wilson Centre started to use the term serious game-based learning in 2002 (Susi, Johannesson & Backlund, 2007:3). Several educators see game-based learning and serious games as the same concept. The purpose of the initiative is to discover more possibilities for the use of games for management and training.

Futurelab (2011) focuses on the pedagogical influence of serious game-based learning. Research has been done on the effect of games on learning. Futurelab (2011) has developed and maintains a strategic plan for game-based learning.

The software company Systyms, Applications and Products in Data Processing (SAP) (2010) initiated the concept of simulation games for training in South Africa. SAP hopes to drive the fun concept of game-based learning for businesses.

The Shuttleworth Foundation (2012) emphasises the importance of research for game-based learning in South Africa. The Shuttleworth Foundation's advice is that teachers and game developers must cooperate to create games for education in the South African perspective.

Foko and Amory's (2008:5757) presentation, 'Social Constructivism in Games Based Learning in the South African Context', advocates the importance of games as problem-solving tools for learners in South Africa. Different educational institutes are taking part in the experiment in South Africa to test the effectiveness of games for disadvantaged institutions.

3.3 CRITERIA FOR AN EDUCATIONAL GAME

The literature review in this chapter will be based on the research problem and sub-questions of the research problem.

Section 1.2 of Chapter 1 stated the research problem of this study.

Certain questions were asked to address the research problem. One of these questions was: What are the criteria for designing an educational game?

Two separate frameworks will be used in this study, namely an information literacy model framework and a framework for the criteria for game-based learning. The information literacy framework was addressed in the literature review in Chapter 2. Chapter 3 will address the literature review of the criteria for game-based learning. Instructional or educational games involve an activity performed by the player to learn about a certain subject. Entertainment games, on the other hand, focus on the play aspect defined by the rules of a game (Connolly, Stansfield & Boyle, 2009:3).

The framework for game-based learning might help to focus research on some of the criteria needed to develop a successful game (O'Neil & Perez, 2008:5).

The key criteria to be selected for the purpose of this study will be based on research done in game-based learning. A diagram of the framework can be seen in Figure 3.1:

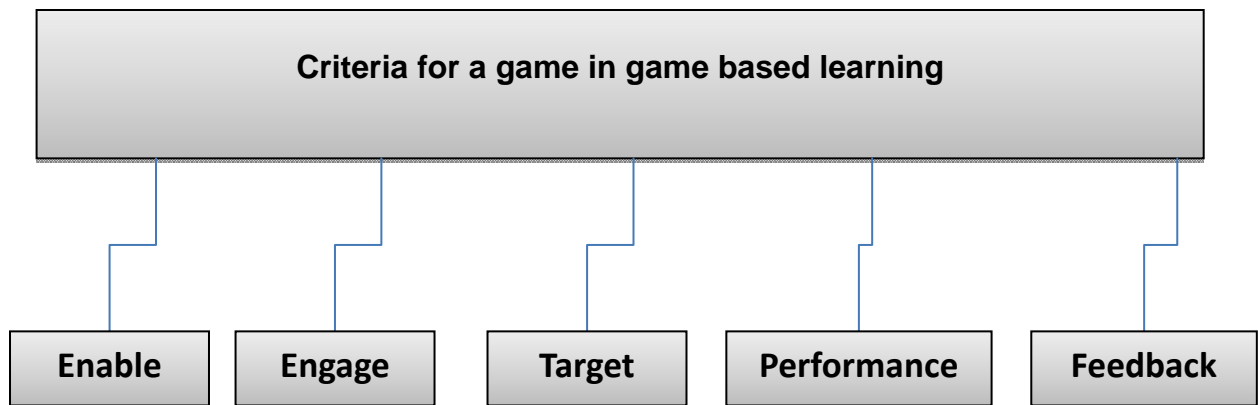


Figure 3.1: Criteria in game-based learning developed by the researcher

Games can be effective tools for teaching if the criteria described in the following sections are applied.

3.4 GAMES SHOULD ENABLE PLAYERS

Learning is a change in human behaviour that can lead to certain capabilities (Gibson, Aldrich & Prensky, 2007:26). Capabilities make human performance possible (Connolly, Stansfield & Hainey, 2009:257).

Learners should be empowered in the game to enable them to apply certain capabilities and skills (Clark, 2006; Connolly, Stansfield & Hainey, 2009:253; Gee, 2004a:17; Kozdra, Haunstetter & King, 2006:520; Liu *et al.*, 2011:1908; Barab *et al.*, 2005:87).

The paradox of skills is that people do not like practising skills over and over again, since they find it meaningless, but without the practice they cannot get good at what they are doing. People learn when they see a set of related skills as a strategy to accomplish goals (Dziabenko & García-Zubia, 2011:1103; Gee, 2004a:21; Markey *et al.*, 2008:30; Smith, 2010:7).

Games can enable players to increase cognitive skills and acquire new knowledge (Wouters, Van der Spek & Oostendorp, 2009:232).

3.4.1 Problem-solving

Although the word “game” usually refers to entertainment, the core of games is challenging practical activities, such as planning, problem-solving, coordinated interaction and analysis

(De Azevedo Filho & Latham, 2006:2). Educational games can be challenging and include activities such as planning, problem-solving, interaction and analysis, while still being entertaining (Barton & Maharg, 2007:115; De Azevedo Filho & Latham, 2006:2).

In games players can practise to reach the goal that they want to accomplish. Skills are first and foremost a strategy for accomplishing a goal and secondly a set of discrete skills. According to Spires *et al.* (2011:457), problem solving is part and parcel of game-based learning. The application of problem solving can be seen as an important life skill (Gee, 2004a:21; Kim, Park & Baek, 2009:808; Papastergiou, 2009:8; Spires *et al.*, 2011:458).

- Game-based learning can be a good vehicle for problem-based learning where the problem is based on a certain context to provide stimuli for the learner. Players “play” the problem in the game (Ebner & Holzinger, 2007:875; Ngai, Lam & Poon, 2011:2).
- Problems in a game should be designed to lead to solutions that can work. Problems should therefore not be too complex or too open or “free-form” to make it too difficult to find a solution. Games should be applicable to the curriculum and enable the player to reach the desired effect (Whitton, 2007:1066).

Ebner and Holzinger (2007:876) define the engineering game, “Internal Force Master”, as an engineering game with well-ordered problems in different steps. “Defense of the Hidgeon” is a good example of a library research game where players are allowed to face research problems early on in the game (Markey *et al.*, 2008:1).

3.4.2 Systems thinking

Systems thinking can be seen as an important skill for the 21st century (Prensky, 2005:2, Shute, 2011:504; Strachan, 2011:3). Certain problems can no longer be solved unilaterally. Everything is connected to everything else. Environmental problems are an example of one system that is connected to many other systems. It is therefore important for learners to become competent in systems thinking. Games can be an ideal opportunity to enable learners to become systems thinkers.

- People learn best and their experiences are enhanced if they see how strategies fit into larger systems as a meaningful whole. Experience is enhanced if they understand the process. The real world experience of games can help to simplify systems (Gee, 2004a:22; Livingstone *et al.*, 2009:37). The immersive environment puts the player in the real world to combine problem-based learning with the

scenarios in the real world (Livingstone *et al.*, 2009:41). Games can help people to see how elements fit into the overall system (Gee, 2004a:22; Livingstone *et al.*, 2009:45).

- Systems thinkers see the whole picture and not just part of it. The whole system becomes interdependent and not a standalone version of the problem. The effect of problems and not only the problem itself will be experienced. A person can become part of the system and does not experience the problem from afar. That is why it is important that an avatar becomes part of the game world to experience the interdependent scenes of a game (Sweeney & Meadows, 2010:2).
- Games should be a fish tank experience that allows learners to understand complex systems (Gee, 2004:20). Fish tanks will enable the player to simplify complex systems because he is playing in a scaled-down version of the complex system of the real world.
- Combining an information literacy standard or model with a game might also enable the player to apply systems thinking. The player will now be able to see each step in the information literacy model or standard in a different scene. The player will be able to see how the different steps in the whole model are related (Eisenberg, 2008:42). Marcum (2001:97) sees the co-operation between users, information workers and departments as part of a whole system as well.
- Systems thinking skills can help to solve different problems, for example ecological problems that are interconnected to one another. Shute (2011:512) used a fishing village and its interrelated problems as a good example of systems thinking. The ecological system and socio-economic system must be taken into consideration when designing a game that enables the player to apply systems thinking. Learners will become less daunted by a complex ecological system if they see the interrelatedness of the system. Systems thinking can develop a learning opportunity for learners if they start to appreciate the connections between different systems (Shute, 2011:513; Strachan, 2011:3).

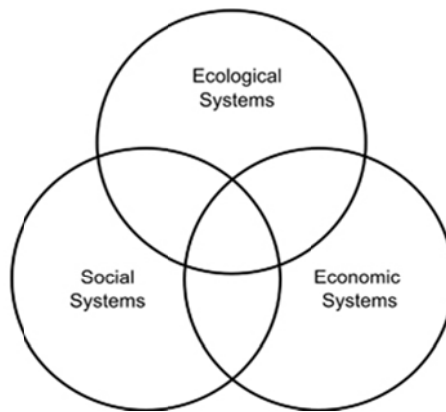


Figure 3.2: Diagram of systems thinking by Strachan (2011:4)

- Systems thinking is one of the important skills for information literacy and lifelong learning. Systems thinking can provide a helicopter viewpoint of the different search engines and information sources. The helicopter viewpoint can prevent the learner from having a narrow viewpoint of the possibilities of different information sources and systems (Coffield, 2002:41; Marcum, 2001:97; Tomic, 2010:30).

The game “Rise of Nations” can be seen as a good example of systems thinking (Gee, 2004a:21).

3.5 GAMES SHOULD ENGAGE PLAYERS

The potential of games to engage players is widely propagated. Some of the engaging effects of games on players can be motivational, interactive and, fun and can enhance the flow of the game (Clark, 2006:21; De Azevedo Filho, 2006:4; Gee, 2003:8; Facer *et al.*, 2004:400; Oblinger, 2004:2; Rapeepisarn *et al.*, 2008:498).

3.5.1 Engagement and flow

The skill of the player and interaction between the player and system can create flow that can engage the player in the game. Flow can be translated into immersive learning (Cowley *et al.*, 2008:2). Elements in flow can be manifested in computer games. The importance of flow in a game cannot be over-estimated. Without flow there is no game (Wouters, Van der Spek & Oostendorp, 2009:245).

Passionate engagement can include skill, challenge, and involvement and time (Connolly & Stansfield, 2007:120; Prensky, 2007:3; Sommerville Healey School, 2012). Passionate involvement can influence the flow and optimal and pleasing activities experienced by

individuals with engagement, less stress, concentration and a sense of time distortion (Refiana, Mizerski & Murhphy, 2005:108).

A number of aspects need to be considered to ensure flow in educational gaming. Cowley *et al.* (2008:4) and Jones (1998:21) identify eight elements contributing to flow during game playing. If the first element is that the game is seen as a task that the player must complete, the ability to concentrate on the task, clear goals, feedback, involvement and a sense of control are necessary. If these elements combine to create flow in the game, concern for self disappears during play.

Simplicity and clarity are also important in games. Endless instructions may disrupt the flow of the game (Ebner & Holtzinger, 2007:874). Markey *et al.* (2009:313) refer to interruptions and their effect on game play during the game, “Defense of the Hidgeon”. The positive effects of game playing can be lost if the flow in the game is not effective. Flow can produce positive emotions, reduce stress and possibly distort time for the player (Refiana, Mizerski & Murphy, 2005:6). The flow process in a game will also be influenced by the game system, the user and the experience of the user (Cowley *et al.*, 2008:2).

The inter-relationships among user, system and experience (USE) are shown in the USE diagram (Cowley *et al.*, 2008:2).

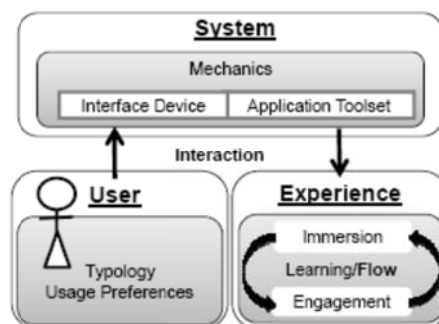


Figure 3.3: USE systems model (Cowley *et al.* 2008:2)

The game structure can be seen as a formal or semi-formal information system and relates to the player’s experience. Player experience may influence the flow of the game. The experience of players can influence the feelings and emotions they may have during the game (Cowley *et al.*, 2008:3; Kiili, 2005b:305). The user’s ability to interact with the interface of the system might have an effect on the flow of the game. The application toolset of the

system will influence immersion and engagement to improve the flow in the learning process (Cowley *et al.*, 2008:4).

A player can be so involved in a goal-driven activity that nothing else seems to matter (Cowley *et al.*, 2008:24; Kiili, 2005a:14; Refiana, Mizerski & Murphy, 2005:3). “The amount of time today’s young people spend playing computer and video games estimated at 10,000 hours by the time they are 21 and often in multi hour bursts – belies the ‘short attention span’ criticism of educators” (Prensky, 2003b:21) The risk of overloading a player’s memory is also high because a rich multimedia element is involved (Kiili, 2005b:303).

3.5.2 Engagement and motivation

The potential of game-based learning to motivate is widely propagated (Clark, 2006:21; De Azevedo Filho, 2006:4; Gee, 2003:8; Joiner *et al.*, 2006:68; Oblinger, 2004; Rapeepisarn *et al.*, 2008:498). According to Prensky (2006:20), educators are not always willing to change their attitude to make learning fun. Students can experience learning content as boring or dry and technical. This may have a negative impact on their willingness to learn. According to Small, Zakaria and El-Figuigui (2004:98), educators will have to understand what motivates students during the learning process.

When exploring motivation in education, Clark’s (2006:20) warning, however, needs to be noted: there is a danger of dehumanising learners and reducing them to objects that need to be manipulated. Educators realised that fun, immediate feedback and engagement can be embedded in games to improve the educational system and the confidence and motivation of learners (Gee, 2003:19; Malone, 1981:334; Oblinger, 2004:12; Squire, 2005:77). Motivation therefore features very strongly in guidelines for educational success, as well as reports on educational programmes (Ebner & Holzinger, 2007:875). Sawyer (2006:50) and Barab *et al.* (2005:88) argue that educational tutorials will not be successful if they lack motivation.

Motivation can be intrinsic or extrinsic (Dickey, 2007:254; Jones, 1998:205; Long, 2007:279; Small, Zakaria & El-Figuigui, 2004:98). Intrinsic motivation takes place when there is no obvious incentive for a person to do something. Extrinsic motivation takes place when a person is rewarded. Rewards can take the form of money or prizes (Small, Zakaria & El-Figuigui, 2004:100). Extrinsic motivation comes from outside the performer.

Participating in the game might allow players to become part of the learning process. Active participation can influence the motivation of the player from extrinsic to intrinsic motivation (Kiili, 2005a:17). In educational contexts it seems as if intrinsic motivation may be more effective. Curiosity can serve the purpose of motivating students intrinsically and enabling them to become lifelong learners (Small, Zakaria & El-Figuigui, 2004:117). The player is more motivated if he has more autonomy and fun. Factors that influence the intrinsic motivation of a game player can be fun, problem-solving, creativity, using skills and learning new skills (Long, 2007:285). The diagram in Figure 3.4 depicts these factors in more detail.

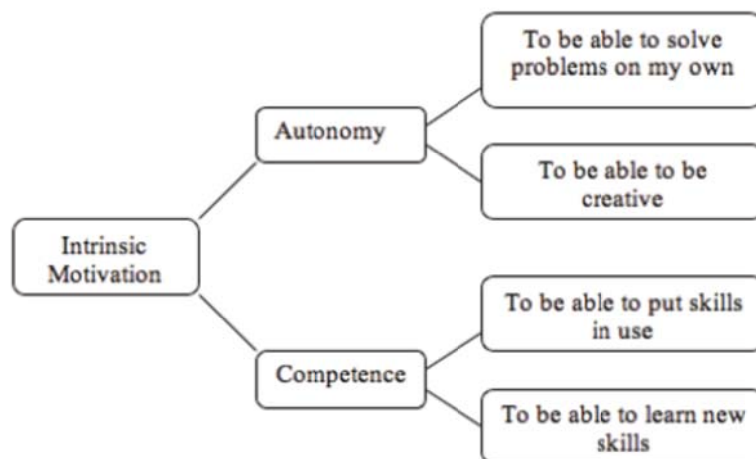


Figure 3.4: Factors that influence intrinsic motivation (Long, 2007:285)

The diagram in Figure 3.4 seems to underline that intrinsic motivation during game play can enable players to solve problems and learn new skills. Motivation can give players the autonomy to be able to solve problems on their own and apply new skills.

Advice on ensuring motivation in game-based education includes that the target group must be able to identify with the contents of the game and be allowed to interact by trying, failing and correcting (Dator, 2004:206; Ebner & Holzinger, 2007:875).

“Motivation is the most important factor that drives learning. When motivation dies, learning dies and playing stops. Since good games are highly motivating to a great many people, we can learn from them how motivation is created and sustained” (Gee, 2003:3).

3.5.3 Engagement and relaxation

Prensky (2001:111) describes the influence of relaxation during game play as follows: “It appears then that the principal roles of fun in the learning process are to create relaxation

and motivation. Relaxation enables a learner to take things in more easily, and motivation enables them to put forth effort without resentment” (Prensky, 2001:111). The fun and relaxation aspect in games are very important because these will engage students in the learning process and give enjoyment and pleasure (Barab *et al.*, 2005; Dator, 2007; Ebner & Holzinger, 2007:84; Jones *et al.*, 2010:730). Ebner and Holzinger (2007:878) looked at the “fun” aspect of a game students played during an engineering class. “The experimental finding supports the efficacy of game playing. Students enjoyed this kind of e-learning” (Ebner & Holzinger, 2007:887). The fun aspect in the new approach to teaching will apply not only to learners but also to all the role players in education (Prensky, 2001:4).

Fun during information literacy training can be just as important (Doshi, 2006:15; Small, Zakaria & El-Figuigui, 2004:98). Armstrong and Georgas (2006:493) looked at the fun aspects of interactive technology during information literacy training and described it as “the icing on the cake”. Playing a game can offer players intense and passionate involvement. The brain can experience play as learning (Prensky, 2001:6; Van Eck, 2006:17). Good learning takes place when people are playing good games (Gee, 2003:199). The fun aspect in a game might also lead to subconscious learning. Incidental learning takes place when the player learns on a subconscious level. The complexity level of the game will have an influence on the incidental learning in the game (Ebner & Holzinger, 2005:4). Ebner and Holzinger (2005:15) demonstrate subconscious learning in an image created for this purpose, which is depicted in Figure 3.5.

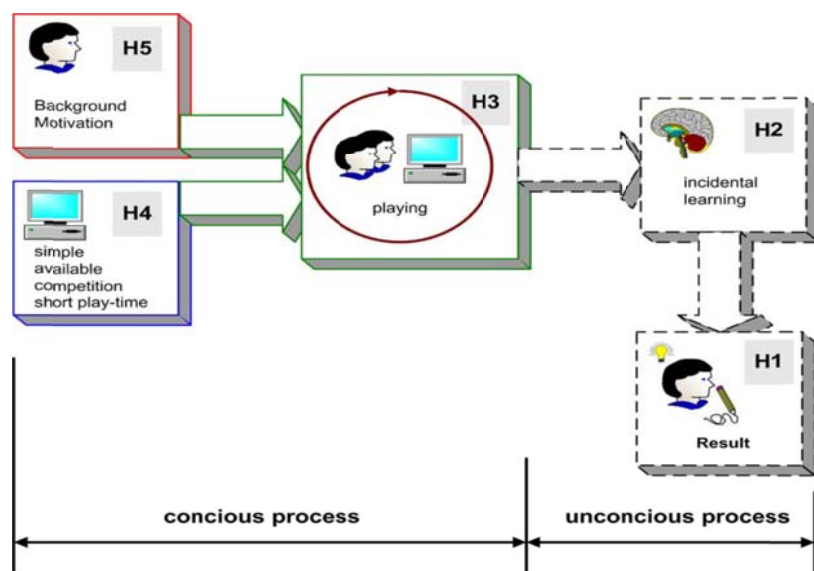


Figure 3.5: Diagram of incidental learning during game play (Ebner & Holzinger, 2005:15)

During incidental learning the player might get new information that was previously unknown.

3.5.4 Engagement and interaction

Games have the potential to be interactive and learner-centred and to ensure that control is not taken away from the learner (Clark, 2006:19). Furthermore, “Games allow players to be producers and not only consumers” (Gee, 2003:2). The learner can thus become involved and positioned in the game. Interaction is also related to learner-centredness because the learner is represented by the avatar in the game (Oshita, 2006:2). Learners are allowed to make their own choices during game play.

Interactive learning can take many different forms, depending on the learning goals. The purpose of serious game-based learning is to educate, assess, gain learners’ attention and improve interaction (Connolly, Stansfield & Hailey, 2011:1390). The interaction process is part of the “doing” during game play and is considered crucial to game-based learning. Digital game-based learning is appropriate for doing and learning (Prensky, 2006:2; Sawyer, 2006:43). Teachers do not have to tell; learners can learn by doing what they are supposed to do in the game. In this type of interactive learning the learner is expected to make different choices (Prensky, 2001:9). The target group, the task and the mission of the game and the objects in the game should be considered when designing a game (Kiili, 2005a:15). Robertson and Howells (2008:570) and Kangas (2010:14) highlight the importance of doing as an example of how children learn when they create and co-create their own games. The possible actions in games are also of great importance. Learners can do while they play.

The interactive structure of games requires players to concentrate on struggling toward a goal (Bjork & Holopainen, 2003:132). Interactive learning objects are important in goals to create more interaction and engagement by the players (Ebner & Holzinger, 2007:873; Nowak & Rauh, 2008:1476). Good examples of this type of interactive learning are offered by Prensky (2003:18). Learning can take place through failing and trying. Creative learning and learning from mistakes take place when the learner tries and fails during the process (Kafai, 1995; Robertson & Howells, 2008:560).

Interaction is also related to learner-centredness because the learner is represented by the avatar in the game (Oshita, 2006:2). Players can choose avatars to act on their behalf (Nowak & Rauh, 2008:1475). The two-way interaction between player and game can increase the attention span of the player (Pivec, 2006:27). Gagné and Medsker (1996:139) describe learners’ attention as a sense of alertness to rapid changes in stimuli.

Once learners' attention and reception have been gained, the game appears to be playing itself, for instance games in arcades. Learners can be stimulated by auditory or visual stimuli of the game that appears to play itself. Research has proven that games can capture the visual selective attention of a player (Green & Bavelier, 2006:1466; Kiili, 2005a:15).

3.6 GAMES AND TARGET GROUPS

The importance of the target group cannot be underestimated; the needs of the target group must come first. Understanding the target group will contribute to the success and innovation of the game (Kerr, 2002:3; Prensky, 2007:16; Schell, 2008:6). Great care must be taken to accommodate the target group when designing a game. Considering the needs of the target group and the age group and background of members will influence the learning process. Game designers will have to listen to their clients' needs or stand a chance to lose the client (Schell, 2008:7). It is important to test the game within a representative sample of the target group (Gerling & Masuch, 2011:4; Kerr, 2002:4; Liarokapis & De Freitas, 2010:190; Schell, 2008:10).

Designers should custom-tailor the game according to age (Greenberg *et al.*, 2010:241; Whitton, 2009:26). Whitton (2007:1064) highlights the necessity to accommodate adult learners when creating a game. Higher education students will have different needs from primary education students. It is important to have a clear goal for adult learners. Game designers will have to consider the fact that it will be their responsibility to have a goal when they create games. Experiences in the game design must fit the target group (Schell, 2008:10).

According to Dator (2007:205), 21st century learning is learner-centred and fun. It might therefore be important to cater for the new learning needs. Game creators will have to keep the following aspects in mind to be able to cater for a target group:

3.6.1 Characteristics

Students' needs have changed, but their need for education has not (Stone *et al.*, 2006:120). Educators must therefore adjust to the characteristics and learning needs of students (Kennedy *et al.*, 2008:109; Kiili, 2005a:14). Although the field of education is considered part of the permeation of technology, there have been suggestions that the educational field does not make enough use of the potential of educational technology, for example by using the interactivity of games to improve the e-learning experiences of students (Connolly & Stansfield, 2007:203). Arguments that have been advanced in this

regard include those of Gee (2003:2) and Squire, DeVane and Durga (2008:243), who state that games are an emerging technological medium shaping contemporary theories of learning and instruction. Instructional designers should make special provision for the way generations learn (Feiertag & Berge, 2008:458; Gibson, Aldrich & Prensky, 2007:10).

People belonging to the net generation were born in or after 1982 and often exhibit different characteristics from students who were born just a few years before 1982 (Oblinger, 2004:1; Prensky, 2006:28). The following aspects will influence the learning behaviour of the net generation:

- The net generation prefers technology, speed, collaboration, experimental learning, multimedia and multitasking. The net generation prefers to apply, create and experiment with learning material (Gee, 2003:2; Ghaith, 2010:489; Stevens, 2007:349; Whitton, 2009:1063).
- The fast-changing speed of the internet and online games, multitasking and the rich media text of games might fit the learning behaviour of the net generation. Boring lecturers do not fit into the framework of the game players of today (Gibson, Aldrich & Prensky, 2007:3; Prensky, 2001:4; Prensky 2007:26; Schell, 2008:445).
- Instant feedback is an important issue for the net generation because they prefer to get results as fast as possible (Berk, 2009: 23; Ghaith, 2010:489; Prensky, 2006:29; Schell, 2008:230).
- The digital natives or net generation of today are used to the digitally rich world of the web and visual learning. The net generation's learning behaviour can be different from that of their predecessors (Felicia & Pitt, 2009:132; Prensky, 2006:28; Whitton, 2009:18).
- Previous generations might have problems when teaching the net generation, because their attitude to technology and visual learning might be different. Prensky (2006:29) refers to those with different preferences than the net generation as digital immigrants. One of the characteristics of digital immigrants is their preference for printed information rather than online information (Abram & Luther, 2004:35; Bennet, Maton & Kervind *et al.*, 2008:776; Buschman, 2009:95; Prensky, 2006:30; Van Eck, 2006:2).
- Several calls have been made that education should be adapted to meet the needs and expectations of the net generation. "Change your teaching style. Make blogs, iPods, and video games part of your pedagogy. And learn to accept divided attention spans. A new generation of students has arrived - and sorry, but they

might not want to hear your lecture for an hour” (Carlson, 2005:1). Game designers will have to be innovative and creative (Schell, 2008:3).

- Libraries will have to cater for the needs of the net generation. Doshi (2006:15), Small, Zakaria and El-Figuigui (2004:98) and Leach and Sugarman (2005:196) warn against the danger of continuing on the same path with one-dimensional tutorials for information literacy and the same often boring presentation styles of some librarians. “Therefore, to interface successfully with Gen-D, librarians, together with teaching faculty and staff, must adopt and become adept at key learning technologies themselves; in other words, educational facilitators must keep apace technologically with their students” (Shih & Mills, 2007).

Educators have warned against the danger of generalising the attitude to the so-called net generation. Great care must be taken not to assume everybody belonging to the net generation prefers games (Berk, 2009:23; Hargittai, 2010:93). Rowlands *et al.* (2008:300) argue that although the net generation may prefer visual information, text remains an important source of information. Bennet, Maton and Kervind (2008:767), Robinson (2008:71) and Ghaith (2010:489) warn against the danger of assuming that all students of the net generation are on equal footing with technology and necessarily have the same characteristics. Games do not have a motivational effect on all students. More research will be necessary to see if games really teach what they are supposed to teach (Roodt & Joubert, 2011; Whitton, 2009:1066). The game player will not benefit pedagogically if the game is not created in the right context.

Libraries have clients from different generations with different needs and experiences (Abram & Luther, 2004:3; Bennet *et al.*, 2008:67; Buschman, 2009:96; Jones *et al.*, 2010:732). Some students may be inexperienced and will require more training (Kennedy *et al.*, 2008:110). For this study it will be necessary to look at both sides of the coin, the experienced game player and the player with less experience.

3.6.2 Identity

Lack of personalisation is one of the main problems with traditional learning (Gee, 2004:17, Santally & Senteni, 2005). This is sometimes also mentioned with regard to e-learning environments. Personalisation can be a problem for the learner in the normal learning environment (Seeney & Routledge, 2009:275).

Game-based learning can allow the player to take on a new identity (Greco, 2009:165; Kim, Park & Baek, 2009:805). In game-based learning a player's experience can be adaptive and personalised with the use of avatars. Avatars can be seen as electronic images that represent computer users (Kim, Park & Baek, 2008:2). The use of avatars can make game playing very personal, with the player feeling that he himself is represented in the game. Such a personal experience can make the player part of the learning process. The avatar itself is then the vehicle through which the participant interacts with the environment and a possible real world experience (Barab *et al.*, 2005:94; Tang, Hanneghan & Rahlibi, 2009:3). Users can sometimes be allowed to choose their own avatars and first person or third person view at the beginning of a game (Nowak & Rauh, 2007:480; Oshita, 2006:14; Soeffner & Nam, 2007:1613).

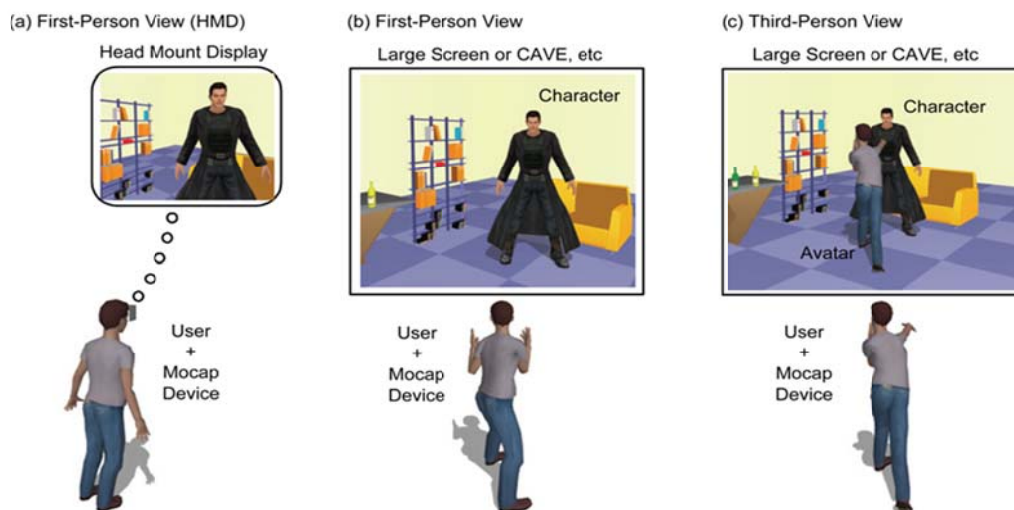


Figure 3.6: First and third person views in a game (Oshita, 2006:14)

Such a difference between first person view and third person view has been considered by Oshita (2006:14), and is depicted in Figure 3.6. In third person view the player watches himself as the player and becomes more immersed in the game. Some players might feel uncomfortable with the angle of the camera viewpoint when the camera angle is set on first person viewpoint (De Freitas, 2009:227).

Personalisation can improve the effectiveness of the user's actions and make technology 'my technology' (Jacucci, Oulasvirta & Salovaara, 2007:2). The role of the avatars might have an influence on the net generations' choice to play games, owing to their interest in learning more about new technology (Valtonen *et al.*, 2011:212). Games inherently involve action. The more the player can manipulate a game, the more the player can invest in the

game world. Good games offer characters and storylines so that the player can move effectively through the game world (Gee, 2004:19).

If players take on a new identity they invest heavily in what they are doing. Deep learning requires an extended commitment. Perception and action are deeply inter-connected for humans. When people manipulate robots it causes humans to feel that their imagination and brains have stretched into a new sphere. Humans feel empowered when they can manipulate tools (Gee, 2004:18; Oshita, 2006:16). Games offer players identities that trigger an investment on the player's part. Some games have characters that players want to inhabit and into which they can project their own fantasies. Avatars can allow players to take on a new cultural identity that might enable them to understand different cultures. New identities can be useful in almost any subject (Gee, 2004; Greco, 2009:168; Roodt & Joubert, 2011; Valtonen *et al.*, 2011:212; Zheng *et al.*, 2009:502).

Players can play a role during games. The player can play his/her own character in a game or take on a different character. The player takes control of the character that he/she represents during the game (Greco, 2009:158). Role playing can be a safe environment for the player to experience the position of different roles in different scenarios.

Role playing can be used to master soft skills such as interviewing skills through role playing. Role playing can make the learning relevant for the player to apply the learning in the real world (Huang, 2011:704; Jong *et al.*, 2010:206; Wright, 2002:384).

An example of a game where the player takes on a new identity is "Metal Solid Gear" (Gee, 2004:18).

3.6.3 Learning styles

Salinas (2008) considers the paradigm shift in educational technology. The empowerment of the learner is central in new educational technologies such as games, because the learner can now control the learning environment and be active in the process.

The learner's uniqueness is emphasised through this process. "The traditional teacher-centred models have to change to development models that will empower the student, making the computer a learning tool, not a technological 'frisbee'" (Salinas, 2008:654). Felicia and Pitt (2009:137) refer to the possibility that learning and motivation can increase, if

provision is made for the learning styles of the player. Tools to that effect have been developed where the personality of the learner will fit his or her learning style.

People have different learning styles and can become better learners if they have a say in their own learning process (De Boer, Bothma & Du Toit, 2011:74). Players should also be encouraged to use new and different learning styles during game play (Gee, 2004:18).

Learning styles are an important variable in choosing the appropriate game for each learning style (Felicia & Pitt, 2009:139; Kafai, 1995:7; Rapeerisarn *et al.*, 2008:498). Learning styles are the methods by which people prefer to receive information. “Each person has his or her own way of converting, processing, storing and retrieving information” (Rapeepisarn *et al.*, 2008:498). Prensky (2005) and Rapeepisarn *et al.* (2008) looked at the relationship between learning style, game playing and computer usage. The learning styles of pragmatists, theorists, reflectors and activists were compared. This is reflected in Table 3.1.

Learning styles	Behaviour when playing game	Behaviour when using computer	Learning activities	Possible game genres
Activists	Prefer working as a team, being a group leader, Be able to brainstorm to solve the problem	Like to use shortcut key-combinations but will also find the toolbar buttons useful.	<ul style="list-style-type: none"> • Practice • Imitation • Work with other • Tackle problem 'head on' 	Multiplayer interaction, action game, role-playing game
Reflectors	Go through the important data in the game, follow the instructions, spend a long time before make decision, not to lead the game	Prefer to use dropdown menus but will soon discover what is best for themselves, like to browse through SEARCH FOR HELP in the HELP menu	<ul style="list-style-type: none"> • Observing • Feedback • Graduated task • Work alone at their own pace 	Concentration game, adventure game, simulation game
Theorists	Go through the data and follow the instruction before start the game, be able to give careful thoughts when choosing the game elements, Formulate good strategy to defeat the enemy	Often use dropdown menus to see what else the application can do, like to browse through the INDEX or SEARCH FOR HELP in the HELP menu	<ul style="list-style-type: none"> • Logic • Understanding Principle • Analyse & develop plan • Explore relationship between things 	Strategies game, simulation game
Pragmatists	Follow closely the instructions & strategies that were mentioned in the briefing, believe they can play better if they were given proper instruction, Show a great interest in puzzle game and dislike role-playing game	Probably use the toolbars buttons to get things done, often find HELP menu to get things done	<ul style="list-style-type: none"> • Experimentation • Asking question, • Try things out • structure plan with definable purpose 	Puzzle game, building game, constructing game, reality testing game, detective game

Table 3.1: Comparison between learning styles, computer use and game genre (Rapeepisarn *et al.*, 2008:506)

Rapeepisarn *et al.* (2008:506) evaluate the behaviour of students when playing a game, and the players' behaviour when using a computer to follow Prensky's learning and games style. The framework in Table 3.1 gives a comparison between learning styles in computer use and the game genre (Rapeepisam *et al.*, 2008:506).

Poyner (2005) looked at the importance of learning styles during information literacy training. People with different learning styles will react differently in class. Poyner (2005) also recognised the different learning types as practical, theoretical, reflective and pragmatic.

Gibson, Aldrich and Prensky (2007) looked at the different intelligences and game-based learning. Different intelligences may play a role in game-based learning and the customisation thereof. Gardner's theory of multiple intelligences was used in connection with game play (Gibson, Aldrich & Prensky, 2007:36-38). These include:

- Linguistic intelligences: use written and spoken elements
- Musical intelligence: sound effects in games are important
- Logical-mathematical intelligences: prefer puzzle games
- Spatial intelligences: prefer highly visual games
- Kinaesthetic intelligences: prefer games where players are immersed in the game
- Intrapersonal intelligences: prefer games with various skills
- Interpersonal intelligences: prefer games with multiplayer modes
- Naturalistic intelligence: prefer games with fauna and flora.

Learning styles have an influence on the information-seeking process and the way in which people prefer to receive information (Felicia & Pitt, 2009:141). Felicia and Pitt divide the different information seekers into careless, loners, social, structured and emotional information seekers. Careless information seekers are spontaneous during the information-seeking process. Confirmation of previous knowledge during information seeking will have an influence on the introvert. Innovative information will have an effect on social or extrovert information seekers. Structure will be important to the contentious information seeker. The emotional seeker will be influenced by negative facts in the information-seeking process (Felicia & Pitt, 2009:142).

The University of Pretoria did research about the theory of whole brain learning in order to determine the value that it will have for information literacy training. The conclusion was that

individual learning styles should be taken into consideration to create the best learning opportunities (De Boer, Bothma & du Toit, 2011:74).

“Rise of Nations” allow players to manipulate the game to fit their learning style and ability (Gee, 2003:2).

3.6.4 Context

The value of the game can increase if the game is customised for a specific target group. The context in the game must be of value to the target group.

Context in game-based learning can be defined by the different scenes created in games. Learning is more successful if the context in the game is complementary to the learning topic (Van Eck, 2006:18). Lots of information out of context can be a problem for humans. Humans use verbal information best when it is given “just in time” for them to put it to use. Memory is context-dependent, with accepted points of reference and comparison, which can be a model, a discipline or an event (Wang & Ahmed, 2003:8). Information received out of context can relate to memory loss (Gee, 2003:3). Contextualised clues in a game world can help with recall in the learning process. Stimulating recall of prior learning can promote retrieval of previously learned material. Recall is associated with an experience, or things learned or discovered during previous learning or previous scenes or context in a game. Recall of facts can be seen as a first step in the learning process (Gagné & Medsker, 1996:143; Kebritchi & Hirumi; 2008:1737; Leach & Sugarman, 2005:200).

Game worlds can give the context for learning, be it a hospital, airport or medieval village (Clark, 2006:26). Games are effective because they can take place in a meaningful context where the information can be applied within context (Prensky, 2001; Van Eck, 2006:3). De Freitas (2008:3) emphasises the importance of correlating the virtual world with the players’ context. Virtual worlds in educational context must improve the players’ learning experience. Learning that takes place in the right context is more effective than learning that takes place outside the context of the learning environment (Van Eck, 2006:4; Yusoff *et al.*, 2009:22).

Virtual worlds can be part of the learning management systems that are used by many universities. The context of the game can make provision for the curriculum of the higher education student and enable students to do problem-solving within their specific context (Livingstone *et al.*, 2009:35). “Sloodle” is a perfect example where “Second Life” was embedded in the learning management system Moodle (Livingstone *et al.*, 2009:41).

3.7 PERFORMANCE AND GAMES

The performance of the player in the game can be influenced by different aspects. The educational guidelines include meaningful goals, structures and scoring, difficulty levels, surprise factors and fantasy story lines.

Enhancing retention and transfer (i.e. providing opportunity/stimulus for generalisation) and moving through levels within a single game require skills, knowledge and strategies to overcome obstacles. Retention is the ability to reproduce learner behaviour after a period of time (Gagné & Medsker, 1995:149). Enhancement of performance during game play can entail the finding of certain objects and student's knowledge can increase by finding these objects (Marty, Carron & Heraud, 2009:55). Gee (2005:37) refers to the fact that games allow players to accomplish results before they can apply what they learned, because the performance is part of the learning process.

3.7.1 Goal of the game and performance

It is appropriate to explain the objective at the beginning of the lesson to inform learners about the purpose of the game (Dickey, 2007:268). Goal-based learning can elicit good performance and help to motivate learners, because they have to follow rules and regulations to reach a certain goal (Dickey, 2007:267; Ebner & Holzinger, 2005:875; Huang, 2011:695; Schell, 2008:286). The player will have to know why he is playing the game, or he will lose interest in the game.

Goals in computer games differentiate them from normal games and give structure to the game (Gee, 2004:4; Pivec *et al.*, 2003:4; Shaw, 2004:86; Van Eck, 2006:9). The goals in the game are a big part of what is motivating the player. The goal to finish the operation should keep the player motivated and help him to concentrate on the facts. One of the perspectives for the goal of the game must always be pedagogical outcomes (Van Eck, 2006:3). The game can be augmented by instructional activities that preserve the context of the game by extending its goals (Van Eck, 2006:8). Tang, Hanneghan and Rhalibi (2009:5) refer to the difference between computer games for relaxation and educational games. The purpose of educational games should be to develop skills and meaningful outcomes; rules must support the activity of play, clear learning outcomes and feedback. The general goal of game-based learning for higher education is to make complex learning material more accessible for the learner to practise and learn (Ebner & Holzinger, 2005:373).

Comprehension of the learning object and goal of the game may relate to an expectancy of the learner throughout the learning process (Dickey, 2007:524). Kiili (2005a:24) emphasises the importance of a clear goal to enhance the game flow.

3.7.2 Eliciting performance

Eliciting performance and interactivity is essential. The learner has to practise what he learned (Gagné & Medsker, 1995:147). Appropriate learning material and competition can be essential to elicit good performance during game play (Burguillo, 2010:575; Yusof *et al.*, 2009:24). Traditional learning might focus more on the content and less on the applications in learning. “Serious games focus more on the ‘how’ with much better results” (Seeney & Routledge, 2009:86). Learners will have to feel like active agents, not only passive recipients. Learners will be able to choose the game during playing and take an active role in the experience of the game. Schell (2008:445) argues that games are the best vehicle to enable players to “do” during game play. Schell (2008:445) refers to Miller’s pyramid and confirms that games are an ideal educational tool to enable the learner to reach the different stages in the pyramid. This is depicted in Figure 3.7.

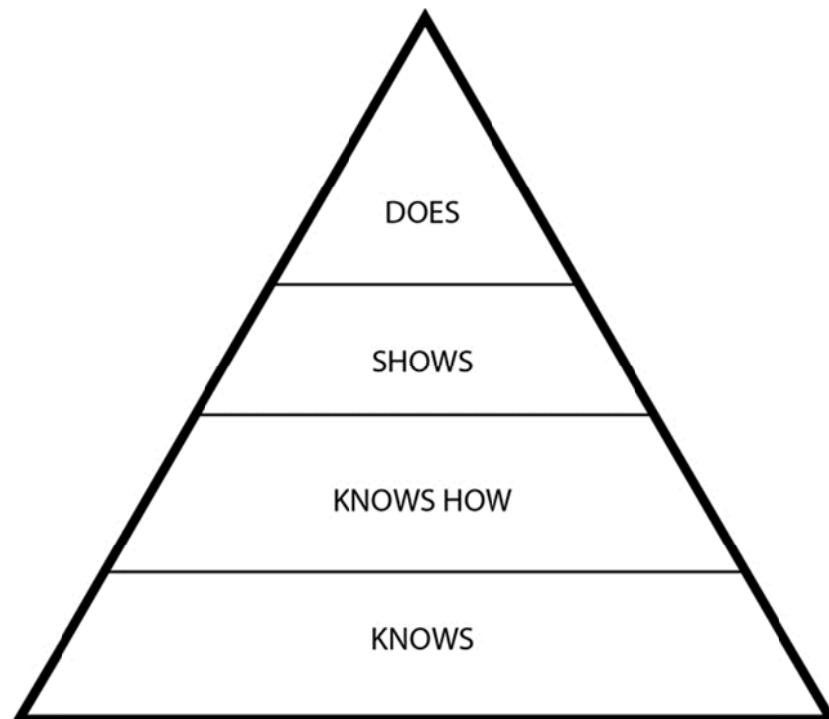


Figure 3.7: Miller’s pyramid of learning as indicated by Schell (2008:445)

Good games will give players the opportunity to participate and demonstrate and to gain skills and knowledge, encompassing the four steps in the pyramid (Seeney & Routledge,

2009:86; Schell, 2008:445). Application of the knowledge is the most important aspect in learning (Miller, 1990:S65).

People learn by building their own learning experience (Whitton, 2007:106). Co-creating the world they are in and the experiences they are having will enhance the active experience (Gee, 2004:17; Markey *et al.*, 2008:5).

Robertson and Howells (2008:565) describe the enhancement of performance in the co-design process. Creators will use certain skills to co-design. Educators not only deliver contents, but also design experiences when they create a game (Seeney & Routledge, 2009:85). Co-designing of games can be a difficult experience for game designers, because the instructional designer and the game designer or educator may speak different languages that can create big challenges (Seeney & Routledge, 2009:85).

Players are allowed to co-design and do in the game “Elder Scrolls” (Gee, 2003:2).

3.7.3 Challenge and performance

According to Clark (2006:3) and Admiraal *et al.* (2011:1186), good simulation games should have the ability to challenge the player. The player has to move onwards to reach the next level. Players will have the ability to move beyond their current knowledge to learn more with each step (Clark, 2008:27).

Incremental learning refers to step-by step-learning and takes place when a learner learns gradually and the learning material and challenges are provided to the learner in increments (Yusoff *et al.*, 2009:23). The advantage of incremental learning is that learning can take place in sequences and levels. Players will be stretched and challenged to think beyond a certain level.

In game-based learning it can apply to each character or scene in the game, where each character or scene can build on previous information. Trying to pass one level to go to the next level may be part of the player’s feeling of achievement to keep him in the game (Clark, 2008:21).

Games can offer a safe environment and allow students to fail without serious consequences (Kebritchi & Hirumi, 2008:1735). The Air Force game “JVID and Finflach” (Prensky, 2001:13) is a good example of safe failure. Players learn how to identify friendly

aircraft. Shooting down the wrong aircraft would not have serious consequences for the player. Creating games also provides a safe failure environment to change potentially dangerous activities into safe activities (Ebner & Holzinger, 2007:876; Robertson & Howells, 2008:561).

Games allow for repetition and give the player an opportunity to try again and again. Online games can be played repeatedly in the student's own time (Clark, 2006:23; Greenop & Busa, 2008; Huang, 2011:231). Leach and Sugarman (2006:200) used reinforcement learning in their game. Knowledge retention can take place if a game is played during library instruction. Leach and Sugarman (2005:194) addressed the online catalogue of the Library of Congress in their library game. A general introduction to the use of a library or in-depth instruction about databases can be provided in a game. A library game can thus provide a framework of its different products to the player.

Learners achieve expertise by repeated cycles until these are nearly automatic. Faced with new obstacles, the learners have to think again and learn again to apply new knowledge (Gee, 2004:20). Good games support the cycle of expertise. With good pacing the game can present the player with new challenges (Gee, 2004:20).

Assessing the performance of a player helps to ensure that the learning is stable (Gagné & Medsker, 1995:149). It will therefore be important to test whether the assessment was effective to the extent that the assessment tested what it was supposed to test (Wouters, Van der Spek & Oostendorp, 2009:246).

Feedback and results on the performance of the player are important. An assessment engine in games is important to assess how the player is doing (Dondi & Moretti, 2007:506). "Ratchet and Clank" is an example of a game where players can think again to learn anew (Gee, 2004:20).

3.7.4 Competition and performance

Competition-based learning can enhance the performance of students (Burguillo, 2010:574). Performance is not only enhanced during the playing of the game but can also be enhanced by creating a game. Game creators will have to create rules, narratives, programming and more. Enhancement of performance can thus occur on different levels and in different formats, not only in the playing of the game (Robertson & Howells, 2008:565).

Squire (2003:83) and Hirumi *et al.* (2010:28) emphasise that games without challenge and competition will become boring to the player. It is therefore very important to build cycles of expertise where the player can be challenged throughout the game.

3.7.5 Collaboration and performance

Game-based learning can accommodate extroverts as well as introverts or loners. Introverts can join large online communities on the web, where discussion groups can be formed and dialogues can take place (Clark, 2006:24; Shaffer *et al.*, 2005:230; Kebritchi & Hirumi, 2008:1736). Students who work together and share their knowledge and skills to reach a goal can feel more responsible for their success. Caspian Learning stated in a report that online communities within games can work well. Groups of people that have the same interest share their views via voice over internet protocol to share and discuss their activities in the game (Caspian Learning, 2008:29). Gamers share the same goal to reach the final destination. People from different geographic areas join together as teams in large online games (Ebner & Holzinger, 2007:3). Massive multiplayer online games allow students to share and experience together to improve the learning experience (Pivec & Dziabenko, 2003:4).

3.7.6 Rich media text

The quality of the rich media text in the game might have an influence on the performance of the player.

The technical criteria for games can include the quality of producers and authors, the game, standard, fluent installation process, adaptivity of design and usage, artistic outlay, quality of audio, quality of text and keeping time in the game. Multimedia will influence the decision to use the right educational game. The player will understand the game if the operational methods in the game are clearly outlined (Clark, 2006:22; Liu & Lin, 2009:178; Whitton, 2009:29).

Video clips, audio and music can be used in games, giving them a huge benefit over flat media. Video games that lack sound have never been popular, because sound can improve flow. Although audio input can be used to improve flow, it must be natural or it may result in splitting of attention that may interrupt the flow (Liu & Lin, 2009:177; Parker, 2007:225).

Clark (2006:22) and Liu (2008) evaluate multimedia in gaming as a prerequisite for effective learning. Liu and Lin (2009:177) emphasise the importance of the multimedia materials being in accordance with the learning goals and the needs of the target group. Multimedia can affect the assessment process, since visual knowledge can have an influence on the player that would not normally happen with text-based learning (Wouters, Van der Spek & Oostendorp, 2009:246). Visual literacy is an important aspect of information literacy and will be applicable to the net generation (Clark, 2006; Felicia & Pitt, 2009:132; Marcum, 2001:97; Prensky, 2006:28; Whitton, 2009:18).

The camera viewpoint during the design process might have a huge influence on the multimedia effect. De Freitas and Jarvis (2007:227) emphasise the importance of the camera viewpoint to underline certain visual evidence in the game world. Some players get light-headed if they play in the first person view (De Freitas & Jarvis, 2007:227).

According to Gibson, Aldrich and Prensky (2007:3), the rich media text will fit the characteristics of the net generation. Rich media text will also have an influence on the storyline of the game.

Game creators may find it very problematic to link the story with the game. Games must have a well-designed storyline that relates to the learning material. Storylines could improve systems thinking when the different scenes in a game are combined by an innovative and interactive storyline (Liu & Lin, 2009:4; Shaw, 2004:3).

During game play the player has choices on how to interact with the characters in the game and how to control his next steps. A story can give a game emotion (Prensky, 2001). Storylines can improve the flow of the game and enhance the fun and interaction in a game (Shaw, 2004:2).

3.8 FEEDBACK AND PERFORMANCE

Good games should give feedback so that the players feel that they are challenged but will be able to solve the problem. Feedback will give players direction on whether they are moving forward or not (Gee, 2004:19; Prensky, 2001:13).

This discussion builds on Oblinger's (2004:8) work explaining among others that gaming can offer immediate and contextual feedback and opportunities for tailored and active learning,

and that game-based learning can be a social and participatory process, where learners are gradually challenged.

3.8.1 Feedback and guidance

Feedback can be seen as a guideline or pointer for gamers. Gamers can be informed where they are in a game and if they are moving up to different levels or new challenges. Good games should give feedback so that the players feel that they are challenged but will be able to solve the problem. Feedback will give players direction on whether they are moving forward or not (Burgos & Nimwegen, 2009:121; Kickmeier-Rust & Albert, 2010:96; Seeney & Routledge, 2009:86).

- The provision of learning guidance and feedback must be self-contained; players do not use manuals at the start of the game. Support can be given during the learning activities in the game (Dickey, 2006:4; Yusoff *et al.*, 2009:22).
- Clark (2006) and Kebritchi and Hirumi (2008:1733), as well as Whitton (2009:28), reported that guidance and support during playing proved more successful. The guidance can be provided with clear goals and directions and feedback during game play. Sensible hints will affect the quality of the game.
- The feedback will enable the player to move or make choices based on prior feedback, learning and experience (Bjork & Holopainen, 2003:1; Ebner & Holtzinger, 2007:877; Seeney & Routledge, 2009:86).
- Challenges with feedback are important for the flow of the game. Burguillo (2010:574), Huang (2011:698) and Kiili (2005a:15) find that even the word “feedback” in the results can motivate the player to carry on with the game. Admiraal *et al.* (2011:1186) state that feedback poses challenges that could prevent boredom and anxiety. Feedback can flow from the player in the game to the game and the other way round. This type of information-sharing can enhance the flow in a game (Schell, 2008:369).
- Instructive feedback is related to the knowledge domain and informative feedback is related to the context where learning is happening. Feedback can be critical to the player’s motivation and problem solving. Relevant feedback will give hints to solve problems in a game (Burgos & Van Nimwegen, 2009:123,124; Gee, 2003:4; Kickmeier-Rust & Albert, 2010:97; Sonnemans & Tuinstra, 2010:970).
- Feedback can help with decisions during game play. Careful consideration to provide feedback is necessary in order to keep balance in the game. Players must

not become dependent on feedback and must at all times be able to make the next step on their own (Burgos & Nimwegen, 2009:119; Johnson & Mayer, 2010:1246).

3.8.2 Feedback and results

Feedback can be given in many ways, for example scores, displays and verbal feedback. Feedback can be given in direct results (Burgos & Van Nimwegen, 2009:121).

- A computer programme can keep track of how people answer questions and solve problems in game-based learning, and can offer repetitive opportunities to practise and get it right. It is also possible to set the difficulty in game-based learning at higher, lower or intermediate levels. Results through a feedback system are important to keep the player in the game. Results are also important to prove that certain capabilities of the learner have changed (Connolly, Stansfield & Hailey, 2009:257).
- A student can get immediate feedback while playing an online game. There is no waiting for test results, since test results are available at the end of the game (Clark, 2006; Kiili, 2005a). The game “Plagiarism Court” is a good example, where the student will know immediately if the answer was right or wrong (Fairfield University DiMenna-Nyselius Library, 2012). The player will receive feedback while he is playing the game.
- A score card can provide immediate results at the end of a game. Leach and Sugarman (2006:197) emphasise the fact that the net generation are used to speed and interaction. The immediate feedback and visual feedback in games are thus suitable for the net generation.
- The progress of the player is automatically measured in the game with outcomes or feedback (Prensky, 2001; Marshall, 2007). Score and time limits are important in a game and can keep the player motivated (Ebner & Holzinger, 2007; Johnson & Mayer, 2010:1251).
- The performance feedback might motivate learners to play on to see if they can increase their scores. Instant feedback can engage and motivate a learner to do better in a game. Good feedback can facilitate cognitive processes and enhance motivation and engagement in playing (Admiraal *et al.*, 2011:1190; Burgos & Van Nimwegen, 2009:123,124; Gee, 2003:4; Sonnemans & Tuinstra, 2010:970).
- Liu and Lin (2009:178) suggest that feedback must be in a timely manner and must report and update the player’s current status. A game must allow an educator to edit the feedback of the game.

3.9 LIBRARY GAMES AND INSTRUCTION

The value of library instruction was argued in the previous chapter. It will therefore be of value to look at games used for library instruction.

In the context of library instruction and information literacy, it has been argued that games can meet the different learning techniques of students and improve their experience during library instruction (Leach & Sugarman, 2006:192; Rapeepisarn *et al.*, 2008:498; Connolly, Stansfield & Hainey, 2011:1390). Games can result in increased retention of knowledge (Leach & Sugarman, 2005:4). Apart from games fitting the learning style of the net generation, they can also influence their attitudes to and engagement with information literacy training (Doshi, 2008:14; Leach & Sugarman, 2006:3).

Intrinsic motivation is important during instruction. “Librarians are in a remarkable position to engage with this new generation of gamers” (Doshi, 2008:17). Librarians can challenge students to become more engaged in the whole library instruction and information literacy training process. Librarians seem to become more accessible to undergraduate students if they include games during information literacy training.

With regard to the use of games in library instruction, the following will be noted: scavenger hunts, web-administered board games and the application of an information literacy standard to a real life game. Such games are not always electronic. Different games have been used in past years for library instruction to encourage students to take part and interact in the library instruction process. A few examples of library games will be given in this section.

3.9.1 Non-electronic games

Radford University used a scavenger hunt during a library tour to introduce students to the library. Students were asked to search applicable places, such as the reference desk and online library catalogue, in order to become familiar with the places and facilities that they were going to use during their studies (Ackermann, Benjes-Small & Vassady, 2005). The scavenger hunt was replaced by a jeopardy game that entailed questions and answers. Jeopardy-based games are reported to work well during library instruction (Doshi, 2006:16). Leach and Sugarman (2005:195) describe a knowledge quest game at the University of California where students had to search for a rare book that had been stolen. They report that the game engaged the students.

The University of Notre Dame developed a Boolean operator crossword puzzle for their information library instruction classes. Comments of the students were, "An otherwise boring and painful course was not so boring and painful!" (Smith, 2007:1).

3.9.2 Web-administered board games

The University of Michigan created a storytelling and gaming strategy to engage undergraduate students in information literacy training (Markey *et al.*, 2008:5). The focus was on students who could not attend the library instruction sessions. The purpose of the task team was to create an online game for the benefit of students who were not in the library and were not in a position to ask a librarian.

The "Defense of Hidgeon" is a web-administered board game. In this game, action takes place in the mid-14th century at the height of the Black Death's sweep through Europe. The objective is to be the duchy's richest, fastest, and most accurate research team (Markey *et al.*, 2008:xi). An electronic die is used to move to the different questions on the board and players have to do information searches to enable them to answer these questions.

3.9.3 Real life games

The value of the ACRL standards was demonstrated during library instruction. Librarians at the University of Dubuque used "Fantasy Football" to teach information literacy to incoming students. "Fantasy Football" is a fantasy sports game that is scored on the statistical information of players based on real life. Millions of fantasy sport fans play all types of sport, e.g. fantasy rugby. One of the examples of online "Fantasy Football" is the online game "Fantasy Premier League". "Fantasy Premier League" (2011) allows players to create their own team and to analyse statistical information for strategic planning. According to Waelchli (2008), critical thinking and communication skills are required to succeed in the game. Waelchli (2008) used an online "Fantasy Football" game to involve the students during library instruction. Critical thinking skills based on the ACRL information literacy standards were applied (Research Quest, 2011). The learners applied four of the five ACRL information literacy competency standards. These were intended to determine an information need, to construct and implement the information effectively and to summarise and apply new information. The concept of game-based learning was used to apply information literacy standards. "Games work with these strategies because games do it all at once" (Waelchli, 2008). Librarians can build upon the information literacy skills that students have already unconsciously been using to analyse the statistical information of "Fantasy Football" play.

The success of evaluating library products was described in the article, “The shifted librarian: Shifting librarians at the speed of byte” (Waelchli, 2008). The majority of students benefit from this kind of instruction and are able to apply the information literacy standards.

3.10 DISADVANTAGES OF GAME-BASED LEARNING

Ebner and Holzinger (2007:887) and Van Eck (2006:3) warn against the danger of multimedia tools as the easy way out, or to use them just because they are the hype of the day. Learning is hard with or without tools (Ebner & Holzinger, 2007:887). Educators and gamers still hesitate to accept the value of game-based learning.

3.10.1 Game designers and disadvantages

The design of a game can have a direct influence on the learning process. One of the disadvantages of game-based learning is that the game designer might not make provision for the balance between learning and engagement.

- Prensky (2005) refers to the game-based learning scale where both the engagement factor and the learning factor must be equal. “Digital game based learning comes only when engagement and learning are both high” (Prensky, 2001:149). Several authors argue the need for engagement and learning (Clark, 2006:21; De Azevedo Filho, 2006:4; Gee, 2003:8; Kickmeier-Rust *et al.*, 2007:649; Oblinger; 2004; Rapeepisarn *et al.*, 2008:498) and consider the importance of balance in game-based learning. The balance between engagement and play can be influenced by the fact that the interface or challenges in the game might be too busy and therefore hinder the engagement of the player (Anderson & Courtney, 2011:2; Clarke & Duimering, 2006:16; Squire *et al.*, 2004:519). According to Dondlinger (2007:21), poor game design will have a negative effect on the memory of game players.
- Frameworks or guides for game-based learning might manipulate game designers to such an extent that they lose sight of the balance between fun and learning (Prensky, 2005:12; Van Eck, 2006:3).
- Motivation during game play might be insufficient. The time schedule must allow for both game-based learning and ordinary learning. Fun and motivation should not be the only factors in game-based learning. Significant learning should take place during the game (Barab *et al.*, 2005:88; Clark, 2006; Dator, 2004:215; Wouters, Van der Spek & Oostendorp, 2009:241).

- Educators might be hesitant to accept games as an educational tool because of several negative aspects such as violence, the dependence effect and a-social behaviour that can be a direct result of games (Kheradmand *et al.*, 2012:1; Prensky, 2005:12).
- Game designers will have to be careful when they create challenges in a game. The balance between challenge and ability can be a disadvantage in gaming. A challenge might be too high for certain players (Gee, 2004:19; Ke, 2008:1615; Hildmann *et al.*, 2008; Dziabenko & García-Zubia, 2011:1103).
- De Freitas and Jarvis (2007:524), as well as Wouters, Van der Spek and Oostendorp (2009:240), point out that the empirical evidence for the effectiveness of game-based learning might not be sufficient to convince educators. Connolly, Stansfield and Hainey (2009:251) describe the lack of empirical evidence as the “death” of game-based learning.
- Cost factors should be taken into consideration. Lack of knowledge of the didactic design of games and the cost of the game may have a serious influence on the quality of the game (De Freitas & Jarvis, 2009:225; Livingstone *et al.*, 2009:49; Seeney & Routledge, 2009:277; Whitton, 2007:1066).
- Increased workload on staff can be a disadvantage. Staff will have to be self-disciplined and motivated (Connolly, Stansfield & Boyle, 2007:6). Some of the educational games of today do not engage learners as much as off-the-shelf games. Games might be time-consuming and will have an effect on the time allocated to a class (Seeney & Routledge, 2009:279).
- Software restrictions of the game engine may prevent the designer from including certain actions or behaviour during game design (Prensky, 2005:14; Seeney & Routledge, 2009:85).
- Feedback can be so overwhelming that it prohibits learning and fun for the player (Burgos & Van Nimwegen, 2009:119).
- Representative groups of the target audience might be ignored at the early stages of the game, thus preventing the designer from understanding the needs of the target group (Prensky, 2005:98; Schell, 2008:488).
- Games might have an effect on the player’s health. It has been indicated but not proven that obesity, pain in the hands and wrists and hallucinations can be a result of playing games (Clarke & Duimering, 2006:2; Griffiths, 2005:123).

3.10.2 Players and disadvantages

- Gender will have an effect on gaming. Males and females may have different attitudes to games (Clark, 2006; Greenberg *et al.*, 2010:242).
- All games are not suitable for all learners. Learners may not like games and may not learn from games (Squire, DeVane & Durga, 2008:244).
- Experienced and inexperienced players will have an effect on the results of the player. The complexity of game playing might have a negative influence on game players (Wouters, Van der Spek & Oostendorp, 2009:243).
- The restriction of games may be too rigid to allow personal growth and innovation (Prensky, 2005:13; Seeney & Routledge, 2009:278).
- Single-player games can exclude the player socially and can therefore exclude the didactic process of social learning (Bopp, 2006:10). In real life there will be poor teachers and good teachers; an equivalent asocial situation in single games may not be a good example of real life (Bopp, 2006:13; Clarke & Duimering, 2006:15). Games might have a negative effect on the health of a player. The player might suffer from cyber sickness or epilepsy.
- Considering the age of the target group is very important, especially when adult learners are involved. Adult learners might lose interest if they think the game was not designed for their age group (Whitton, 2009:25). Application will play an important role in adult game-based learning. Higher education students want to apply what they learn during the game (Whitton, 2009:25). Software programmes may not always allow a significant extent of application (Seeney & Routledge, 2009:87).

3.10.3 Advantages of game-based learning

The advantages of game-based learning have been argued by several researchers. An outline of some of the advantages will be given.

- The motivational effect of game-based learning can have a very positive effect on such learning (Clark, 2006:21; De Azevedo Filho & Latham, 2006:3; Gee, 2003:8; Joiner *et al.*, 2006:68; Oblinger, 2004; Rapeepisarn *et al.*, 2008:498). According to Jackson, Davis and McNamara (2011:520), the motivational aspect in game-based learning can have a positive effect on the learning experience of the player.

- Griffiths (2005:123), and Haninger and Thompson (2004:865) emphasise the effect of video games on the pain experience of patients. Patients can be positively influenced by the engaging influence of games.
- The direct effect of performance on the achievement of the player is a definite advantage in game-based learning (Cheng & Tsai, 2012; Warren *et al.*, 2012:405).
- Several researchers discussed the correlation between flow and problem-solving in game-based learning. More research is needed to prove the correlation between problem-solving as one of the positive effects of game playing. Liu *et al.* (2011:1916) analysed the effect of flow in a game on problem-solving. Indications during game play were that students' problem-solving skills were improved by the flow effect of the game.
- Co-creation and creation of games by learners effectively improved the learning experience of students, thus proving that not only the play effect but also the designer attribute of games can have a positive effect (Kafai, 1995). Games can serve as a background to improve the thinking levels of the designers. The narrative of the game will also have a positive effect on the creative thinking of the game creator (Good & Robertson, 2006:394; Robertson & Howells, 2008:561; Sardone & Devlin-Scherer, 2010:412).

3.11 CONCLUSION

Although game-based learning has disadvantages, it can still be said that games have the potential to be good learning tools. "Games are effective not because of what they are, but because of what they embody and what learners are doing as they play a game" (Van Eck, 2006:14). Research into game-based learning has proven that learning can take place during game play.

The researcher deemed it important to create a summary for the criteria to create a game based upon the principles and possibilities of game-based learning. The summary can be seen in Figure 3.8.

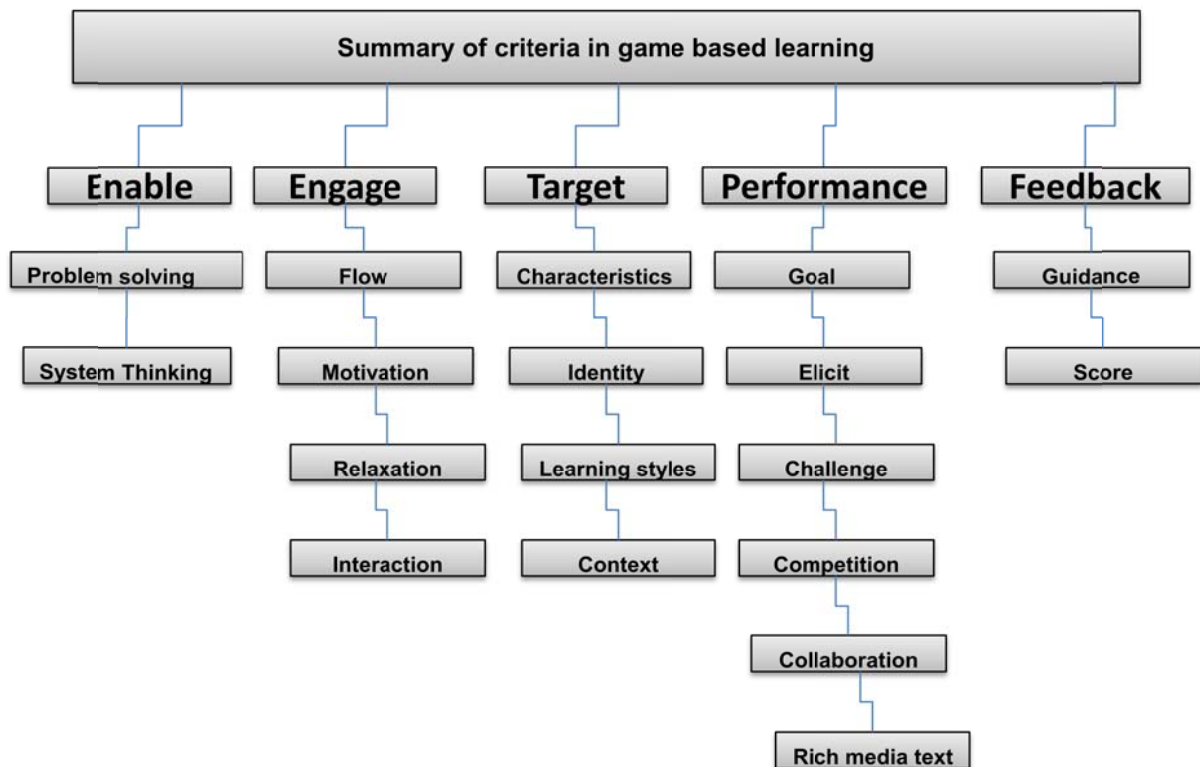


Figure 3.8: Summary of criteria in game-based learning

The value of game-based learning and the criteria for game-based learning were emphasised in this chapter. The possibility of enabling players to solve problems and become systems thinkers was discussed. Systems thinking and problem solving are important skills.

Research proved that systems thinking skills and problem-solving are declining among younger people, while the performance of adults is improving. The decline in the so-called 21st century skills will have a negative influence on performance at the workplace (Gibson, Aldrich & Prensky, 2007:59). Students with a high level of computer skills sometimes fail to apply systems thinking skills (Kennedy *et al.*, 2008:109; Kiili, 2005a:14). Game-based learning has the potential to enable players to use certain skills, such as problem-solving and systems thinking skills. Problem solving as a skill can be seen as a critical thinking skill (Beedle & Wright, 2007:152; Kiili, 2005:22; Spires *et al.*, 2011:457; Van Eck, 2006:4).

Games can present new problems and questions to players, with which the students were not familiar before they played the game. Presenting the players with new questions might enhance incidental learning (Jeffrey *et al.*, 2011:396; Van Eck, 2007:272). Gee (2004a:19), Robertson and Howells (2008:567) and Shute (2011:506) point out that games can present problems and decisions to players that need to be solved with innovative thinking. Game-

based learning might enable players to come up with solutions to problems (Shute, 2011:506).

In conclusion it can be said that the literature study of game-based learning showed that games can be pedagogically sound learning environments. The summary for criteria in game-based learning might help game creators and researchers with the design and research of games.

The aim of the next chapter will be to look at the design and creation of the game “Library Quest” for library instruction.

CHAPTER 4

4. RESEARCH METHODOLOGY AND DESIGN

4.1 INTRODUCTION

The purpose of this chapter is to describe the research methodology used in this study. The research purpose of this study is to determine to what extent a game can be used as an instruction tool for library instruction. The research methodology and the research design will be outlined in this chapter.

4.2 RESEARCH METHODOLOGY

According to Leedy and Ormrod (2013:2), the research process can be seen as gathering information in order to analyse the data, manage outcomes and contribute to the understanding of the research question. The research methodology for this study is based on the advice given by Leedy and Ormrod (2013:102).

The research methodology for this study encompasses the following:

- Literature review
- Case study
- Data collection
- Instructional design for game-based learning.

The methodology will be discussed below.

4.2.1 Literature review

Neuman (1997:89) defines a literature review as an important tool that will help researchers to familiarise themselves with the research field. A literature review will enable the researcher to become familiar with the knowledge of other researchers and to become aware of the main sources of information in a specific subject field (Neuman, 1997:89).

The latest developments in certain fields will be available in literature resources. Alert functions in information sources can update and alert the researcher about new developments in the field (Hofstee, 2006:91). The literature review will give the researcher the background knowledge to decide on the research methods for the purpose of the study.

4.2.2 Case study

Different research methods are available in the research process. The problem statement and sub-questions of the research will define the research method. Case studies can be a good research method to answer research problems such as the “who” “what” “where” and “why” questions (Yin, 1993:5).

According to Silverman (2005:126) and Neuman (1991:331) a case study method in research is applicable if the researcher wants to use a certain unit of analysis to determine the behaviour or response of the unit.

A case study can also be defined as a specific action undertaken by the case study group (Gillham, 2000:1). Leedy (1993:123) uses the example of social workers who observe a certain group to make observations of the given circumstances. The conclusions of the observations can then be used to influence the circumstances of the group. One of the advantages of a case study method is that it takes place in normal surroundings that are familiar to the target group. Becoming part of the natural environment of the group will allow the researcher to answer some of the research questions of the study (Gillham, 2000:1; Neuman, 1994:331; Sarantakos 2005:217).

A single case study or multiple case studies can be used for research. A single case study can be used for a single experiment. Multiple case studies can be done when the researcher uses more than one case study for the research. The researcher will have to determine if he/she is going to use a single case study or multiple case studies before he/she starts to collect data (Yin, 1994:45). A single case study method can be useful if the researcher has to choose a unit of analysis based on its previously observed attitude to certain beliefs or behaviours. Yin (1993:41) refers to an example where a school was chosen on the basis of its prior positive attitude to innovation. Selecting the right case might exclude certain barriers that a specific institute may have in respect of an innovative intervention. A single case study at an institution with a positive attitude to an innovative intervention will be important and useful for this study. According to Hepworth and Walton (2009:84), an information literacy intervention could improve the learning experience of students if it takes place in familiar

surroundings. A single case study will allow the researcher to experience the effect of the intervention in a particular case and in real life experience and will therefore be valuable for the study. The case study will encompass the literature review, research method, data collection method and data analysis. A game for library instruction will be used as intervention during the case study. Therefore it will be necessary to discuss the instructional design process of a game as part of this study. The DODDEL model (McMahon, 2009) for the design of games will be used for this study. The DODDEL model consists of different stages and phases to outline the design process. The stages in the DODDEL model are the situation analysis, design proposal, design documentation and production documentation.

A mixed-method approach using qualitative and quantitative research approaches, as well as formative and summative evaluation, will be used. Questionnaires will be used to collect the data from the participants. The data will be analysed to test the effectiveness of the game.

The rationale for using the single-case study method for this study is outlined below:

- Case studies can be valuable to explore an intervention.
- A case study can be valuable if a researcher wants to know why a programme worked or did not work.
- The value of a single case study is that the researcher has an intimate familiarity with and immersion in the data collection process that can add value to the research.
- A single case study can comprise different methods of data collection and will be suitable for this study.
- The case study method will allow the researcher to select an appropriate unit of analysis. It will be important for this study to choose a unit of analysis that does not have barriers to innovative experiments.
- Triangulation (i.e. using a mixed-method approach) as a research method can be applied in case studies. The case study will consist of a questionnaire, an expert evaluation process and a heuristic evaluation process.

4.2.3 Data collection

Multiple methods can be used to collect data. A mixed-method approach might improve the reliability of the research and help to exclude the limitations of one research method (Mouton & Joubert, 1990:90; Sarantakos, 2005:146). A mixed-method approach can increase the

new knowledge derived from the research. Different perspectives of the research topic can also be given if a mixed-method approach is used (Sarantakos, 2005:146). In the words of Leedy (1993:142), the “cold” and the “warm” method combined can give the researcher a wider perspective of the research study. The methods used in this study will be a questionnaire, an expert evaluation and heuristic evaluation. A questionnaire will be used that consists of quantitative and qualitative questions. Quantitative questions will allow the participant to rate the effectiveness of the learning experience. Qualitative questions will allow participants to describe their affective experience with the game.

Neuman (1997:232) states that the instrument to collect data will have certain consequences for the research process (Neuman, 1997:233). Objective planning is necessary to ensure that the appropriate data are collected (Leedy, 1997:188). A pilot study can be used to determine whether the participants in the research project understand the questions and the layout of the questionnaire. Questionnaires can be used as instruments to collect information from research participants (Hofstee, 2006:132).

It will therefore be important to ensure that the questionnaire is clearly laid out and the applicable approach and language are used for the design of the questionnaire (Neuman, 1997:233). According to Hofstee (2006:132), Leedy (1997:187) and Neuman (1997:233) the questionnaire must be concise and clear to avoid confusion for the participants. The researcher will have to avoid misleading questions, idiomatic language, biased questions and questions that are too complicated. Neuman (1997:233) summarises the criteria for a questionnaire as follows:

- Avoid colloquial language.
- Avoid interpretations that might not be clear to the participant.
- Avoid questions that can have more than one answer.
- Avoid questions that might be too difficult for the respondents.
- Avoid assumptions.
- Avoid questions that cannot be answered in the present.
- Avoid questions that are not balanced.

Open-ended questions will be used to collect qualitative data and closed-ended questions can be used to collect quantitative data. Closed-ended questions will have certain advantages, such as saving time for the respondent.

Open-ended questions will allow the respondent to give his/her choice of answers. Respondents can reveal their personal feelings and give detailed answers to open-ended questions (Neuman, 1997:241; Sarantakos, 2005:245). Open-ended questions are an ideal method for participants to state their affective feelings.

The mixed-methods approach will be applicable to this study for the reasons mentioned below:

- Different perspectives to evaluate the game might add value to the research.
- Participants are allowed to rate the effectiveness of the game.
- Participants can describe their affective experience with the game.
- The researcher is able to derive a balanced perspective of the collected data.

4.3 INSTRUCTIONAL DESIGN FOR GAME-BASED LEARNING

“Learning can be more effective if it is carefully planned. The aim of instructional design is to plan a process for intentional learning” (Gagné, 2005:21).

Gagné (2005:12) describes the rationale for instructional design as the systematic planning of instruction to achieve learning through a process of goals, selecting or developing instructional interventions and using feedback from learners to improve the instruction.

Many models of instructional design have been proposed, for example that of Dick and Carey (Gagné, 2005:39) where instructional design is based on the following criteria placed in the following sequence:

- identify instructional goals,
- conduct instructional analysis,
- identify entry behaviours,
- write performance objectives,
- revise instruction,
- develop criteria,
- develop instructional strategy,
- develop and select instructional materials,
- design and conduct formative evaluation,
- design and conduct summative evaluation.

The Dick and Carrey model (Gagné, 2005:39) incorporates the elements of the ADDIE model.

The ADDIE model is a basic model of instructional design that consists of five different steps to facilitate the learning process. The five steps are analysis, design, development, implementation and evaluation (Gagné, 2005:21).

Although there are many textbooks, such as the *Handbook of computer game studies* (Raessens & Goldstein, 2011), on the instructional design of games that can guide the planning of an interactive game, the researcher will limit herself to a brief description for the purposes of this study. A model for a more open epistemology is needed for game-based learning. According to McMahon (2009:98) the DODDEL model correlates with the ADDIE model and will be ideal for the use of novice game developers.

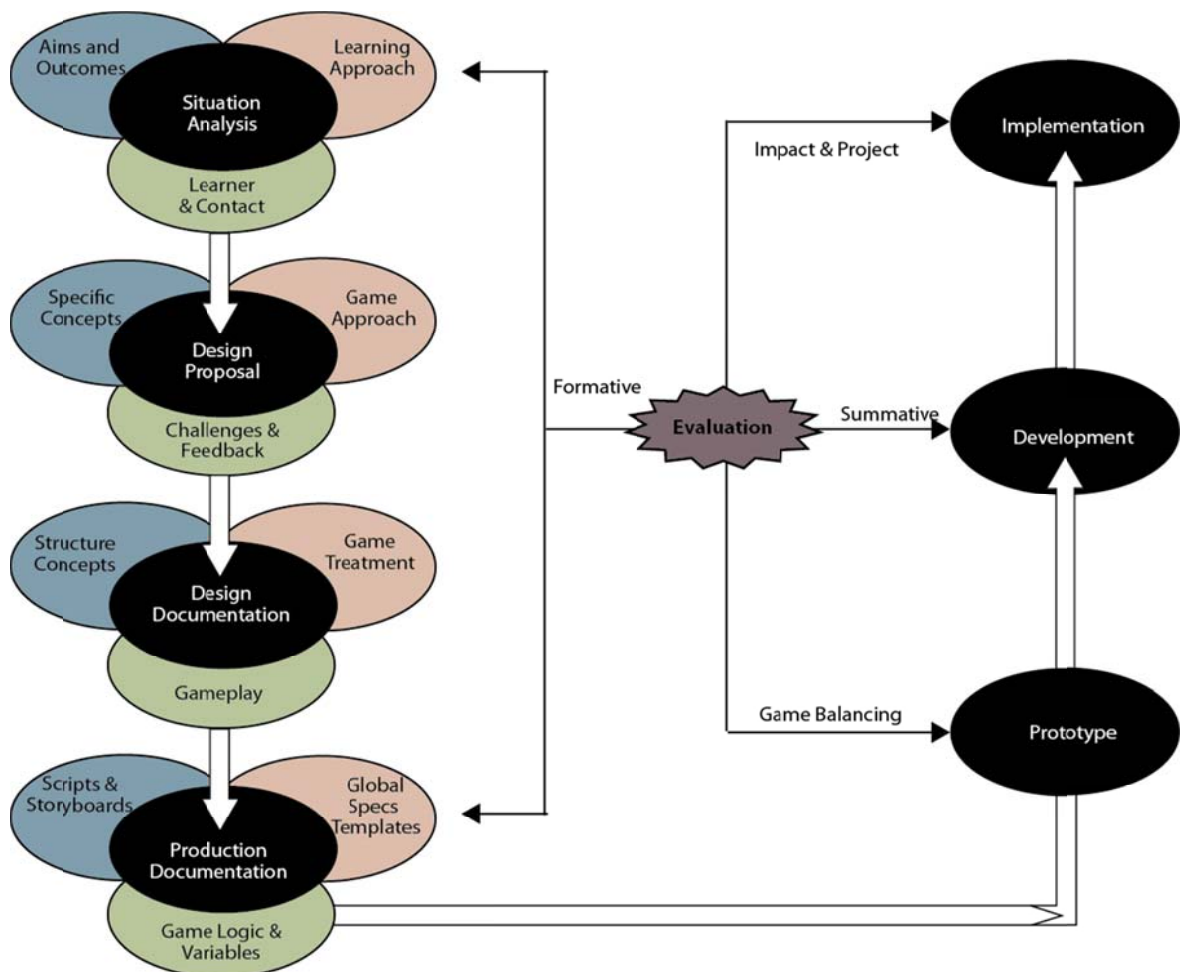


Figure 4.1: DODDEL Model (McMahon, 2009b:98), adapted by the researcher

Figure 4.1 illustrates the stages and components of the DODDEL model. The research method for the DODDEL model consists of stages, components and outputs. The design stages have different outcomes that will help the game designer to deliver a well-planned product. The design stages are the situation analysis, design proposal, design documentation and production documentation.

The components are the aims and outcomes, learning approach, learner and contact, specific concepts, game approach, challenges and feedback, structure concepts, game treatment, game play, scripts and storyboards, global specifications and templates, game logic and variables.

The implementation stages of the DODDEL model are the prototype, development and implementation stages. The evaluation component of the DODDEL model is illustrated in Figure 4.1.

The first stage of the evaluation component consists of the formative evaluation of the prototype and game balancing. According to McMahon (2009:647), game balance evaluation is important in order to balance the different effects, design interfaces and interaction in the game. The second stage in the evaluation component is the summative evaluation of the implementation stage. The impact of the project will be evaluated during the summative evaluation stage. The stages and components will be described in the next section.

4.3.1 Situation analysis

The first stage in the design stages of the DODDEL model is the analysis of the situation. The purpose of the situation analyses is to determine whether a game is necessary or needed for a certain group. The game will have to address the needs of the research participants to be relevant. The different stages of the situational analysis, namely the aims and outcomes, the learner approach and the learner contact, will be part of this stage.

- **Aims and outcomes:**
The aim of a specific organisation or educational institute to use a game can be to improve student success and achieve better performance at the organisation or educational institute through an innovative intervention. The outcome relates to the learning process and expected learning outcomes.
- **Learning approach:**
The goal and purpose of the game must be clear to the end user. Extensive research in the subject field is important.

- Learner and contact:

The learning needs and learning styles of the target group are important. Students have different learning needs that might fit in with their age group and their preferred learning style. Any development project must take the needs of the target audience into account. Knowledge of the target group is crucial for the design of the game. The game designer will have to cater for the specific technology required for the software of the game. Time constraints must be taken into consideration to plan ahead.

4.3.2 Design proposal

The needs identified in the situation analysis are important at this stage. Solutions for the specific needs of the client and target audience are planned. The game type is considered, but final decisions are not made during this stage. The specific outcomes of this stage are:

- Specific concepts:

The game designer will have to consider the expected performance outcome at this stage. End users will have to gain new knowledge during game play. Planning and designing the knowledge outcome will improve the quality of the game.

- Game approach:

Different types of games include quizzes, puzzles and strategy games. Choosing the most appropriate game for the end user and learning material is important.

- Challenge and feedback:

Feedback will keep the player in the game and engagement will be improved by challenge. McMahon (2009:105) differentiates between challenges such as interface challenges, lateral thinking and memory challenges.

4.3.3 Design documentation

The design of the documentation is crucial for the quality of the game. The structure of the game will be designed during this phase.

- Structure concepts:

Mapping can be used to outline the structure of the concept. A detailed organisational chart will support the linear process of the game design.

- Game treatment:

The game world is chosen during this stage. Action planning is necessary for this stage. Menus, head-up displays and characters are developed to underline the narrative aspects of the game.

- Integrating structure, game play and game treatment:
All three elements of the design are integrated during this stage. These three stages consist of learning outcomes, visual media, auditory media and interaction. All these elements can improve the simulation of the game.

4.3.4 Production documentation

The design of the game is described during this stage. Different elements are outlined for the approval of the client. The client will then be able to make suggestions before he/she accepts the final design of the game. Certain elements are used throughout.

4.3.5 Prototype stage

Prototyping is an important stage in game development. Judging the quality of the game is important at an early stage of game design to ensure an effective final product. The prototype stage in game development allows the game developer to detect obvious mistakes that can be corrected at an early stage. Prototyping the game also allows the game developer to be more creative and innovative and to play around with ideas. The prototype stage can help the game developer to gain insight into the subject field, target group and needs of the client. Evaluating the prototype game helps the game developer to detect whether the game complies with the criteria for game development. The client can use the prototype game as an evaluation process to determine the quality of the game.

4.3.6 Development stage

McMahon (2009:102) describes the ability to respond to changes as an agile approach during game design. The game software must be flexible to cater for rapid change during the development stage. Responding to necessary changes will therefore be a valuable contribution by the game designer and developer.

4.3.7 Implementation

The design and development plan of the game is put into action during the implementation phase.

4.3.8 Evaluation

The evaluation of games can be different from normal evaluation techniques because it is not based on assumptions. Game players can approach a game differently, since the game play can depend on the strategy of the game or the motivation for playing the game. Heuristic evaluation is an inspection technique that gives evaluators the freedom to conduct evaluation based on game usability (Pinelle, Wong & Stach, 2008:1454). Usability inspection techniques can be used during the game design to improve the usability of the game. User participation will not be necessary during the design of the game. Skilled evaluators can evaluate the game during the game development.

The game design will be evaluated in formative and summative stages.

4.4 RESEARCH DESIGN

The research design consists of a literature review, case study and data collection.

4.4.1 Literature review

Chapter 1 referred to the importance of the literature review in research. It is also mentioned here in Section 4.2.1. A literature review was done to obtain background information for the research, namely the information literacy model and the list of game-based learning criteria (Hofstee, 2006:91).

A literature review was conducted of several applicable information sources, including books, journals, blogs, websites, conference papers and game developers' websites. Valuable information was gained from these sources. Blogs about the personal experience of game designers helped to get a perspective of what was happening in the field of game-based learning. Information about the criteria of game-based learning and information literacy models enabled the researcher to use a list of game-based learning criteria to create a game for the purpose of the study. The game was based on the information literacy model accepted in Chapter 1 section 1.4.1 and the criteria for game-based learning were embedded in the game.

4.4.2 Case study

The unit of analysis for this study will be the library instruction sessions at the Department of Library Services at the University of Pretoria. The game that was developed for this study will be used as an innovative intervention during library instruction. The Department of

Library Services at the University of Pretoria has a very innovative approach to training and library instruction. A single-case study method will be used to analyse the effect of the intervention on the participants.

Participants in the study were first-year students of the University of Pretoria who attended library instruction sessions. The non-compulsory library instruction took place in the training room of the Department of Library Services. The study was conducted in the Department of Library Services. It was planned that the training sessions would be attended by 60 students per session, each session lasting an hour.

Computers with the necessary system requirements were used in the training room to allow the students to receive hands-on training. The game was loaded on the computers to enable students to play the game after the library introductory session. Librarians were responsible for the training. Additional members of the library staff assisted the librarians during the training process, assisting students with the hands-on training session and playing the game.

The sessions consisted of a short PowerPoint introduction to the library services and products. After the introduction students had to play the game covering the assignment-writing process combined with library sources and information.

At the time when the game on which this study reports was assessed, the sessions took place over four days, namely 26 to 29 January 2010.

4.4.3 Data collection

In Chapter 1, section 1.7.6, it was explained that a quantitative as well as qualitative approach would be followed in the case study, based on an instructional game for library instruction to be used with first-year students at the University of Pretoria. A questionnaire was designed to collect data from the participants. The questionnaire consisted of 31 questions. Answers, rated on a Likert scale, and open-ended answers were given.

The purpose of the questionnaire was to collect data on the experiences mentioned below:

- Experience with games
Yes or no answers were used to test the participant's previous experience with games.

- Affective experience
The affective game experiences of the participants were evaluated. Relevant questions were asked to enable participants to describe their satisfaction, immersion and reaction during game play.
- Learning experience
Participants were asked to rate their learning experience in the game. Rated questions enabled them to rate the improvement in their knowledge.

The analysis of this study is covered in Chapter 6.

4.5 INSTRUCTIONAL DESIGN FOR GAME-BASED LEARNING

The DODDEL model was used for the design process of the game. The design method is explained in the following sections.

4.5.1 Situational analysis

The need for instruction will be determined during the situation analysis phase (McMahon, 2009:102).

Incoming first-year students at the University of Pretoria need library instruction in a format that fits the net generation. See Chapter 2 for more information about the learning needs of the net generation and the importance of library instruction for first-year students in higher education. The Department of Library Services at the University of Pretoria (in this case, the client) realised that an innovative approach might improve library instruction for students. A pilot study was done during 2009 with a similar game to determine the attitude of the students to a game during library instruction. The reaction of the students to game-based learning was very positive. The positive attitude of the students convinced the management of the Department of Library Services at the University of Pretoria that a game could be an appropriate innovative intervention to improve library instruction.

The analysis will determine the aims and learning outcomes of the game, the user characteristics and context for the game (McMahon, 2009:102).

- Aims and outcomes: According to McMahon (2009:102), the aims will relate to the goals of the game and the outcomes will relate to the results of learning. The aim of the Department of Library Services at the University of Pretoria was to improve

the library instruction for first-year students. Improving library instruction could have a positive effect on the students' success during their studies.

- Learner approach: The learner approach proves the designer's intent and ensures that the product is based on research (McMahon, 2009:103). The Big6 information literacy model (Eisenberg, 2008:41) was used as a learner approach to ensure that the product was grounded in research (McMahon, 2009:103). The cover page of the game outlined the goal and purpose of the game to ensure that the participants knew what was expected of them.
- Learner and contact: The target audience and an understanding of learner contact are important for game design (McMahon, 2009:103). The target audience consisted of first-year students at the University of Pretoria. It was accepted that there would be individual differences in the audience but that the audience would consist mostly of the net generation. See the characteristics of the net generation in Chapter 2, section 2.6. Some of the students did not have libraries at their schools and were new to an academic library. A general concept was to be used to cater for the different needs of students from various backgrounds. The specific culture and content of South Africa were incorporated in the game with a soccer theme. Soccer balls as objects in the game portrayed the major sport event in South Africa at the time.

4.5.2 Design proposal

The design proposal was an approach to meet the needs that were identified in the situation analysis phase (McMahon, 2009:104).

McMahon refers to the importance of outlining and mapping knowledge to achieve learning outcomes (McMahon, 2009:106).

- Specific contents: A model based on the Big6 was designed to use for the design of this game. A learning journey was created with different scenes to portray the different steps in the Big6 information literacy model. The intent of the designer was to provide new knowledge about library and information literacy for the participants.
- Game approach: "The game approach situates the product in a genre and identifies some basic criteria for its look and feel of the product" (McMahon, 2009:105). The researcher chose a 3D, immersive simulation game based on the needs of the net generation.

- Challenge and feedback: Challenge and feedback were built into the game. Specific graphics were used as feedback. Challenges were based on interactions in the game. The formative evaluation that was done after the situational analysis and the design proposal is discussed in Section 4.6.1.

4.5.3 Design documentation

The structure of the game is outlined in the design documentation phase.

- Structure concepts: The structure of the concept was organised and outlined during this phase. The assignment-writing process based on the Big6 information literacy model was used as the concept of the learning material. The different steps of the Big6 information literacy model were illustrated in each scene of the game. The specific purpose of each scene in the game was outlined with incoming messages at the start of each scene. The player knew exactly what the learning outcome of each scene would be. The expected outcome was provided in the game with the interaction feedback provided in the game software. Participants knew exactly what to expect from a specific scene or period in a game. Scene 6 summarised all the information given in the previous five scenes. The summarisation captured the six steps of the information literacy model to enforce the learning material.
- Game treatment: McMahon describes game treatment as follows: “The game treatment should give a sense of the look and feel of the game” (McMahon, 2009:106). The visual look and feel of the game was determined by the specific software that was used. The researcher was guided and restricted by the specific software and visuals that were available in the game-authoring engine (Thinkingworlds, 2010). The layout and scenes were developed during this phase. Specific scenes in the software were used to enhance engagement and the concept of the learning material. Six scenes were used to convey the learning context of the information literacy model. The role of the characters was identified during the stage of design documentation. Specific characters, appropriate for each scene, were used. The characters and scenes portrayed the real life environment of the participants. Objects and their specific purpose were identified during this phase. Specific animations were chosen to enhance the engagement in the game.
- Gameplay: The rules, boundaries, feedback, interface, goals and challenge represent the gameplay (McMahon, 2009:107). The goal had to be stated clearly at

the start of the game. Rules played a role in the decisions made during the game. Provision was made for the scoring of the game. The rules of the game allowed the player to score a point or to lose player lives. A specific time period was identified for the game, namely 15 minutes. The time restriction of the game influenced the game play. Players had to finish the game on time. Different challenges were presented to the player. The player had to pass certain challenges before he could proceed to the next scene. The challenges consisted of tests, drag-and-drop exercises and choices. The feedback in the form of results and directions engaged the player during game play.

- Integrating structure, game play and game treatment: Visual and auditory aspects and interactions were combined during this phase. Provision was made for enhancing the visual experience of the game player. Specific sounds were imported to enhance the look and feel of the game. Interactions were created to combine the different elements. Great care was taken to balance the different elements in the game. Too many animations could have a negative effect on the engagement of the player and affect the concentration of the player in the game. Interactions were created to take place at the right time in the game to provide the right stimulation in the game.

4.5.4 Production documentation

The development of the game was documented during this phase, proceeding from the scripts and storyboard to the game logic and variables and eventually game launch.

- Scripts and storyboard: The narrative framework for the game was based on the different scenes in the game. The script for scene one was a typical discussion between a student and lecturer in a classroom. The event manager discussed and demonstrates the advantages of library information in scene two. Scene three shows a typical library where a conversation was taking place between a librarian and an avatar. Scene four took place in an apartment where the student had to start writing the assignment. A demonstration of the layout of the assignment was presented in scene five. The coach helped the avatar to evaluate his assignment in scene six. The Soccer World Cup theme was included in the storyboard. The story line was enhanced by the feedback and rich media text provided during the game.
- Game logic and variables: The game logic and variables were created on the scene flow canvas in the authoring engine (Thinkingworlds, 2010). Certain elements in the game were combined in a flowchart process to create the virtual

world for the player. One flow per scene was used to control every event in the specific scene. Adding and editing nodes was part of the flowchart. Nodes represented questions and events for each scene. A typical example of a flowchart with nodes can be seen below:

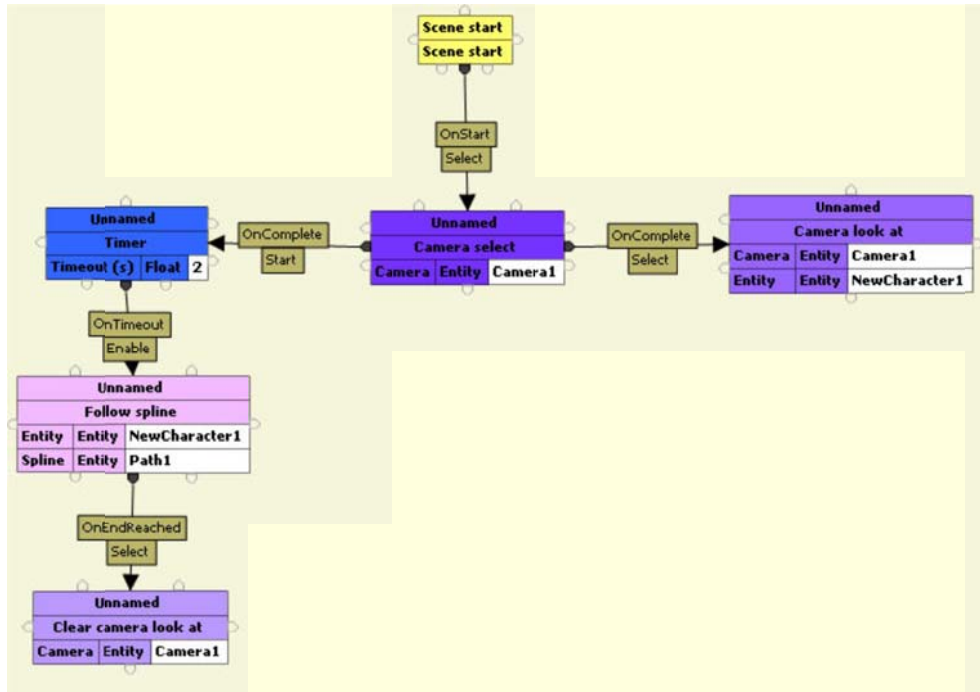


Figure 4.2: Scene flowcharts in Thinkingworlds authoring engine (Thinkingworlds, 2010)

Nodes were connected with wires on the scene flow to perform certain functions. The wires in the scene flow linked the functions in the game. These functions could include the audio aspects in the game, feedback and testing the outcome of a question. The sequence of the nodes would determine the sequence of the actions in the game. Arithmetic operations were created with specified nodes on the scene flow canvas. Splines or paths for the characters were created to allow the characters or objects to move at a specified time. The head-up display appearance was created with the combination of certain nodes. The camera in the scene was controlled by certain nodes to create a specific camera “look at” in the game. See chapter 5 for the image of the scene flow for the specific game.

Global specifications and templates as specified by Thinkingworlds (2010):

- Windows XP SP2 or above
- 500MB of hard disk space
- 1 GB of memory
- 1 GHz of CPU or above

- Net framework 2.0
- DirectX 9.0

Game launch: The authoring engine of the game allowed the creator to launch the game with the export and publishing options. The game could be published in three different versions:

- Standalone version to be distributed to the desktop of different computers
- Web version of game to be published on the web
- SCORM-compliant version to publish the game in a learning management system.

The web version might have complications for the bandwidth of the university. The researcher chose the standalone version with the above-mentioned consequences in mind.

The specific learning journey created by the researcher was exported to a designated folder. The designated folder consisted of the following files:

- A copy of the Thinkingworlds (2010) player.exe
- “A config file – ‘config.cfg’
- ‘Pak files’ folder
- Export pak with game data” Thinkingworlds (2010).

The folder with the above-mentioned files was loaded on the computers in the library instruction room. The players could just click on the WorldPlayer.exe to play the game. The next stage in the DODDEL model was the prototype stage.

4.5.5 Prototype stage

A prototype of the game was loaded on a computer for evaluation and further development purposes. Rapid prototyping was done during the whole design and development process.

4.5.6 Development stage

The technological aspects of the game were tested during the prototype stage of the game design. The scene flow of the prototype game was refined during this stage. The development stage of the prototype game was an ongoing process with several iterations and changes.

The balancing of the game prototype was important during this stage. McMahon (2009:101) describes the balancing stage in the game design as the “sweetening” process. Game balancing was applied during the prototype stage of the game. The right balance in a game can enhance and improve the flow in the game. Unnecessarily rich media text or animations were removed from scenes to ensure that the player would rather concentrate on the learning material.

4.5.7 Implementation stage

The game was implemented on several computers for summative evaluation. The summative evaluation was done by external evaluators to ensure the quality of the game. The evaluation process is described below.

4.6 EVALUATION

4.6.1 Formative evaluation

All the stages of the DODDEL model (McMahon, 2009:100) were applied and evaluated to enable the researcher to improve the game. The researcher evaluated the game continually. The design stages were evaluated during the formative evaluation.

- Situation analysis:
Regular discussions with the client, in this case the Library of the University of Pretoria, ensured that the aims and the outcomes of the learning process met the expectations of the client. Discussions with patrons of the library were used to address the aims and outcomes, the goal of the game and the learning needs and learning styles.
- Design proposal:
The most appropriate game type was evaluated to ensure that it would fit the needs of the target group.
- Design documentation:
The look and feel of the game were evaluated and improved where possible. Game worlds were evaluated to ensure that the right world was chosen to represent the different stages of the game. Restrictions in the software made it impossible to improve certain aspects of the game. Only a certain choice of

characters, worlds and objects were available in the game software. Certain screen prints that were created by the researcher were changed to improve the visual aspects of the game. The size of the screen prints was taken into consideration to ensure that they would be clearly visible to the game player.

The balance of the game was evaluated during this stage. The researcher had to ensure that the effects in the game were not overwhelming. Careful analysis was done to remove any unnecessary effects in the game.

The text in the game was evaluated to ensure that the right text was used at the right moment and in the right context. Lengthy text in the game would have a boring effect. Interactions were balanced with the effects and text in the game. A fair amount of testing through interaction was necessary to encourage the user to perform well.

Scene flows were readjusted where possible flaws were discovered. The variables in the scene flow were evaluated to determine the reliability of the results in the game. Arithmetic operations were improved with specified nodes on the flow scene canvas. Certain variables were changed to increase or decrease scores and player lives to make these more appropriate for the difficulty level of the challenge. Actions in the game, such as the paths or movements of the characters, were improved where necessary.

The prototype game was published as a standalone game to test and evaluate the different scenes and actions in the game. Assistant lecturers in the Department of Information Science at the University of Pretoria were asked to evaluate the prototype game. The expressions and critical evaluation of the assistant lecturers were taken into account to improve the game after the dry test run. Some of the comments included:

“Make the instructions more clear by indicating if this is an instruction, like turn right and walk to computer, and if it is a task like complete the first step of the assignment-writing process.” (Opinion of an assistant lecturer)

“They should lead you more.” (Opinion of another assistant lecturer)

The recommendations were used to improve the game. More learning guidance was added with the right feedback. Instruction feedbacks were created.

There were no solutions to some of the comments:

“Need more of a reward or some form of a reward; a score is not enough”.

Extra rewards could not be created.

Some of the assistant lecturers were very satisfied with the game and made comments such as:

“Because it was a different kind of learning that the game provided, it was much better than listening to a lecture in class. Also, I learned at my own pace.”

Most of the assistant lecturers rated the game as “very good” or “excellent”.

4.6.2 Summative evaluation

The first stage of implementation happens when the instructional product is implemented for summative evaluation purposes (Gagné, 2005:34). “Summative evaluation takes place to assess an end product and is usually performed by external evaluators” (McMahon, 2009: 253).

External evaluators from the Department of Library Services of the University of Pretoria and the Department of Information Science of the University of Pretoria were asked to evaluate the end product of the game. The external evaluators played the game to assess several aspects of the game. Playing the game enabled the evaluators to control and manipulate it. The difficulty level of the game manipulation was therefore determined and evaluated by the evaluators. The application of the information literacy model during the game was evaluated. The evaluation of the information literacy model used in the game was important to ensure that it was based on the theoretical model of the Big6 (Eisenberg, 2008). The sequence of the game scenes was assessed to ensure that it followed the correct sequence of the Big6 model (Eisenberg, 2008).

The game should be used to its fullest capacity to improve the learning experience of the players. Game play should enable the students to use the library and library products effectively for their assignments. The assessment of the learning experience of the game was done by external evaluators.

It was important to ensure that the needs of the lecturers and students were addressed during the design of the game. Lecturers at the University of Pretoria have specific rules and criteria for assignments. These standards and requirements were applied in the game and evaluated during the summative evaluation.

The look and feel of the game were evaluated during the summative evaluation. The need and appropriate application of the graphic objects, such as the soccer ball and customised posters for the upcoming soccer event in South Africa, were evaluated by the external evaluators.

Appropriate language and text were important to convey the right message during the game. External evaluation was important to get an objective evaluation of the language and subject terminology used during the design of the game.

Summative evaluation was also done on the technical requirements of the game. It was of the utmost importance to follow the right procedures to ensure that the software was uploaded and working to ensure the quality and flow of the learning process. The evaluators approved and accepted the end product, the game.

4.7 DATA COLLECTION

The research event took place at the Merensky Library on the main campus of the University of Pretoria during the library instruction sessions in January 2010. Students played the game after an introductory session. After completing the game, paper questionnaires were given to students for completion (see Appendix A). Students were asked to sign the informed consent form before they completed the questionnaire. The questionnaire consisted of 31 questions, which collected quantitative as well as qualitative data. Open-ended questions were used for qualitative data and closed-ended questions, requiring yes or no answers, as well as choices on a six-point Likert scale ranking, were used to collect quantitative data from the 1 803 participants who completed the questionnaires.

The coding of the questionnaire was done manually. The Department of Statistics at the University of Pretoria did the final statistical analysis. Qualitative data were sorted and categorised in certain categories based on the purpose of this study. The analysis of the data will be discussed in Chapter 6.

4.8 LIMITATIONS OF THE RESEARCH

There were limitations in the research:

- The limited choice of characters and objects in the library of the authoring engine restricted the design of the game.
- The complexity of the nodes in the scene flow canvas can be seen as one of the restrictions of the software.
- The time constraint during library instruction sessions was problematical. More time would have made it more convenient to collect the data for the study.
- The lengthy questionnaires might have had an influence on the quality of the answers.
- The large group of participants could be a disadvantage. A lot of time was needed to do the coding for the questionnaires.

4.9 CONCLUSION

The purpose of Chapter 4 was to describe the research methodology and design that were used for this study. The research methodology of the study was discussed in the first section, the design of the research was discussed in the second section of this chapter and the instructional design of game-based learning and its application were also discussed. Different stages of the evaluation process, namely the formative and summative evaluation processes, were discussed. The administering of the questionnaires and the layout of the questionnaire were outlined.

The instructional design of the game was discussed in Chapter 4. The purpose of Chapter 5 will be to discuss the creation of the game. The game was based on the Big6 information literacy model (Eisenberg, 2008:40). Game-based learning criteria were embedded during the creation phase of the game.

CHAPTER 5

5. GAME DESIGN AND GAME CRITERIA

5.1 INTRODUCTION

Library instruction as a subset of information literacy has become more important to enable higher education students to become independent learners (Arko-Cobbah, 2004:267; Bundy, 2004:6; Fourie & Bothma, 2006:469; Kavulya, 2003:216). It will therefore be important to engage students in library instruction (Connolly, Stansfield & Hainey, 2011:1390; Leach & Sugarman, 2005:192; Rapeepisarn, Wong & Khine, 2008:498). The design of the game for this study will be discussed in Chapter 5.

5.2 GAMES AS INSTRUCTION TOOLS

In accordance with the discussion of games as pedagogically sound learning environments in Chapter 3, gaming seems to be the ideal way to teach incoming first-year students to navigate the mass of printed and electronic library material (Markey *et al.* 2008:1). This chapter will focus on the creation process of a virtual game for library instruction based on the criteria discussed in Chapter 3, as well as learning from reports discussed in Chapter 2. The section below will discuss the functions of the game-authoring engine.

5.3 GAME-BASED AUTHORIZING ENGINE

A digital game-based learning engine is a template into which teachers can insert their content into a game. Thinkingworlds is a learning educational game-authoring engine (Thinkingworlds, 2010). An authoring engine allows the user to create a game based on the software provided in the system. The author can choose his/her own scenes, avatars, non-player characters and objects from a library provided in the software. Rich media text can be included. Thinkingworlds (2010) learning experiences are based on a number of principles needed to improve learner motivation. The software library included in the authoring engine ensures an active learning experience (Thinkingworlds, 2010).

5.3.1 Software library

The software library in the authoring engine consists of several functions and objects that can be added to the scene.

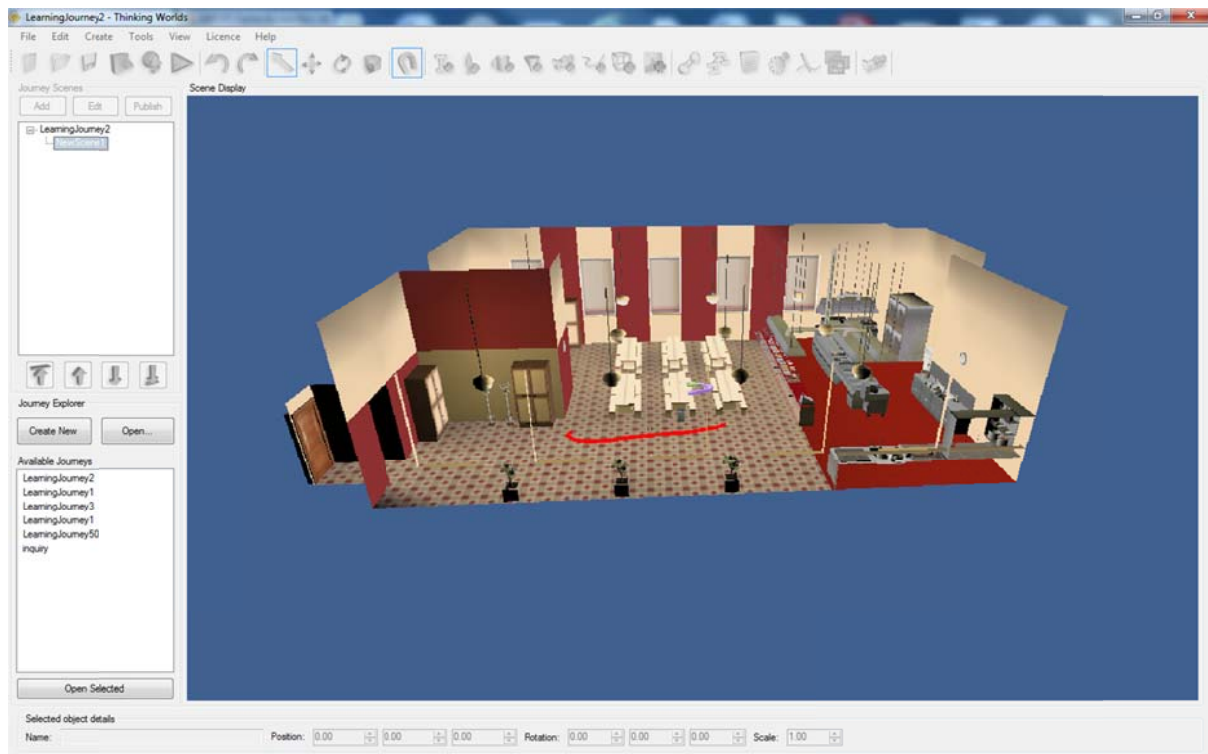


Figure 5.1: Software library in authoring engine

The software library in the authoring engine consists of:

- **Game worlds:** The game developer can choose from several game worlds. Examples of game worlds can be the classroom scene, the gymnasium, the mall, the library, the flat.
- **Game characters:** The software library contains several characters. Examples of these characters are a lecturer, a coach and students.
- **Game objects:** Specific objects can be added to the game scene. Some of the examples of the objects in the software library are shelves, books, plants and several objects that can be added to a scene.
- **Interactions:** The interactions provided in the game-authoring engine are communication interaction, conversations, a choice list, freeform branches, a label option to enable drag and drop interaction, custom facilities and multiple choice questions.
- **Camera:** A camera can be added to the scene to provide a movie-like atmosphere to the game. The camera will provide zoom-in facilities, look-at facilities and shake facilities. "In all games and simulations, the player's avatar has two cameras associated with its 3rd person and 1st person. The 3rd person camera is always positioned behind the avatar and moves with him. Here is what the view looks like

from the 3rd person camera” (Thinkingworlds, 2010). Figure 5.2 illustrates the third function view of the camera, where the player looks at a scene through the eyes of the avatar.



Figure 5.2: Camera function in third person view (Thinkingworlds, 2010)



Figure 5.3: Same example as in Figure 5.2 with camera view in first person (Thinkingworlds, 2010)

In Figure 5.3 the player looks directly at the scene and not through the eyes of the avatar. The player will not be able to control the following:

- Splines: The splines or paths in the software library compel the game creator to create specific splines (paths) for the non-player characters. The non-player character is able to follow the spline to provide movement for the scene in the game.
- Markers: Markers can be added to the scene to enable movement of the objects in the scene.

Avatars: Special characters that can be used as avatars are provided in the software library. The game developer can then choose between several avatars in the game. The camera select function can select a first person player or a third person player. It is best to use the third person camera so that the player can control the avatar.

5.3.2 Scene flow canvas

The scene flow canvas in the authoring engine is used to invoke the different events and actions that will take place in the scene. Each scene in the journey has its own specific scene canvas. This is reflected in Figure 5.4.



Figure 5.4: Scene flow canvas in the authoring engine

The scene flow in the scene canvas is very powerful and will invoke action in the game. A library of nodes will provide different functions to different nodes, for example animation nodes, sound nodes, spin nodes. Action happens with the node function when scene flow passes to the node.

Events happen when the node processing is complete and control passes to the next node. Nodes can have a single “on complete event”, where action takes place after a certain event. The wires will connect the different nodes to put the events and actions in the right sequence. This is reflected in Figure 5.5.

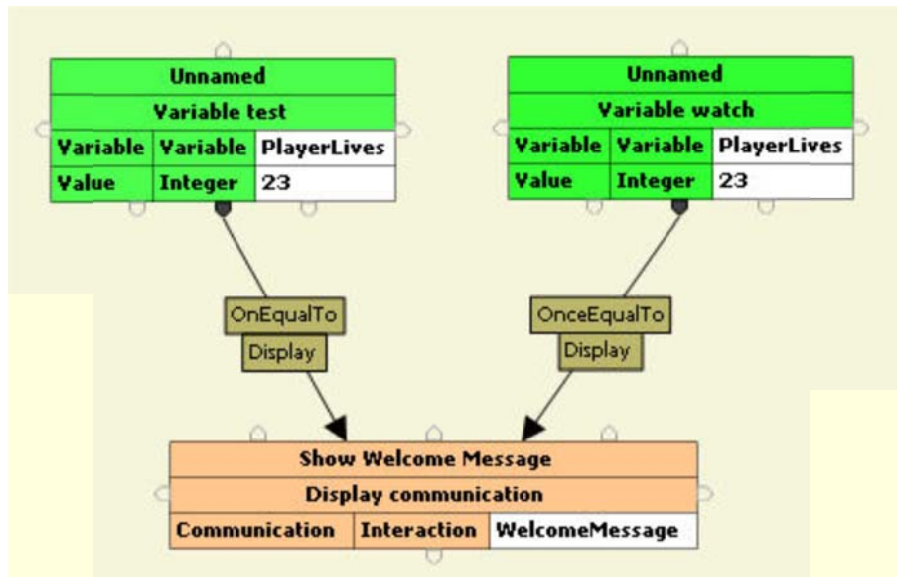


Figure 5.5: Example of variables and scene flow events (Thinkingworlds, 2010)

Figure 5.5 portrays a typical scene flow event in a scene. Wires link the nodes in the scene flow canvas to perform a function. Wires can link the variable “test” and the variable “watch” to a message node that will appear after the performance of a certain action.

- Counter watch nodes control the value of a counter. The event selected will be controlled with an event that is equal to or less than the selected event. If the event in the assessment is equal to the control, a mark will be added to the score. If the event is less than equal to the control, a player life will be deducted from the initial number of player lives.
- Counter control nodes were set up with different values for specific challenges, depending on the importance and value of the challenge. Certain challenges have more value and are controlled by the counter control nodes.
- Immediate feedback messages were created to give the results of the game. The player is informed of the results on completion of each challenge. The immediate feedback provides the player with feedback in the head-up display in the game.

5.3.3 Head-up display

The head-up display displays the status of the player. Player lives, the game score, remaining time and the radar can be displayed in the game. An example of the head-up display in the game can be seen in Figure 5.6.

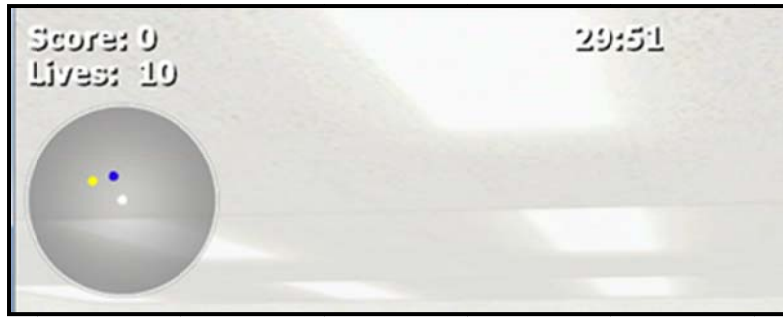


Figure 5.6: Head-up display score, lives, remaining time and radar (Thinkingworlds, 2010)

Figure 5.6 illustrates the head-up display that will provide the following information to the game player:

- **Timer:** The player competes against the game timer in the head-up display to finish on time. The remaining time is displayed.
- **Score:** The player tries to achieve the highest score and is influenced by the score in the head-up display in the game.
- **Player lives:** The player tries to lose the lowest number of player lives and is influenced by the number of player lives in the head-up display in the game.
- **Results:** Feedback on the overall performance of a player is provided at the end of the game. A progress bar was developed to add to the results page. The results page indicates the total score of the player, as well as the time taken to complete the game and the number of player lives lost.
- **Radar:** The radar function in the head-up display displays the position of a certain object or character in the scene. The radar display properties of objects and characters can be displayed in different colours on the radar screen.

5.4 DESCRIPTION OF SCENES IN THE GAME

The game sequence is based on the Big6 (Eisenberg, 2008:41) information literacy model. The steps of the Big6 information literacy model are indicated in Figure 5.7.

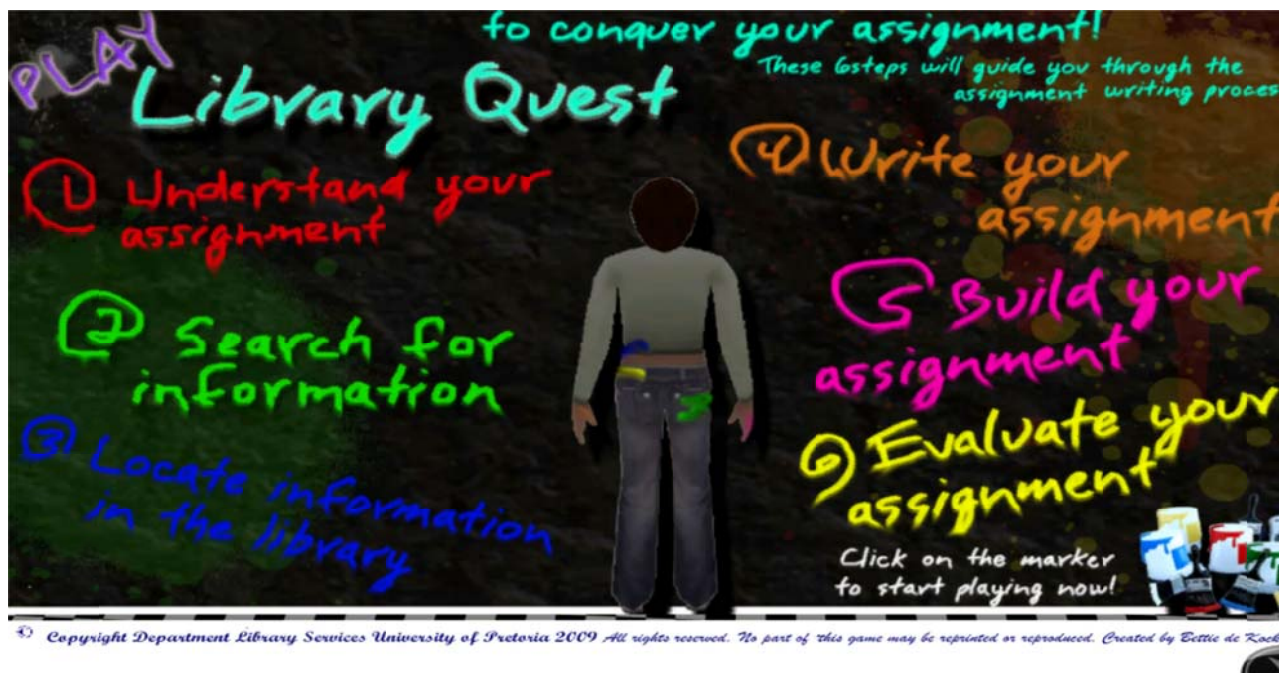


Figure 5.7: Front page of the game developed by researcher

The front page of the game portrays the six steps of the Big6 information literacy model:

- Understand your assignment (Scene 1)
- Search for information (Scene 2)
- Locate information in the library (Scene 3)
- Tips to write the assignment (Scene 4)
- “Build” (layout) of your assignment (Scene 5)
- Evaluate your assignment (Scene 6).

5.4.1 Scene 1

A typical classroom scene was developed for scene 1. The purpose of this scene is to explain the first step in the Big6 information literacy model, namely to understand the assignment topic.

Characters in the scene

- Student as avatar
- Lecturer
- Students

Objects in the scene:

- Customised posters of the Soccer World Cup
- Computers

Animations in the scene:

- The non-player characters follow splines in the scene to make the scene more realistic.
- Groups of students have discussions during the scene.
- A conversation takes place between the lecturer and the avatar.

Camera placement in the scene:

The camera follows several markers that are placed in the classroom scene to give the player an overview of the specific scene. The camera “look at” function is used to zoom in on different characters and objects in the scene.

The initial communication in the scene is: “The first step in the assignment-writing process will be to know what the topic of your assignment is and to understand the concept of the assignment. Find the lecturer to get the topic of the assignment.”

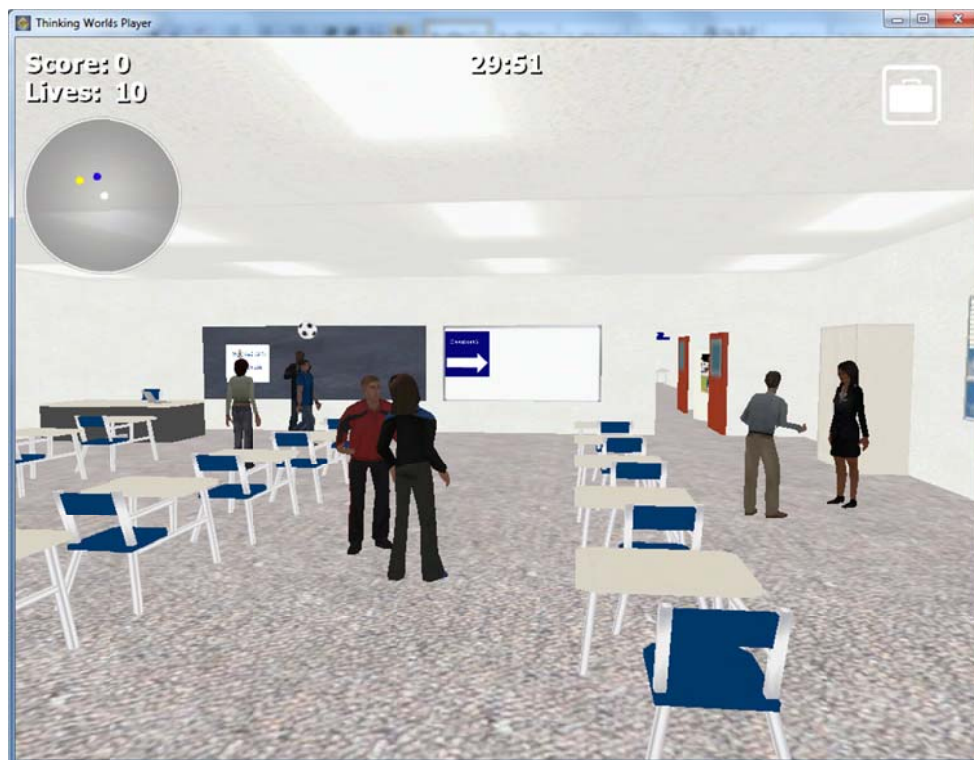


Figure 5.8: A classroom scene was used for scene 1

The lecturer explained why it was important to use concept sources to understand the topic of the assignment. The tutorials were provided for two concept sources: Tutorials for Wikipedia (Wikipedia, 2010) and Pharos (Pharos, 2007) were provided. The player could choose if he/she wanted to learn more about Wikipedia or Pharos.

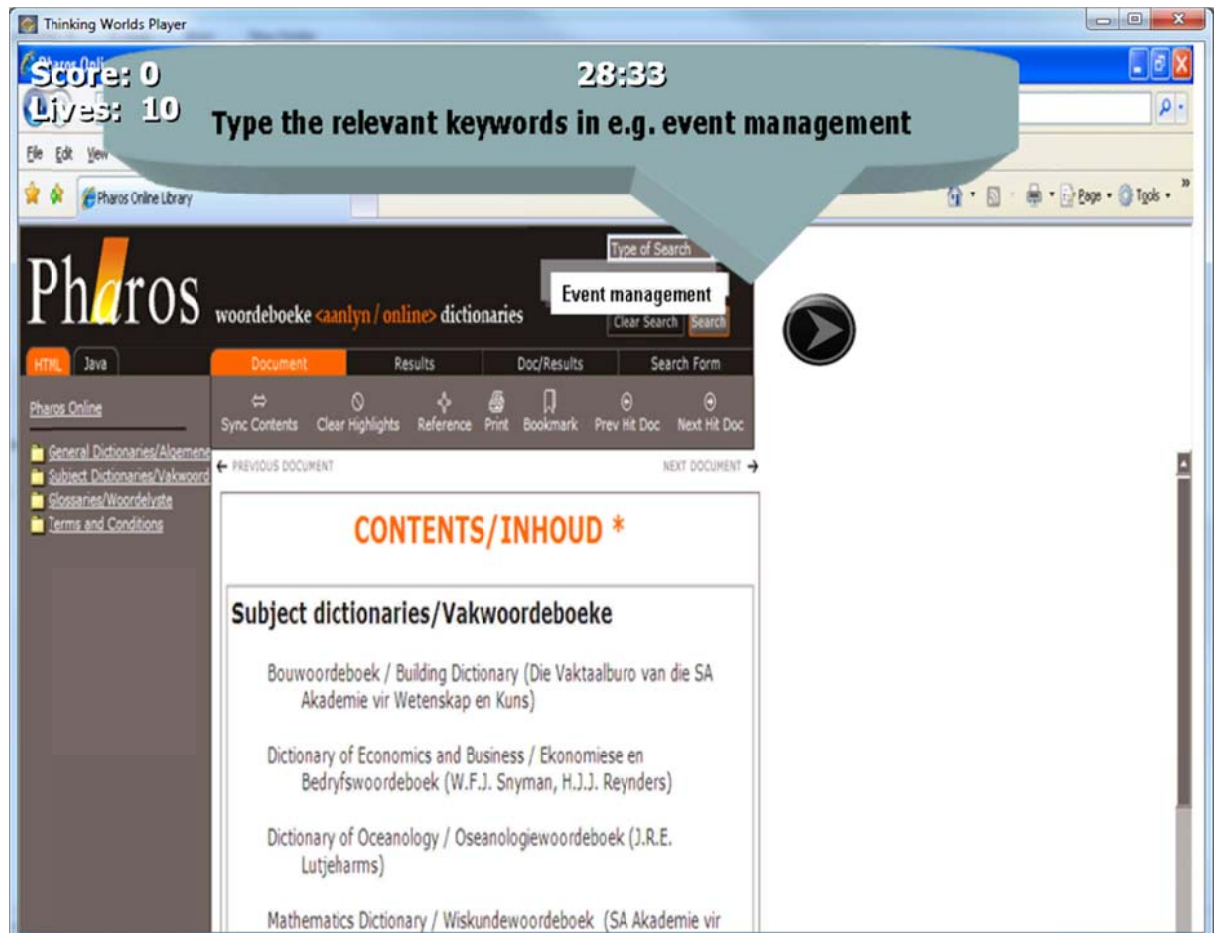


Figure 5.9: Example of the tutorial for Pharos

A checklist test was provided at the end of the scene. The player had to choose the correct concept sources to test whether he/she could differentiate between general information sources and concept sources. The player could score or lose player lives as a result of the outcome of the test.

5.4.2 Scene 2

A typical mall scene was used to demonstrate that library sources are available from outside the library. The purpose of scene 2 was to demonstrate the search process on the library website.



Figure 5.10: The mall scene that was used for scene 2

Characters in the scene:

- Student as avatar
- Event manager in the mall
- Office personnel

Objects in the scene:

- Cars
- Laptop
- Office furniture

Animations in the scene:

- The office characters follow splines during the scene to make the scene more realistic.
- Cars move in and out of the mall scene.
- A conversation takes place between the event manager and the avatar.

Camera placement in the scene:

The camera follows several markers that are placed in the mall scene to give the player an overview of the specific scene. The camera “look at” function is used to zoom in on different characters and objects in the scene.

The initial communication is: “The second step in the assignment-writing process is to search for information. The event manager found a lot of information on his laptop even if he was not in the library. The event manager will demonstrate how he found information on the library website.”

Tutorials for the library catalogue are part of scene two. These include instruction on the library catalogue and Boolean operators.



Figure 5.11: A choice of the different search terms

The player can choose the best Boolean combination of keywords to get the best results. The choice list is demonstrated in Figure 5.11. The immediate feedback results of the wrong and right choices are demonstrated with rich media text.

The player receives a numerical alphabetical number (Dewey number) for a specific book in the library that he/she has to locate in scene 3. This is reflected in Figure 5.12.



Figure 5.12: A note with the numerical alphabetical number of the book (Dewey number)

Multiple choice questions are used to test if the player understands the information that he/she has received during the scene. Immediate feedback, with the results, is given. The player loses a player life if he/she fails the test and scores if he/she passes the test.

5.4.3 Scene 3

Scene 3 is a typical library scene. The initial communication in the scene is: "Step three of the assignment-writing process is to locate information in the library." The camera placement in the software of the authoring engine focuses on a shelf in the library.

Characters in the scene:

- Student as avatar
- Librarian
- Library personnel
- Library patrons
- Security personnel

Objects in the scene:

- Library shelves
- Library books with yellow stickers and numerical alphabetical numbers
- Plants
- Library counter

Animations in the scene:

- The library patrons follow splines in the scene to make the scene more realistic.
- A book appears when the player has found the correct book.
- A conversation takes place between the librarian and the avatar.

Camera placement in the scene:

The camera follows several markers that are placed in the library scene to give the player an overview of the specific scene. The camera “look at” function is used to zoom in on the books and the numerical alphabetical numbers on the spines of the books. The camera zooms in on the tile and author information of the books. This is reflected in Figure 5.13.



Figure 5.13: The library scene

Figure 5.13 illustrates a typical shelf in the library. The shelves and books with the yellow stickers on their spines in the game are an exact replica of the shelves that are used at the library of the Department of Library Services of the University of Pretoria.

Books on the shelves are arranged according to the numerical alphabetical order on the spines of the books. The player has to understand the numerical alphabetical order on the spines of the books to enable him/her to find the right book.

A conversation with the helpdesk librarian is used to discuss the library products and services with the player. The performance of the player is evaluated with drag-and-drop tests. The player has to drag and drop books in the right numerical alphabetical sequence. The player scores a mark if he/she passes the test and loses a player life if he/she fails the test.

A drag-and-drop test is given at the end of the scene. The player has to drag and drop library books in the right numerical alphabetical order (Dewey numbers).

5.4.4 Scene 4

A typical student apartment is used for the fourth scene. The fourth step in the Big6 gives tips about the assignment-writing process.

Characters in the scene:

- Student as avatar

Objects in the scene:

- Hat stand
- Mincer
- Water cooler
- Refrigerator
- Ironing board

Animations in the scene:

- The objects disappeared after the tips about the assignment-writing process are given.
- A book appears when the player has found the correct book.
- A conversation takes place between the librarian and the avatar.

Camera placement:

- The camera zooms in on the different objects in the flat.



Figure 5.14: Student flat used for scene 4

Figure 5.14 illustrates a typical example of a student flat with library books and equipment in the flat.

The initial communication is an instruction to find several objects in the apartment. The player has to search for different objects in the apartment. Finding an object will result in a tip about the assignment-writing process. The different objects with the feedback messages are a hat stand, refrigerator, mincer, water cooler and ironing board.



Figure 5.15: Incoming communication

The “distance watch” node in the scene flow canvas is used to invoke the action in the scene. A specific message that relates to the object appears when the player is within a certain distance of the object. In this scene various metaphorical messages are used.

The following metaphorical message appears when the player is within a certain distance of the hat stand: “Hang” your words on the author if you used his ideas. Correct referencing is important.”

The following metaphorical message appears when the player is within a certain distance of the refrigerator. “Order your assignment ‘fridge’ with headings and sub-headings.”

The following metaphorical message appears when the player is within a certain distance of the mincer: “Find a mincer in the kitchen ‘Mince’ your words to say what you really mean.”

The following metaphorical message appears when the player is within a certain distance of the water cooler: “Express your thoughts like crystal clear water.”

The following metaphorical message appears when the player is within a certain distance of the ironing board. “Find an ironing board in the bedroom. ‘Iron your assignment’. Present a neat assignment.”

The player scores after finding all the objects in the apartment.

5.4.5 Scene 5

A metaphoric scene is used to demonstrate the layout of the assignment. A typical construction scene is used for scene 5 to demonstrate the layout or “building process” of the assignment.

Characters in the scene:

- Student as avatar
- Builders

Objects in the scene:

- Building equipment

Animations in the scene:

- The sequence of the layout of the assignment appears in front of the player.

Camera placement:

The camera zooms in on the layout pages in the assignment.



Figure 5.16: The construction scene used for scene 5

The initial communication is: “Step five of the assignment-writing process is the construction of your assignment. This is where you start with the layout of your assignment.”

The layout (construction) of the assignment is demonstrated with graphics of a real assignment. The sequence of the layout of the assignment consists of the title page, plagiarism declaration, table of contents, content of the assignment and reference page. The player could “watch” the layout of the assignment as it appears in the scene. The player scores after he has watched all the layout pages. Figure 5.17 is an example of one of the layout pages of the layout of the assignment.



Figure 5.17: An example of the layout pages in the assignment

5.4.6 Scene 6

Step 6 of the Big6 information literacy model (Eisenberg, 2008) is meant to evaluate the assignment.

A metaphorical scene is used for scene 6. A gymnasium is used for scene 6 to allow the player to evaluate the “equipment” in his assignment.

Characters in the scene:

- Student as avatar
- Coach
- Characters that do exercises in the gymnasium

Objects in the scene:

- Sport equipment

Animations in the scene:

- Lifting of the equipment by the non-player characters in the gymnasium
- Exercise animation by the non-player characters in the gymnasium

Camera placement:

The camera follows several markers that are placed in the scene to give the player an overview of the gymnasium. The camera zooms in on the coach to indicate to the player where to find the coach.



Figure 5.18: The gymnasium scene used for scene 5

The initial communication is: “Find the coach in the gym; he will help you to ‘evaluate the equipment’ for your assignment.” The coach in the gymnasium explains the evaluation of the assignment.

The instruction from the coach is to mark the tick boxes on a checklist to ensure that the player follows the right steps in the assignment-writing process. Four evaluation checklists are used. The player is asked if he/she took the necessary steps during the assignment-writing process, namely the Big6 steps, searching all possible sources, following the writing procedure tips and ensuring correct layout of the assignment.



Figure 5.19: Checklist with tick boxes to evaluate the assignment

The player scores after he/she has made the right choices to evaluate the assignment. The instruction to the player is to attend a party to celebrate the completion of the assignment.



Figure 5.20: Party scene at the end of the game

Figure 5.20 illustrates a party scene at the end of the game. The scorecard with the final results appears after the party scene. A bouncing “soccer ball” is placed in each scene of the game to emphasise the topic of the assignment and the upcoming Soccer World Cup in South Africa.

The next section will describe the application of the game criteria in the game.

5.5 LIST OF GAME CRITERIA

Game-based learning criteria were embedded in the game. The criteria, which are reflected in Figure 5.21, were the result of the literature study in Chapter 3.

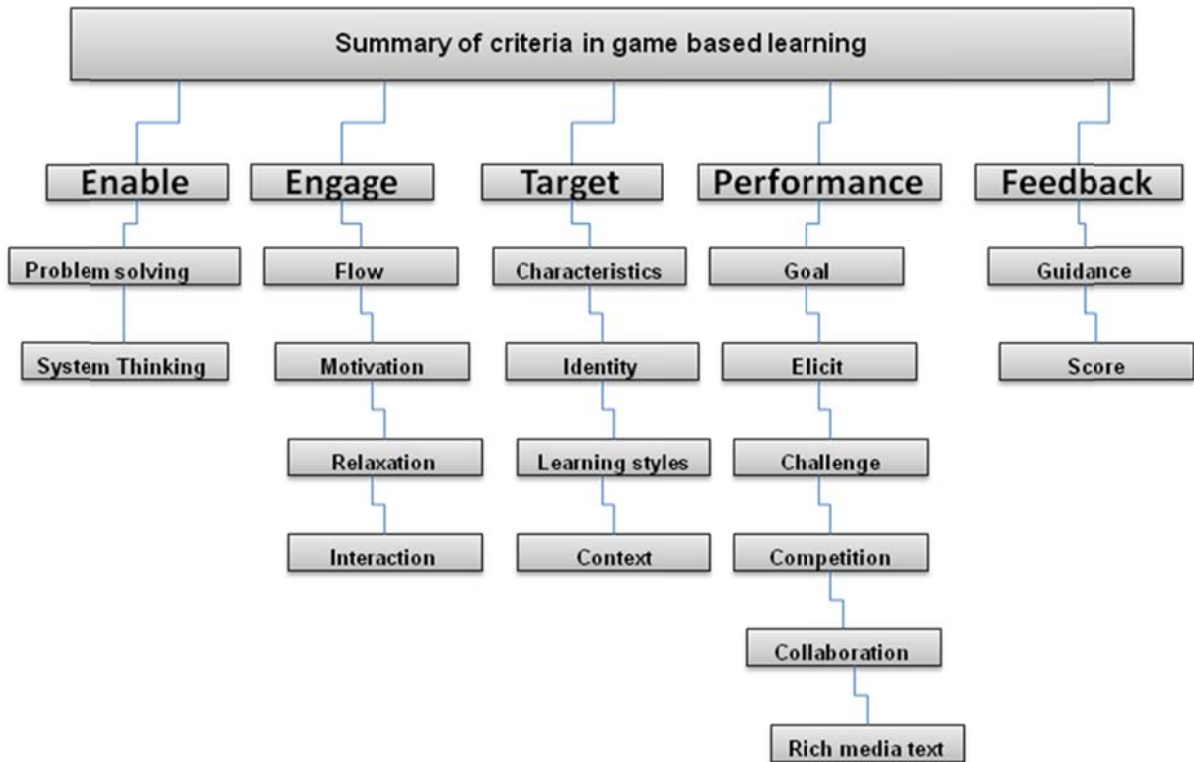


Figure 5.21: Criteria of game-based learning (also reflected in figure 3.11)

Figure 5.21 indicates the list of criteria that can be applied during the creation of the game. The criteria and the application in the game will be indicated in the following section.

5.5.1 Enable

5.5.1.1 Problem solving

The aim of the game is to enable players to solve the problems of assignment writing. The game allows the player to play through the different steps of the assignment-writing process. Each scene challenges the player to perform well to find a solution for the specific problem. The structure of the problem-solving tasks is based on the stages in problem solving as outlined by Crebert *et al.* (2011:10) and Eisenberg (2008). The stages of the problem-solving process are outlined in Table 5.1.

Stages in the problem-solving process	
Identify the problem	Determine the topic of the assignment.

Define the problem	Students should be able to understand the concept of the problem. Use concept sources to define and understand the problem.
Search information	Students should be able to search for and find information in the library.
Create or select a strategy to resolve the problem	Students should be able to use Boolean search operators to get the best results.
Allocate resources to solve the problem	Students should be able to locate information sources in the library, as well as relevant products and equipment to be able to write the assignment.
Evaluate the final solution	Students evaluate the assignment-writing process to ensure that they have followed the right process.

Table 5.1: Stages of the problem-solving process adapted by researcher

The sequence of the information literacy model and problem solving is indicated in Table 5.1. The Big6 (Eisenberg, 2008:41) steps in the assignment-writing process and the problem-solving stages (Crebert *et al.*, 2004:10) are combined to illustrate the problem-solving process in the game.

Each scene in the game indicates the steps in the information literacy model. The characters in the game correlate with the scenes and have a specific function during the assignment-writing process.

5.5.1.2 Systems thinking

Systems thinking can be enhanced during game play. All the scenes in the game are interrelated to provide the player with an overview of the whole assignment-writing process. The player is able to see the whole process of assignment writing and not only a single step. The criteria are embedded in all the scenes in the game. The combination of the criteria and

the information literacy model might encourage systems thinking. The assignment-writing process consists of different steps that influence the whole procedure. Systems thinking might improve the assignment-writing process if the student realises how strategies fit into the larger process.

5.5.2 Engage

Some of the engaging effects of games on players rely on motivation, interactivity, relaxation and the flow of the game (Clark, 2006:21; De Azevedo Filho & Latham, 2006:6, Gee, 2003:8; Joiner *et al.*, 2006:68; Oblinger, 2004:2; Rapeepisarn *et al.*, 2008:498). Certain elements engage the player in the game.

5.5.2.1 Flow and engagement

The player has to use certain skills during game play. One of these skills is to control the avatar in the game.

The designer chose a third person avatar for the reasons stated by Oshita (2006:14) in Chapter 3. A single avatar was embedded into the game, with the result that the player did not have a choice between several avatars. Choosing between several avatars might be confusing for players who lack game-playing experience.

The presence of the avatar might enhance the following game-based learning criteria:

- Personalisation and a feeling of manipulation by the player
- Learner centricity
- Identification
- Skills
- Engagement



Figure 5.22: Typical example of an avatar in the game

Figure 5.22 illustrates the avatar that will represent the player in the game.

5.5.2.2 Motivation and engagement

- Score
 - Players are motivated and stimulated to score during tests and performances in the game. Motivation and stimulation as game-based learning criteria are embedded through action. Certain acts during game play results in scoring or losing players' lives. Examples of elements of performance are:
 - Checklists
 - Multiple choice questions
 - Drag-and drop-performance
 - Customised performance
- Scenes that provide context to the learning material. Game worlds can give the context for learning with different scenes, for example a library, gymnasium or classroom. The scenes in the game keep the player motivated to proceed to the next scene. Certain activities during each scene keep the player in the game:

- Finding certain objects in the scene can engage the player. An example is that the player has to find a computer or characters during scenes.
- A player has to follow certain instructions to engage in the game.
- Surprise factors during each scene will help to keep the player in the game. The flying book in the library is an example of an unexpected event.
- The “on distance watch” triggers certain messages that can motivate the player to find more objects. The player has to find certain objects in scene 3 to receive a metaphoric tip that will help him/her with the assignment-writing process.
- Worlds that are similar to the real world can engage the player because he/she will be able to identify with the world.
- “Walking” around in the specific world might improve the engagement factor.



Figure 5.23: Typical example of a scene in the game

Figure 5.23 resembles a typical scene in the game. This particular scene takes place in the library. The player is able to identify with the computer room in the library.

5.5.2.3 Relaxation

The rich media text might improve the engagement and relaxation of the player.

- Rich media text is embedded to engage the learner. Sound, graphics and objects are added to engage the player and to add to the relaxation of the player.
- Camera placement in the software of the authoring engine is used to engage and immerse the player during game play. The camera follows certain markers in the scenes to give the player an overview of the scene before certain communications and actions. A relaxed atmosphere, together with the movie-like experience of the camera functions, can improve the fun and relaxed atmosphere for the player.
- Splines or paths for non-player characters give a realistic look and feel to the game. The movement of the non-player characters engages the player and enhances relaxation.

5.5.2.4 Interaction

- The role of the non-player characters is to interact with the avatar or player character. The non-player characters are relevant to the learning context and learning environment. The librarian in the library scene is relevant to the specific world and can help to put the learning material in context.



Figure 5.24: Interaction of the avatar with the librarian

Figure 5.24 illustrates the interaction of the avatar with the non-player character in the game. The interaction in the game can be in the form of conversations or communication and feedback during the game. The interaction with the librarian in the scene is a realistic replica of the helpdesk function in the library.

5.5.2.5 Target

The game is custom-tailored for the specific target group. First-year students that are mostly part of the net generation form the target group for this study. Certain objects were added to the game to provide for the characteristics of the specific target group. The choice of the game type fits the characteristics of the net generation.

5.5.2.6 Considering characteristics of the target group

The following characteristics of the target group were considered:

- The net generation prefers the fast-changing world of technology. The scenes in the game change constantly to engage the player.
- The net generation is used to immediate results. The immediate feedback in the game fits the preference of the net generation to get results as fast as possible.
- The digitally rich worlds of the web and visual learning are important to the net generation. The game provides rich media text to fit the characteristics of the target group.
- Identity is important to this group. Lack of personalisation can be a problem during traditional learning. The game was personalised to cater for the identity of the net generation. The avatar allows the player to take on a new identity. The new identity can extend the commitment of the player.

The avatar represents the player and personalises the learning experience of the player. Personalisation can improve the learning process. The players can feel empowered when they manipulate the avatar. The player is less involved if the first person camera is selected in the scene flow. The player has no control over the avatar with first person view.

The objects in the game are customised to ensure that the target group can identify with the objects. Customised objects, such as the soccer balls and the soccer posters in the game, emphasise the Soccer World Cup in South Africa. Most of the players should be able to identify with the event.



Figure 5.25: The customised soccer objects in the game

5.5.2.7 Learning styles

Different game types can enhance the learning experience of the different learning styles. The simulation game is flexible to accommodate different learning styles. Visually and auditory oriented learners, as well as introverted learners, can all benefit from the game. The game caters for visual learners by providing visual examples of the learning material. Sound in the game enhances the learning experience of students that have an auditory learning style. Introverts might prefer the specific game because they can play it in solitude.

However, the visual and auditory learning style of the game might not be suitable for all learners.

5.5.2.8 Context of the learning material

Learning can be more successful if it happens in an appropriate context. The learning worlds in the game put the player in contact with the learning context. Memory is context-dependent and might improve the learning experience. First-year students will be able to identify with the learning worlds such as the library, mall, classroom, student apartment and gymnasium.

The shelf and books are exact replicas of the library shelves of the academic library of the University of Pretoria. Figure 5.26 below illustrates the learning that takes place in the real world context.



Figure 5.26: Customised learning objects put the learning material in context

Figure 5.26 illustrates the customised objects in the game. The customised objects in this instance are the library books that are arranged in numerical alphabetical order.

The learner context can enhance the Big6 steps in the six scenes in the game.

- Scene 1 – Classroom scene – topic of the assignment
- Scene 2 – Mall scene – search for information
- Scene 3 – Library scene – locate information
- Scene 4 – Flat scene – writing the assignment
- Scene 5 – Construction scene – layout and presentation of the assignment
- Scene 6 – Gymnasium – evaluation of the assignment

5.5.3 Performance

The performance and interaction are the “doing” part during the game play (Prensky, 2001). Interaction as a game-based learning criterion will be embedded during all the scenes in the game.

5.5.3.1 Goal and performance

The goal of the game was explained before the players started to play the game. More detail about the goal and objective of the game were given during game play. Games must be self-explanatory. Learners do not need manuals. Learner guidance as a game-based learning criterion is embedded in the game. Incoming messages give learner guidance at the start of the scenes and during the scenes.

5.5.3.2 Elicit performance

Interactions in the game elicit performance of the player. Examples of the interactions are listed below:

- Conversations between the avatar and non-players enhance the interaction in the game.
- Branch interactions are used to give the player a choice. The player will feel empowered if he/she has a choice during game play.



Figure 5.27: Typical examples of choices in the game

Figure 5.27 illustrates the branch interaction in the game. The player is able to choose whether he wants to play a scene again or wants to stop the game.

The checklist interaction allows the player to choose the correct options. Figure 5.28 demonstrates the checklist interaction in the game.

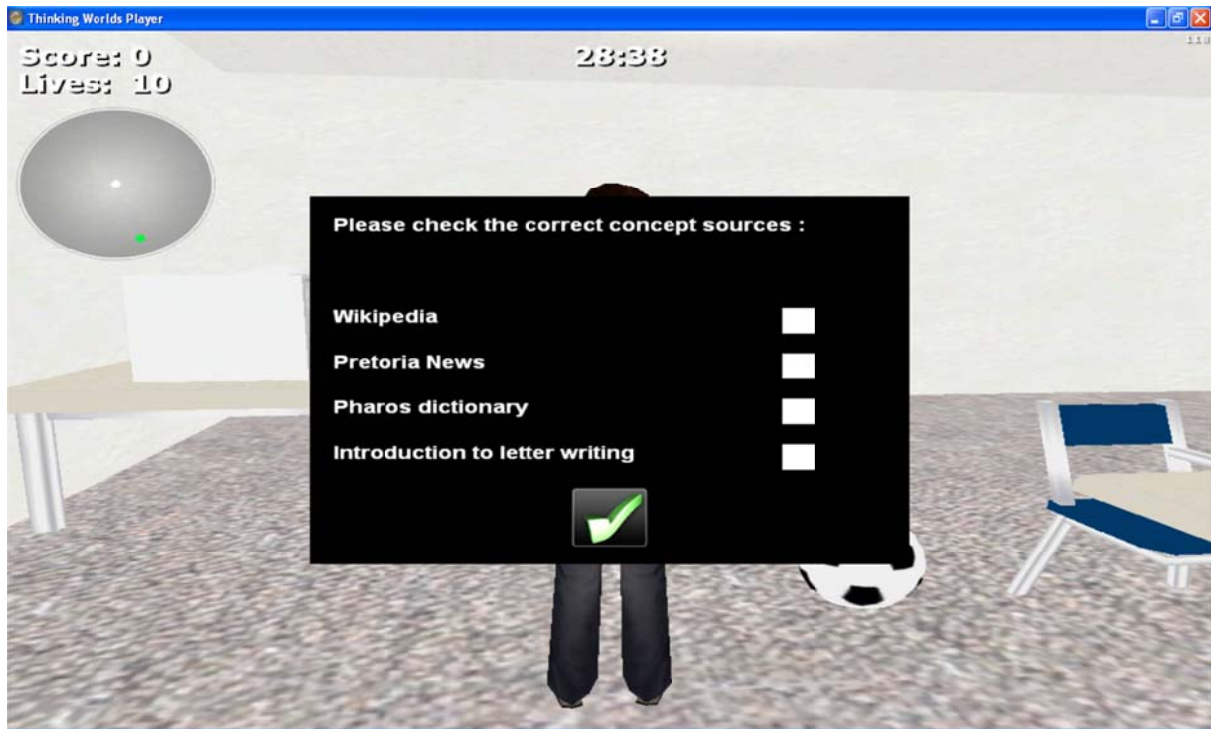


Figure 5.28: Checklist interaction in the game

The player is tested based on the previous learning experience in the specific scene. Drag-and-drop tests were added to the scene to elicit performance. Figure 5.29 demonstrates the drag-and-drop procedure that enables the player to drag and drop the books into the right numerical alphabetical order.

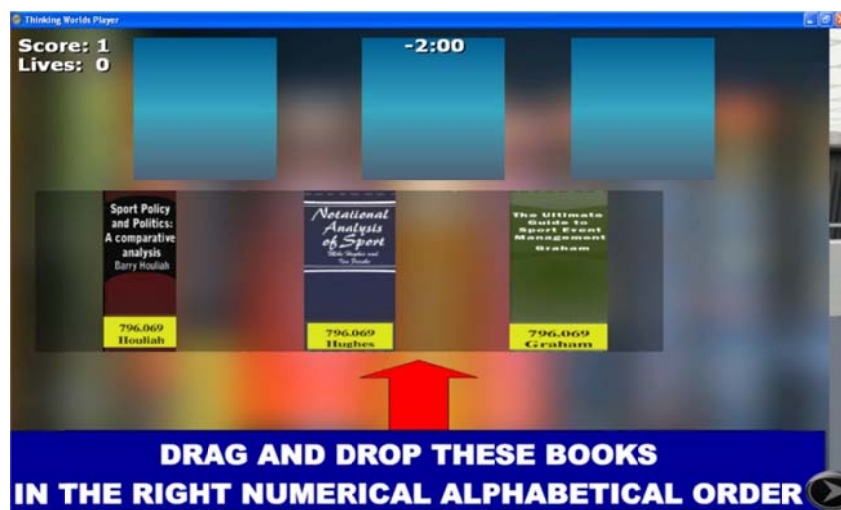


Figure 5.29: Drag-and-drop performance in the game

Conversations between the player and non-players enhance the interaction in the game. The actions are more personalised because the player is able to interact with a non-player. Non-players can challenge the player to find certain objects to enable his/her learning experience.



Figure 5.30: Conversation between avatar and non-player character

Figure 5.30 demonstrates the conversation between an avatar and a non-player. The conversation can lead to improved performance of the player. The lecturer as non-player challenges the player to find a computer in classroom 2 to learn more about the library website.

5.5.3.3 Competition

The competition element in the game is enhanced by the results. Players could score a point with the right answer. Players could lose a player life with the wrong answer. Players compete with the timer in the game to finish on time.

5.5.3.4 Collaboration

Provision could not be made for multiple players. The software in the game provides only for single players and not for multiple players in the game.

5.5.3.5 Rich media text

Rich media text is used to enhance performance during game play. Audio feedback and visual feedback are used for negative and positive results. A loud cheering sound is used if the player has passed a test and an explosion is heard if the player has failed a test.

The animation provided in the software library improved engagement during game play. Non-player characters could “walk” around and do certain tasks to improve the lifelike quality of the game.

Rich media text and visual feedback are built into the game. The image below is an example of the rich media text used for visual feedback during game play.



Figure 5.31: The rich media text during game play

Figure 5.31 illustrates the burning flames as the rich media text during game play.

5.5.4 Feedback

Game play can be the balance between feedback/communication and challenge in a game. Feedback takes place in response to the player's actions (Connolly et al., 2009:121).

Feedback can be seen as a guideline or pointers for gamers. Long manuals are not necessary at the start of the game. Gamers can be informed of where they are in a game or if they are moving up to different levels or new challenges. Feedback in the game can be used as directions for the player. Directions can be given during the conversation with the

player and non-player. Figure 5.32 illustrates that directions can be given during conversations. The player is asked to turn left and look for the laptop next to the coach. Sensible hints affect the quality of the game. The player is thus directed to be able to move on in the game.



Figure 5.32: Directions during a conversation

The feedback enables the player to move or make choices based on the previous feedback, learning and experience.

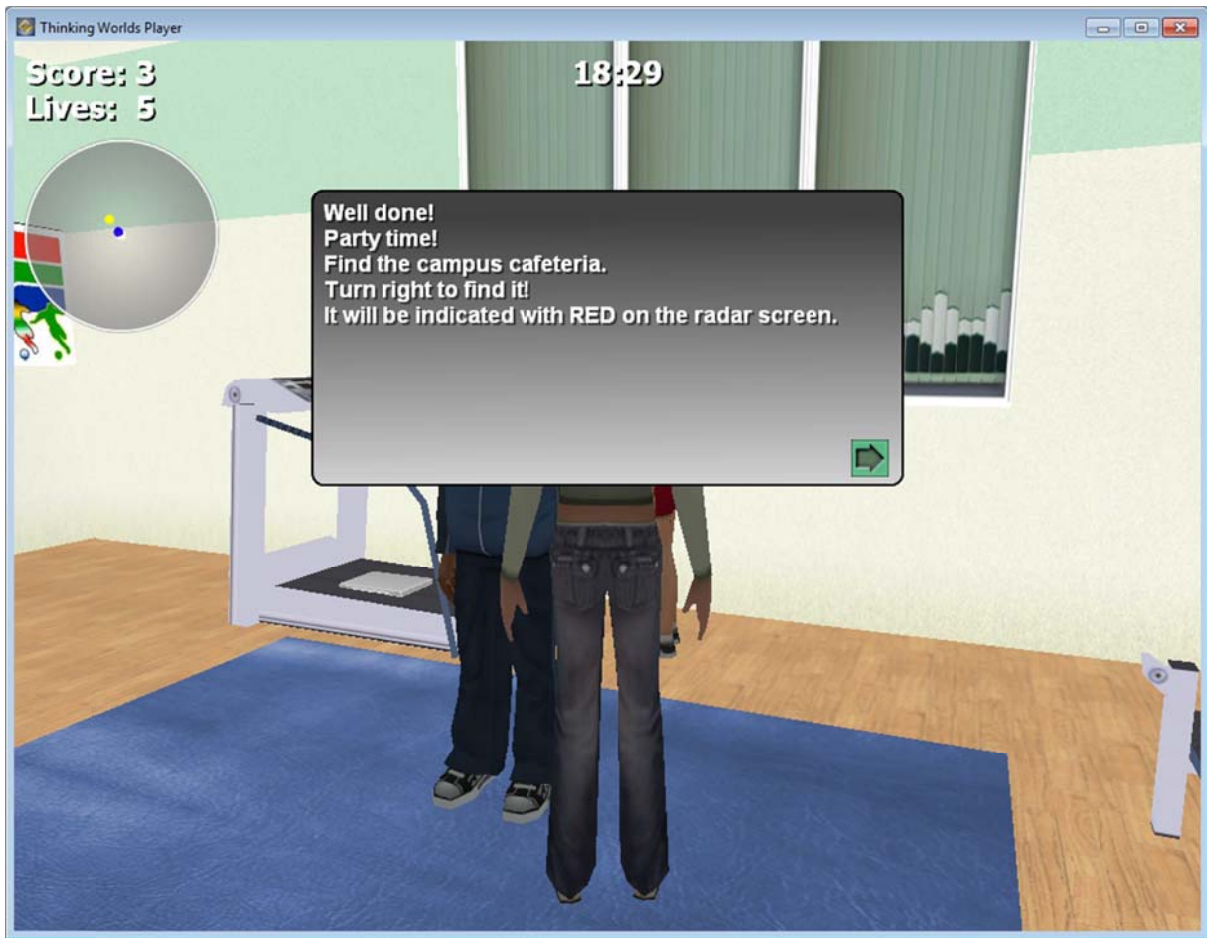


Figure 5.33: Feedback based on prior feedback

Figure 5.33 illustrates the instructions to the player after he/she has received feedback that he/she has passed a test. The following feedback asks the player to find the campus cafeteria.

Challenges with feedback are important for the flow of the game. The player can be asked to find a certain object that will be indicated on the radar in a certain colour. The player is asked to find the campus cafeteria that will be indicated in red on the radar screen.



Figure 5.34: The player uses the radar screen as guidance to find an object

Figure 5.34 is an illustration that the player will have to use the red dot on the radar as guidance to find the cafeteria. Watching the red dot will indicate to the player whether he/she is in the vicinity of the cafeteria or not.

Instructive feedback can guide and direct the player during game play. Figure 5.35 is a good example of instruction feedback during game play. The player is instructed to find the hopping soccer ball to do a test. The instruction feedback guides the player to get on with the game.



Figure 5.35: Instruction feedback during game play

Relevant feedback will give hints to solve problems in a game. The choice of keywords in the mall scene will give the player an indication that he has made the wrong choice through relevant feedback. Figure 5.36 illustrates the feedback to the player that he/she did not choose the best keywords. The hint to the player is that he/she can make a better choice to solve the problem. Feedback can therefore influence the decision-making of the player during game play.



Figure 5.36: Relevant feedback in the game can indicate that there are better choices

5.5.4.1 Feedback and results

Feedback can be given in many ways, for example scores, displays and verbal feedback. Feedback as a direct result can be displayed in the head-up display of the game.



Figure 5.37: The feedback indicates that the player will lose a player life.

The score, the player lives and the timer are indicated on the screen. The feedback on lives, as well as the feedback message, indicates that the player has failed a test. The feedback can also offer repetitive opportunities to practise and pass the next test.

The progress of the player is automatically measured in the game with outcomes or feedback. The results will indicate if the player can progress in the game.



Figure 5.38: Indication of progress to the player

The performance feedback indicates the progress of the player. Figure 5.38 indicates to the player that he/she has passed the test and will score a point and progress to the next level. The performance feedback might motivate the player to score to see if he/she can move to the next level.

An immediate test result is provided through visual feedback. An example of a score card can be seen in Figure 5.38.

The illustration of the score card in Figure 5.39 is an example of immediate feedback of test results after game play. The player will be able to see his/her results in the form of stars for the score of the game. The score for the game, the game time and the number of player lives lost will be given on completion of the game. The player will thus know immediately if he/she has passed or failed the game, and the time it took to finish the game.



Figure 5.39: Score card after game play

5.6 CONCLUSION

The purpose of this chapter was to demonstrate how the game was created and how the criteria for game-based learning can be built into a game.

Section 5.1 discussed and indicated the different functions of the authoring search engine that was used for the creation of this specific game. The software library in the authoring engine, with all the functionalities and purposes, was described to indicate how the game had been created. The scene flow canvas and the creation of the scene flow were described and illustrated to give a clear indication of the purpose and power of the scene flow. The description of the head-up display in the game gave background information on the functions of the score, player lives, timer and radar display. The relevance of these functions for the development of the game was explained.

A description of the scenes and the sequence of the scenes were given. Each scene was described and the relevance of the Big6 (Eisenberg, 2008) information literacy model was

given. A description of the characters, objects, animations and camera placement in the scenes was given.

Table 5.2 is an indication of the combination of game-based learning and an information literacy model (Big6).

The criteria for game-based learning, such as engagement, target group, performance, and feedback and enablement were indicated prior to the discussion of a specific scene or sequence in the game. The specific criteria indicator is not an indication that the criteria are only applicable or embedded for that specific area or stage in the game; they will influence the whole game. The application of the game-based learning criteria was described and illustrated in Chapter 5 from section 5.5. The target indicator above the scenes in the game indicates the engagement during the different scenes in the game. Engagement is not only applicable to the scenes. The player is engaged during the whole game.

The target indicator is placed above the specific characters in the game. Although the target group is able to identify with the characters in the game, there are other objects and scenes, performance and feedback that cater for this specific target group of this study.

Feedback is given throughout the game and not only during the third phase of the game. Feedback is used as guidance and to provide results during the whole game. The application and illustrations were indicated and illustrated in section 5.10.

The performance indicator in the table is an indication of the performance of the player during game play. The action and interaction in the game were described and illustrated in section 5.9.

Table 5.2: Game-based learning and information literacy combined to result in systems thinking

The enablement indicator in the table indicates how the game enables the player. The player is able to solve the assignment-writing problem. The player is able to identify concept sources, use the library catalogue and find library books on the shelves, receive tips about the assignment-writing process and the layout of the assignment. The player is enabled to evaluate his/her assignment during the last scene in the game.

Table 5.2 can be an indication that the combination of game-based learning criteria and information literacy standards enables the player to see how everything fits into everything else. Systems thinking is thus enabled during the whole process.

Chapter 6 will report on the data collection of this study and give a first level of analysis of the results. The conclusive chapter will be Chapter 7, with recommendations and conclusion of this study.

CHAPTER 6

6. DATA COLLECTION AND RESEARCH FINDINGS

6.1 INTRODUCTION

The focus in the preceding chapters was on the importance of engaging students during library instruction. The purpose of Chapter 1 was to highlight the background of this study. Chapter 2 focused on the importance of information literacy, while Chapter 3 focused on the criteria applying to game-based learning and Chapter 4 on the methodology for this study and the methodology for game design. Chapter 5 focused on the criteria that were embedded in the game. The focus of chapter 6 will be on reporting on the data collection and first-level analysis to address the research problem as explained in Chapter 1, sections 1.1 and 1.2.

The research problem was formulated as follows: “To what extent can a game be used as an instructional tool for library instruction?”

Some of the sub-problems could be answered from the literature study and some required data to be collected empirically, namely:

- Which of the criteria identified through the literature survey (see Chapter 3, section 3.8) could be implemented in the design of the game?
 - What are the restrictions based on the software?
 - What are the restrictions based on the content environment?
- What is the user’s experience during the game?
 - What is the affective experience?
 - What is the learning experience?

To put the data that were collected in context, this chapter will also expand on the method for data collection briefly addressed in Chapter 1, section 1.7. Data collected in the empirical study will be discussed according to five main headings, namely:

- Quantitative data
- Feedback on the need for instructional games

- Improvement of knowledge
- Qualitative data
- Reports of negative experiences

The chapter will be concluded with a summary of the value of the data collected and the link of the findings to the theory reported (mostly in Chapter 3).

6.2 REVIEW OF METHOD OF DATA COLLECTION

It was explained in Chapter 4 that a quantitative as well as qualitative approach would be followed in the case study, based on an instructional game for library instruction to be used with first-year students at the University of Pretoria.

The research event took place at the Merensky Library on the main campus of the University of Pretoria during the library instruction sessions in January 2010. Students played the game after an introductory session consisting of a PowerPoint presentation. A librarian was in charge of these training sessions, with two additional library personnel members assisting the librarian. After completing the game students were requested to complete the self-administered questionnaire (Appendix A) consisting of 31 questions, which collected quantitative as well as qualitative data. Open-ended questions were used for qualitative data and closed-ended questions, requiring yes or no answers, as well as choices on a six-point Likert scale ranking, were used to collect quantitative data. Question 31 asked if they would be willing to participate in focus group interviews (if this might be necessary to supplement data).

The questionnaires were completed by 1 284 students. The purpose of the questions and whether they were intended to collect quantitative or qualitative data can be summarised as follows:

- The first question was optional and therefore not numbered. The student number was used to collect personal information about the student.
- Questions 1 to 3 were used to collect data on the players' lives and game time (i.e. the time it took to complete the game). A player lost a player life with a wrong answer and scored with the right answer. The score for the game and the players' lives' lost will be discussed in section 6.6.

- Questions 4 and 7 collected data on students' prior access to school libraries as well as other types of libraries. Responses to these questions will be dealt with in section 6.3.1.
- Question 5 collected data on how often students used school libraries and other libraries. Responses will be dealt with in section 6.3.1.
- Question 6 collected data on their purpose for using the school library. The data on the purpose of the library were excluded, since there could have been misinterpretation of the size and quality of the library.
- Question 8 collected data on the student's knowledge of school libraries before playing the game and will be dealt with in section 6.3.1.
- Questions 9 to 11 collected information about the previous experience of students with computer games and will be dealt with in section 6.3.2.
- The following questions were asked to rate the game, the descriptions in the game and the graphics in the game: 12, 14, 16, 18, 20, 21, 22, 24 and 26. These questions used a six-point Likert scale, where 1 indicated a low and 6 a high ranking. Responses will be dealt with in section 6.3.3.
- For Questions 27 to 29, the values of the rating scale ranged between specific values, namely excellent to very poor, with very good, good, fair and poor in between. Responses to these questions will be dealt with in section 6.3.3.
- Questions 13, 15, 17, 19, 23, 26 and 30 were used for qualitative questions. Open-ended questions were used to collect qualitative data, e.g. on the affective experience of the research participants. Responses to these questions will be dealt with in section 6.7. For qualitative data, to be discussed in section 6.7, there will be no indication of frequency tables.

6.3 QUANTITATIVE DATA COLLECTED

Before reporting and analysing the responses to each question, Tables 6.1 and 6.2 will give overviews of the frequency of responses as well as missing data for each question. Please note that Table 6.1 reflects only the questions collecting quantitative data.

The following explanation applies to the descriptive statistics of response frequencies that will be given in Tables 6.1 and 6.2 presented in this chapter. The first question was optional and asked for the student number. Questions 1, 2 and 3 collected the score of the game and the number of players' lives lost. The descriptors in Table 6.1 can be interpreted as follows:

- Under N for number, the valid as well as missing values for each question are indicated.
- Missing values are questions that were not completed by the respondents (Everitt, 1998:213).
- Validity indicated if the measuring instrument measured what was intended (Everitt, 1998:388).

Statistics

	N	
	Valid	Missing
Q4 Did you have access to a school library at your school?	1249	35
Q5 How often did you use the library?	1032	252
Q7 Did you have access to any other libraries?	1096	188
Q9 Have you played computer games before?	1272	12
Q10 Were you able to find the objects in the game?	285	999
Q11 Were you able to "walk" around in the game?	283	1001
Q12 To what extent did you feel that you wanted to learn more while you were playing the game?	1280	4
Q14 To what extent did you understand the goal of the game?	1280	4
Q16 To what extent did you find the feedback that was given useful during game play?	1273	11
Q18 To what extent did the game hold your attention during game play?	1278	6
Q20 To what extent do you think the game would help you to make better use of the library?	1278	6
Q21 To what extent do you think the game would help you with the assignment-writing process?	1275	9
Q22 To what extent do you feel that games are an effective way to learn?	1274	10
Q24 To what extent did you forget time passing while playing the game?	1273	11
Q25 To what extent did you become involved in the game?	1279	5
Q27 How do you rate the game?	1278	6
Q28 How do you rate the descriptions in the game?	1278	6
Q29 How do you rate the graphics in the game?	1273	11

Table 6.1: Frequencies for questions collecting quantitative data

The frequencies for Questions 1 and 2 are depicted in Table 6.2. Here the descriptive statistics should be interpreted as follows:

- N: score number or the player's lives.
- Maximum: maximum score for the game or the player's lives – in this case respectively 10 and 12.
- Minimum: minimum score for the game or the player's lives – in this case 0 for the game score and -1 for the player's lives.
- Mean: value that is computed by dividing the sum of a set of terms by the number of terms (Dodge, 2002:339).

- Standard (Std) deviation: variation from the average (Everitt, 1998:317).

<u>Descriptive Statistics</u>					
	N	Minimum	Maximum	Mean	Std. Deviation
Q1 Score for the game	1261	0	10	7.01	2.269
Q2 Player lives	1263	-1	12	7.48	2.047

Table 6.2: Frequencies for Questions 1 to 2 dealing with the score and player's lives for the game

In the sub-sections to follow, the responses for each quantitative question will be represented in more detail, with a brief analysis and explanation where necessary.

6.3.1 Questions dealing with access to school libraries and the use of libraries

Questions 4, 5, 6 and 7 enquired whether students had had access to a school library and whether they had made prior use of school libraries or any other library. The responses to these questions are represented in Tables 6.3 and 6.5. Since there was no definition or explanation for the qualification of a school library, e.g. in terms of size or quality, it seems that the questions on the use of and access to school libraries and other libraries might have been misinterpreted by the students. In the questionnaire (Question 7) "other library" was also not specified in terms of type or size; answers to this question might therefore reflect misinterpretation. Since there might be a problem with the validity of the answers to Questions 4 to 8, the researcher will not analyse the questions concerning the prior use of school and other libraries. Tables 6.3 to 6.5 will only reflect the statistics of the responses.

The following applies to the interpretation of the descriptors in Tables 6.3 to 6.5, as well as to all other tables in this section:

- Valid percentage: valid evidence that an enquiry is bias-free (Everitt, 1998:343).
- Percentage: a way of expressing a number as a fraction of 100 (Dodge, 2003:419).
- Frequency: number of occurrences or appearances (Dodge, 2003:208).
- Cumulative percentage: cumulative frequency function (Everitt, 1998:88).

Question 4 Did you have access to a school library at your school?

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Yes	908	70.7	72.7	72.7
	No	341	26.6	27.3	100.0
	Total	1249	97.3	100.0	
Missing	System	35	2.7		
Total		1284	100.0		

Table 6.3: Frequency table for access to school libraries

Table 6.3 depicts that 72.7% of students indicated they had used a school library before, while 27.3% of the research participants indicated they had not. In addition to access to school libraries, it seemed useful to determine how often students used the library. Although there might have been (as explained previously), a misinterpretation of the meaning of a school library, the frequency of responses is noted and depicted in Table 6.4.

Question 5 How often did you use the library

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Once a week	277	21.6	26.8	26.8
	2 Once a month	162	12.6	15.7	42.5
	3 Seldom	388	30.2	37.6	80.1
	4 Never	205	16.0	19.9	100.0
	Total	1032	80.4	100.0	
Missing	System	252	19.6		
Total		1284	100.0		

Table 6.4: Frequency table for use of school libraries

In Table 6.4 it is shown that 26.8% of the participants used the school library once a week, 15.7% used it once a month and 19.9% indicated that they never used the school library. Apart from a school library, research participants might also have had access to other types of libraries, such as public libraries and community libraries, which might influence their knowledge and experience in using libraries and therefore perhaps the impact of the instructional game.

Question 7 therefore enquired about students' access to other libraries. Responses to Question 7 are depicted in Table 6.5.

Question 7 Did you have access to any other libraries?

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Yes	759	59.1	69.3	69.3
	No	337	26.2	30.7	100.0
	Total	1096	85.4	100.0	
Missing	System	188	14.6		
Total		1284	100.0		

Table 6.5: Frequency table for access to other libraries

The majority of students (69.3%) had access to other libraries, while 30.7% indicated they did not have such access. Again, the validity of responses to Question 7 can be a problem, as no explanation was given of the type, size or quality of the other libraries to which students had access. The data will therefore not be analysed further.

6.3.2 Questions on prior experience with computer games and navigation

Prior experience with computer games might influence participants' experience and impressions of the instructional game (Castel, Pratt & Drummond, 2005:220). Question 9 determined prior experience in the use of computer games. Research participants who indicated no prior experience were requested to complete two more questions dealing respectively with finding (i.e. locating) objects in the game and the ease of navigation (i.e. walking around in the game).

The purpose of the objects in the game was to indicate where the player could find certain learning material. Objects included a laptop and library shelves. Navigation could present a problem during game play. The player might get frustrated and lose interest if he/she could not move around in the game area. The question will be repeated for each section in a table, with information about the specific question and a figure to explain the response to that question. A discussion on the specific responses will follow after the figure.

The responses to Question 9 are depicted in Table 6.6 and Figure 6.1.

Question 9 Have you played computer games before?

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Yes	1005	78.3	79.0	79.0
	No	267	20.8	21.0	100.0
	Total	1272	99.1	100.0	
Missing	System	12	.9		
Total		1284	100.0		

Table 6.6: Frequency table for prior experience with computer games

Figure 6.1 is a visual representation of the game experience for the students. According to Figure 6.1, only 267 (20.8%) of the first-year students at the University of Pretoria who attended training had not played games before.

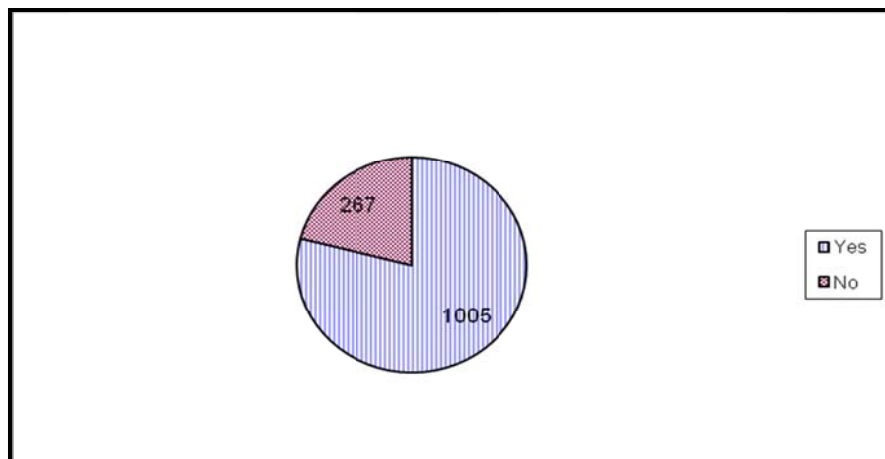


Figure 6.1: Visual representation of prior experience with computer games

The visual figure correlates with the statement by Oblinger (2004) that 69% of the net generation have played games by the time they reach elementary school, 77% by the time they reach high school and 60% of college students are regular game players (Oblinger, 2004:4). Of the 267 who replied “No” to Question 9, further data were collected through Questions 10 and 11. Table 6.7 indicates the response to questions on whether game objects could be located and Table 6.8 on the ease of navigation.

Question 10 Were you able to find the objects in the game?

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Yes	274	21.3	96.1	96.1
	No	11	.9	3.9	100.0
	Total	285	22.2	100.0	
Missing	System	999	77.8		
Total		1284	100.0		

Table 6.7: Frequency table for locating objects in the game

Figure 6.2 is a visual representation of the ability of inexperienced students to find objects in the game. Navigation indicates the finding of certain objects in the game. The player had to navigate to find certain objects in the game.

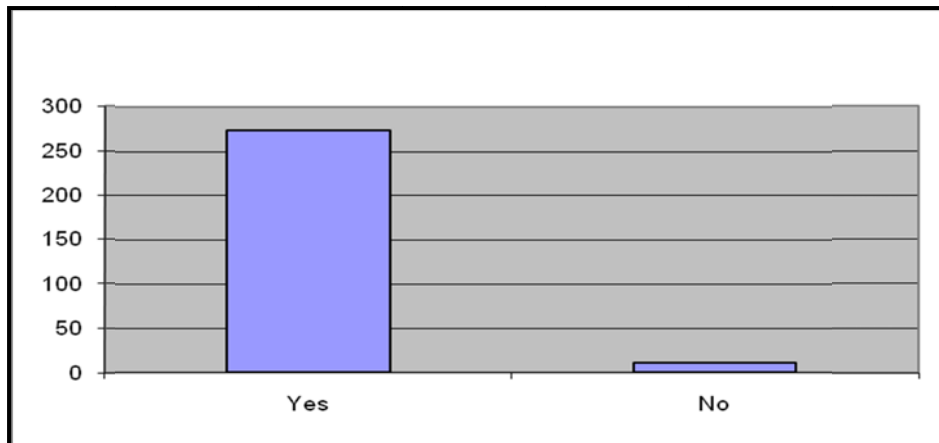


Figure 6.2: Ability of respondents with no prior experience in playing computer games to find objects in the game

Question 11 tested inexperienced game players' ability to "walk" around in the game. The avatar or the electronic image that represents the player (Kim, 2009:89) will be able to walk around in the game. The ability of inexperienced players to control the avatar was tested with Question 11.

Question 11 Were you able to "walk" around in the game?

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Yes	274	21.3	96.8	96.8
	No	9	.7	3.2	100.0
	Total	283	22.0	100.0	
Missing	System	1001	78.0		
Total		1284	100.0		

Table 6.8: Inexperienced players' ability to "walk" around in the game

Figure 6.3 indicates the ability of players to "walk" around in the game in correlation with their experience.

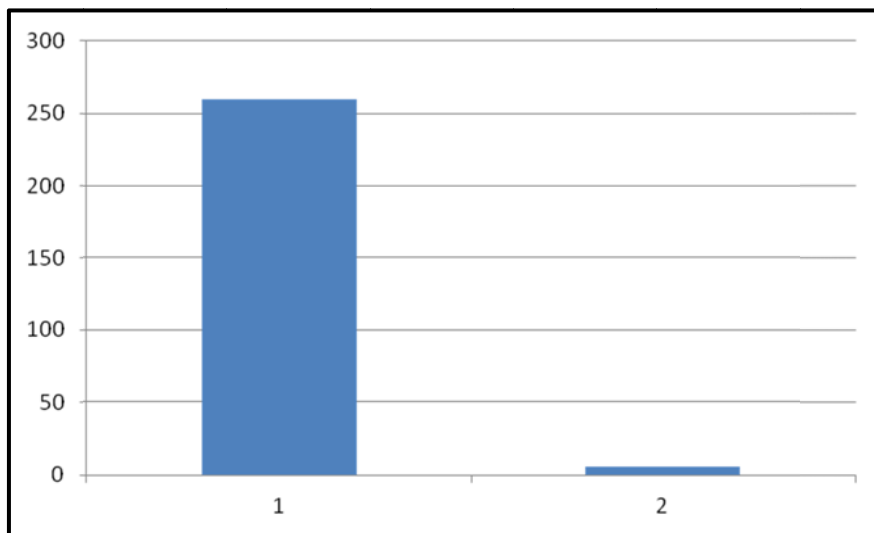


Figure 6.3: Inexperienced players' ability to "walk" around in the game.

Players were asked to answer "Yes" or "No" to the question "Were you able to 'walk' around in the game?" Answering "No" indicated that the player was not able to "walk" around in the game. Column 1 in the graph reflects the "Yes" answers and Column 2 the "No" answers. As indicated in Tables 6.7 and 6.8, even students who had not played computer games before were able to find objects and control their avatars. This can be an indication that the net generation or digital natives will adapt more easily to digital technology (Prensky, 2006:15).

6.3.3 Questions on affective experience and games

Motivation is important in game-based learning. Refer to section 6.6.1 for more detailed information about motivation. Students' reactions to game play were tested with Question 12.

Question 12 To what extent did you feel that you wanted to learn more while you were playing the game?

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Low	30	2.3	2.3	2.3
	2	84	6.5	6.6	8.9
	3	168	13.1	13.1	22.0
	4	424	33.0	33.1	55.2
	5	374	29.1	29.2	84.4
	High	200	15.6	15.6	100.0
	Total	1280	99.7	100.0	
Missing	System	4	.3		
Total		1284	100.0		

Table 6.9: Frequency table for effect of game as stimulus for further learning

Table 6.9 indicates that the majority of students were motivated to learn more while playing the game. Visual stimuli can motivate the player to want to learn more (see Chapter 3, section 3.5).

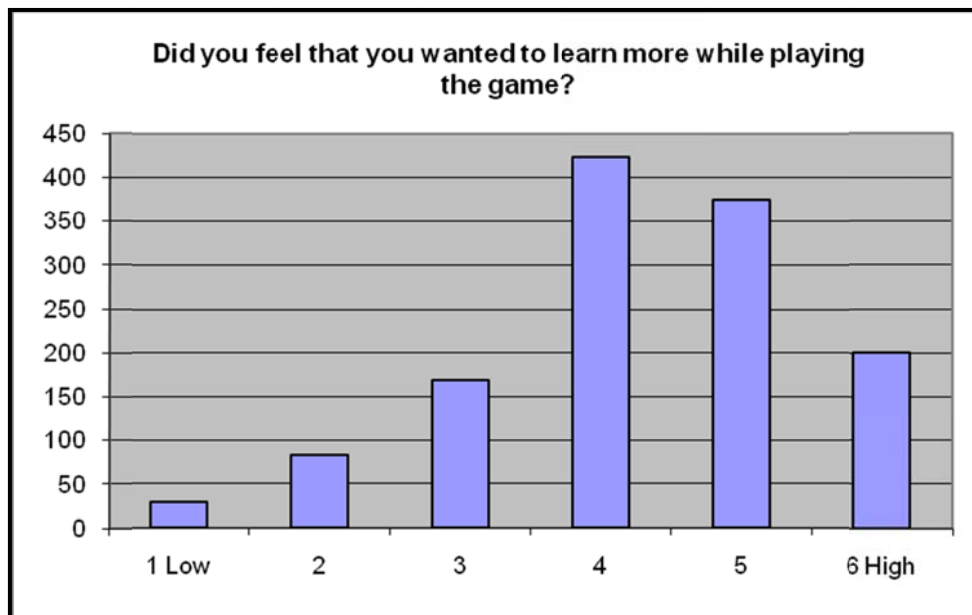


Figure 6.4: Rating the extent of wanting to learn more while playing the game

According to Figure 6.4, most of the students wanted to learn more while playing the game. Only 22% of students did not want to learn more, while 77.9% rated their desire to learn more as 4 and higher.

Question 14 To what extent did you understand the goal of the game?

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	0	1	0.1	0.1	0.1
	Low	7	0.5	.5	0.6
	2	15	1.2	1.2	1.8
	3	34	2.6	2.7	4.5
	4	155	12.1	12.1	16.6
	5	424	33.0	33.1	49.7
	High	643	50.1	50.2	99.9
	9	1	0.1	0.1	100.0
	Total	1280	99.7	100.0	
Missing	System	4	0.3		
Total		1284	100.0		

Table 6.10: Frequency table for understanding the goal

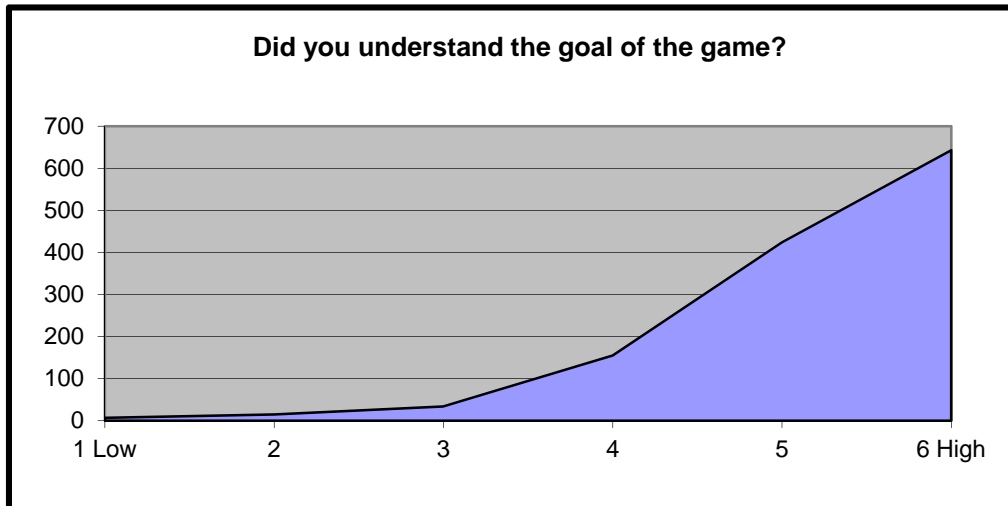


Figure 6.5: Extent of understanding the goal of the game

According to Table 6.10, only 1.8% of students did not understand the goal of the game, while the majority of the students (97.2%) understood the goal of the game.

Question 16 To what extent did you find the feedback that was given useful during game play?

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Low	11	0.9	0.9	0.9
	2	20	1.6	1.6	2.4
	3	71	5.5	5.6	8.0
	4	328	25.5	25.8	33.8
	5	525	40.9	41.2	75.0
	High	318	24.8	25.0	100.0
	Total	1273	99.1	100.0	
Missing	System	11	0.9		
Total		1284	100.0		

Table 6.11: Frequency table for extent of feedback

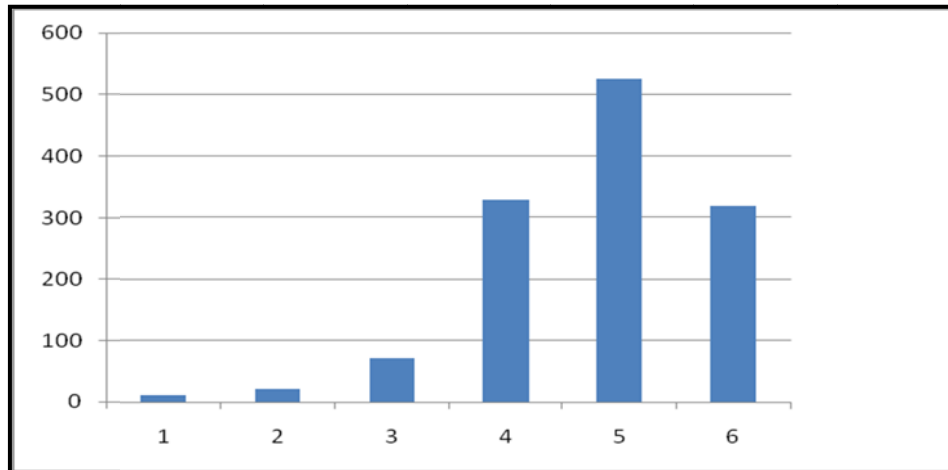


Figure 6.6: Extent of usefulness of feedback

The series in Figure 6.6 indicates the frequency of the usefulness of feedback in the game. Players can be challenged, directed and guided with feedback (Gee, 2004:19). Refer to section 6.6.4 for more information about the importance of feedback in games. It seems that the majority of students (92%) found the feedback useful. Only 8.1% rated the usefulness of the feedback of the game between 1 and 3.

Involvement can enhance concentration and pleasure during game play (Refiana, Mizerski & Murphy 2005:108). Involvement and attention during game play were rated with Question 18. The results to this question are depicted in Table 6.12 and Figure 6.7.

Question 18 To what extent did the game hold your attention during game play?

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Low	22	1.7	1.7	1.7
	2	65	5.1	5.1	6.8
	3	172	13.4	13.5	20.3
	4	332	25.9	26.0	46.2
	5	391	30.5	30.6	76.8
	High	296	23.1	23.2	100.0
	Total	1278	99.5	100.0	
Missing	System	6	0.5		
Total		1284	100.0		

Table 6.12: Frequency table for holding attention during game play

From Table 6.12 it is clear that a high percentage of students (79.8%) were of the opinion that the game held their attention. A very low percentage (20.3%) of students felt the game did not succeed in holding their attention.

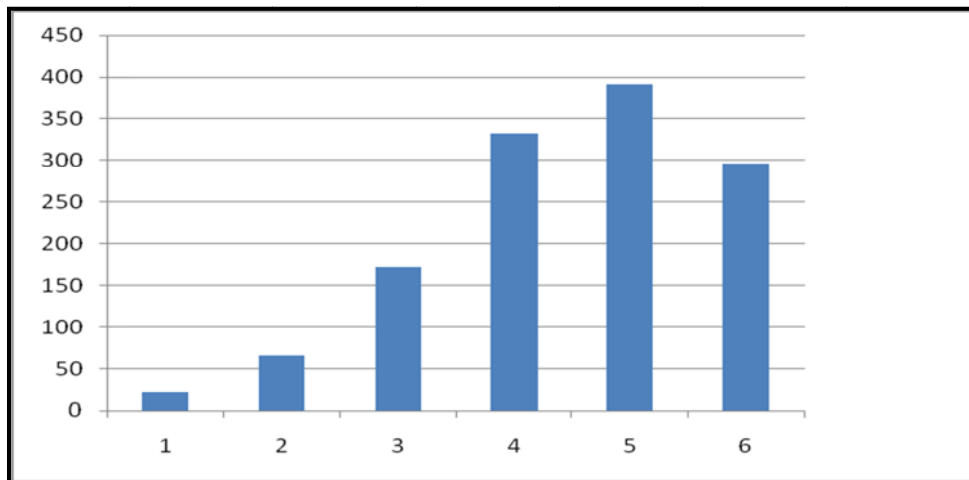


Figure 6.7: Ability of game to hold attention

The purpose of Question 20 was to determine whether students were of the opinion that the game would possibly enable them to make better use of the library. The replies to this question are depicted in Table 6.13 and Figure 6.8. In table 6.13 it is shown that students responded very positively to the impact of the game on their ability to use the library. Figure 6.8 gives a clear visual depiction of the majority of students (93.1%) who seemed to think that the game would help them to make better use of the library; only a very low percentage of 6.8% indicated the game would not help them use the library effectively.

Question 20 To what extent do you think the game would help you to make better use of the library?

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Low	5	0.4	0.4	0.4
	2	10	0.8	0.8	1.2
	3	72	5.6	5.6	6.8
	4	249	19.4	19.5	26.3
	5	458	35.7	35.8	62.1
	High	483	37.6	37.8	99.9
	45	1	0.1	0.1	100.0
	Total	1278	99.5	100.0	
Missing	System	6	0.5		
Total		1284	100.0		

Table 6.13: Frequency table for help with library usage

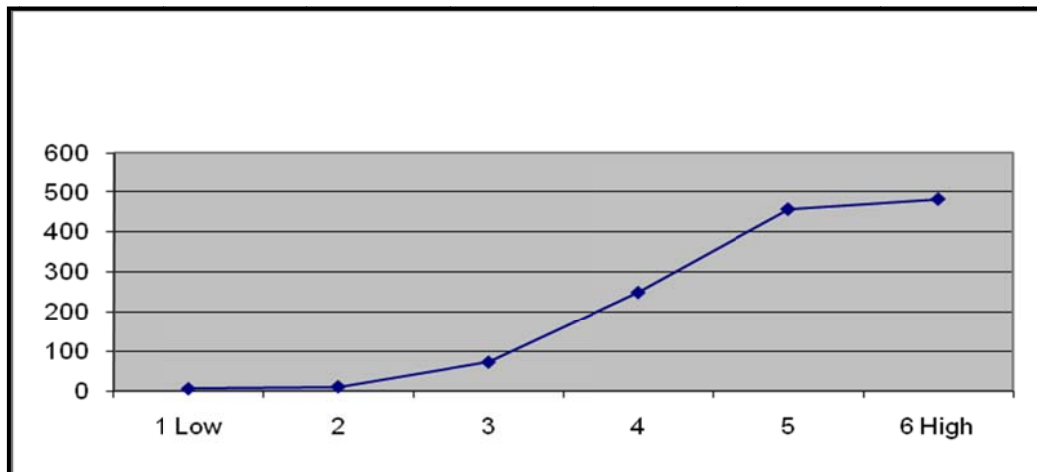


Figure 6.8: Rating scale of perceived ability of game to support better use of the library

The statistical analysis in Figure 6.8 correlates with the idea that educational games may transfer knowledge and fit the needs of the net generation (De Azevedo Filho & Latham 2006:2; Ebner & Holzinger, 2007:872).

Question 21 tested students' opinion on how the game would help them with the assignment-writing process. The replies to this question are reflected in Table 6.14 and Figure 6.9.

Question 21 To what extent do you think the game would help you with the assignment-writing process?

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Low	4	0.3	0.3	0.3
	2	22	1.7	1.7	2.0
	3	63	4.9	4.9	7.0
	4	187	14.6	14.7	21.6
	5	492	38.3	38.6	60.2
	High	507	39.5	39.8	100.0
	Total	1275	99.3	100.0	
Missing	System	9	0.7		
Total		1284	100.0		

Table 6.14: Frequency table for experience of help with the assignment-writing process

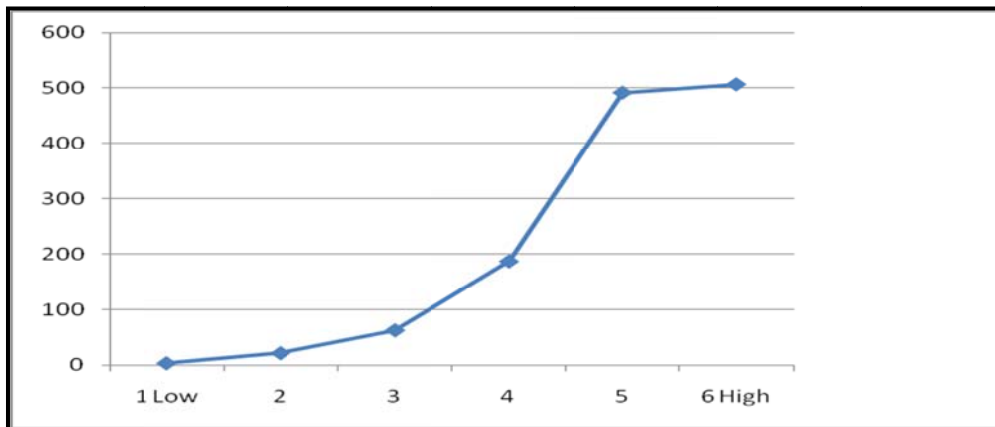


Figure 6.9: Rating of perceived ability of game to support the assignment-writing process

In Figure 6.9 it is shown that students responded very positively to the effect of the game on the assignment-writing process. The rating scale of perceived ability of the game to support the assignment-writing process is that 6.9% of students thought the game would not support the assignment-writing process, while 93.1% thought that the game would support it.

The usefulness of the game in helping with assignment-writing also relates to the issue of improvement of knowledge, which is discussed in more detail in section 6.5.1.

The researcher deemed it necessary to test the student’s feelings about the effectiveness of games. This specific question can establish if more games can be created for library instruction. See Table 6.15 and Figure 6.10.

Question 22 To what extent do you feel that games are an effective way to learn?

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Low	11	0.9	0.9	0.9
	2	29	2.3	2.3	3.1
	3	56	4.4	4.4	7.5
	4	215	16.7	16.9	24.4
	5	461	35.9	36.2	60.6
	High	502	39.1	39.4	100.0
	Total	1274	99.2	100.0	
Missing	System	10	0.8		
Total		1284	100.0		

Table 6.15: Frequency table for effective learning and computer games

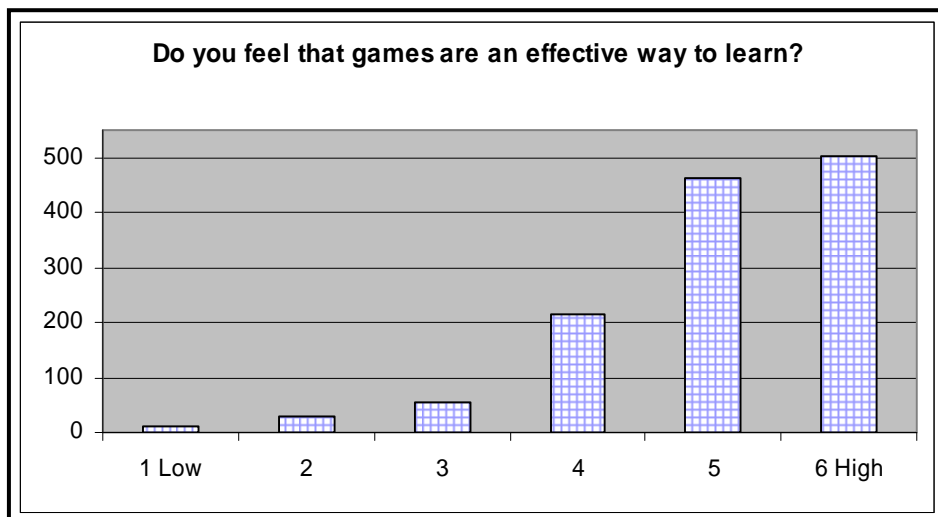


Figure 6.10: Rating games as an effective way to learn

The need for instructional games is discussed in section 6.5. It seems that the need for instructional games correlates with the rating of the students that games are an effective way to learn. The rating scale correlates with Shih and Allen’s (2007:901) statement that librarians will have to accommodate the needs of the Gen-D and net generation to use games as an effective way to learn. Question 24 tested the effect of time on game players. Students were asked to rate the effect of time during game play.

The effect of time on game players is depicted in Table 6.16. A graphic display of the effect of time can be found in Figure 6.11.

Question 24 To what extent did you forget time passing while playing the game?

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Low	105	8.2	8.2	8.2
	2	181	14.1	14.2	22.5
	3	231	18.0	18.1	40.6
	4	362	28.2	28.4	69.0
	5	261	20.3	20.5	89.6
	High	133	10.4	10.4	100.0
	Total	1273	99.1	100.0	
Missing	System	11	0.9		
Total		1284	100.0		

Table 6.16: Frequency table for time passing while playing the game

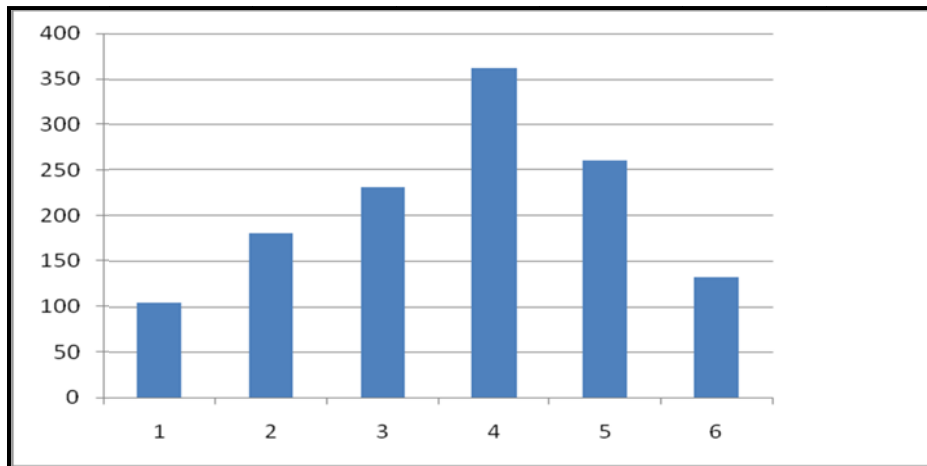


Figure 6.11: The effect of time on game players as rated by students

It seems that the minority (40.5%) of students did not forget time passing while playing the game, while the majority of students (59.3%) forgot time while playing the game. Refer to section 6.6.6 for more information about the effect of time on game play.

Question 25 addressed involvement in the game. Involvement is discussed in section 6.6.2. Students' affective experiences were tested with quantitative questions. More details about gaming and involvement are given in section 6.6.2.

Question 25 To what extent did you become involved in the game?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low	26	2.0	2.0	2.0
	2	74	5.8	5.8	7.8
	3	193	15.0	15.1	22.9
	4	383	29.8	29.9	52.9
	5	383	29.8	29.9	82.8
	High	220	17.1	17.2	100.0
	Total	1279	99.6	100.0	
Missing	System	5	.4		
Total		1284	100.0		

Table 6.17: Frequency table for involvement in the game

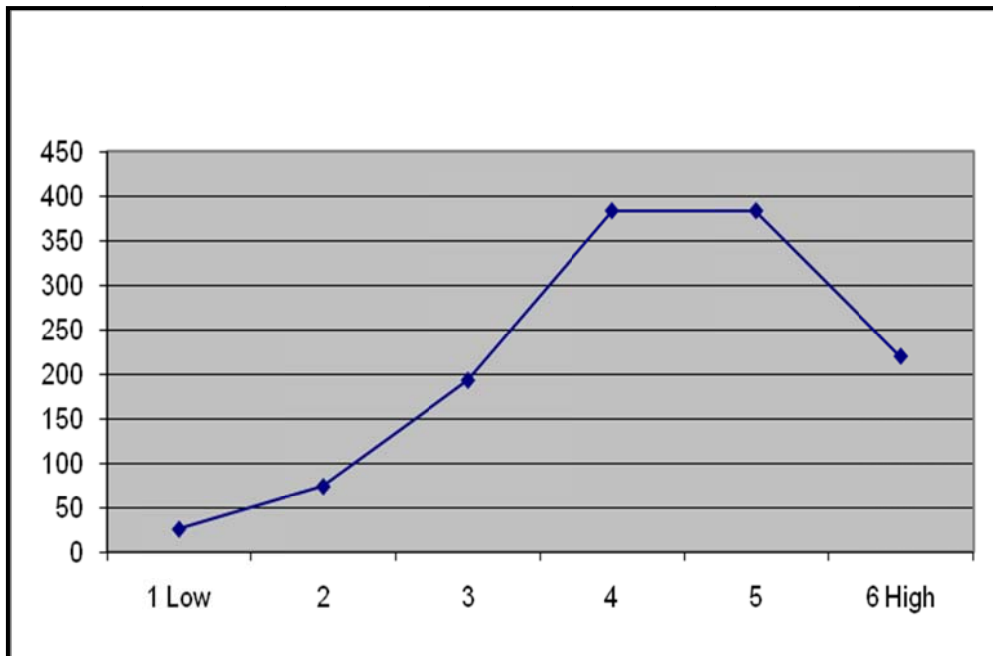


Figure 6.12: Graphic representation of involvement during game play

According to Table 6.17, students became involved in the game, as 17.2% ranked game involvement as high. Only 22.9% of students indicated their involvement in the game as low. The majority of students (77%) rated their involvement in the game between 4 and 6. The importance of motivation and involvement during game-based learning is explained in Chapter 3, section 3.3.1. Students' opinion of the game was tested with Question 27.

Question 27 How do you rate the game?

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Excellent	119	9.3	9.3	9.3
	Very Good	422	32.9	33.0	42.3
	Good	502	39.1	39.3	81.6
	Fair	210	16.4	16.4	98.0
	Poor	20	1.6	1.6	99.6
	Very Poor	5	0.4	0.4	100.0
	Total	1278	99.5	100.0	
Missing	System	6	0.5		
Total		1284	100.0		

Table 6.18: Frequency table for game rating

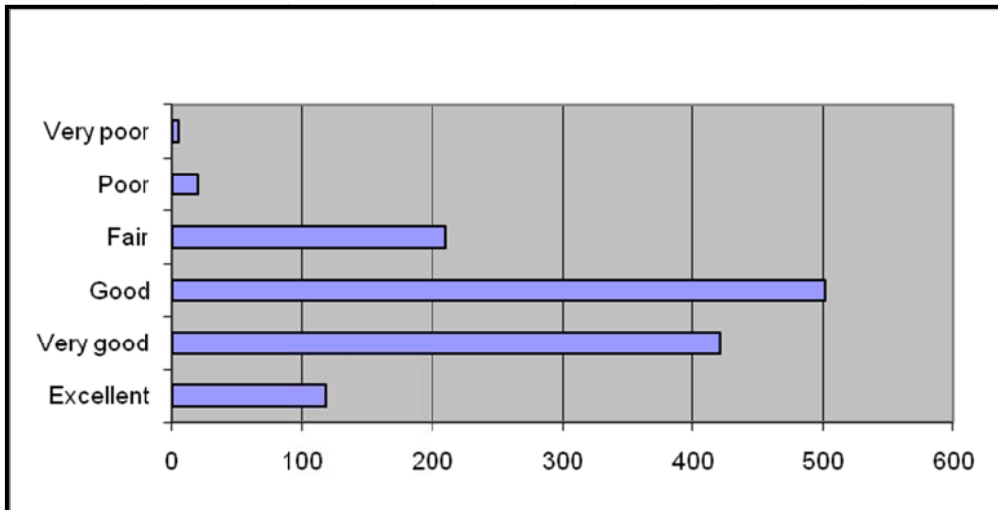


Figure 6.13: Rating the quality of the game

Refer to section 6.6.5 for students' satisfaction with the game, which seems to correlate with the rating of the game. As shown in Table 6.18, 119 (9.3%) of the students rated the game as excellent, 422 (33%) rated the game as very good and 502 (39.3%) rated the game as good. Only 2% of the students rated the game as poor or very poor (see Figure 6.13).

The importance of clear and easy to understand descriptions, as put forth by Liu (2008), is discussed in Chapter 3, section 3.7. Question 28 therefore determined the ratings for descriptions in the game.

Question 28 How do you rate the descriptions in the game?

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Excellent	211	16.4	16.5	16.5
	Very Good	495	38.6	38.7	55.2
	Good	434	33.8	34.0	89.2
	Fair	125	9.7	9.8	99.0
	Poor	8	0.6	0.6	99.6
	Very Poor	5	0.4	0.4	100.0
	Total	1278	99.5	100.0	
Missing	System	6	0.5		
Total		1284	100.0		

Table 6.19: Frequency table for rating descriptions in the game

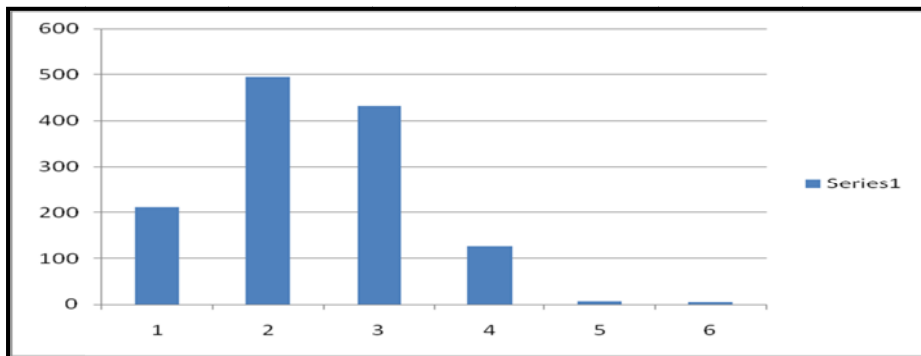


Figure 6.14: Graphic display of the rating of descriptions in the game

As reflected in Table 6.19, only 10.8% of students found the descriptions fair, poor or very poor, while the majority of students found the descriptions excellent, very good, and good (89.2%). Graphics in the game can enhance the player's experience (Liu & Lin, 2009).

Question 29 How do you rate the graphics in the game?

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Excellent	167	13.0	13.1	13.1
	Very Good	270	21.0	21.2	34.3
	Good	395	30.8	31.0	65.4
	Fair	332	25.9	26.1	91.4
	Poor	73	5.7	5.7	97.2
	Very Poor	36	2.8	2.8	100.0
	Total	1273	99.1	100.0	
Missing	System	11	0.9		
Total		1284	100.0		

Table 6.20: Frequency table for rating the graphics in the game

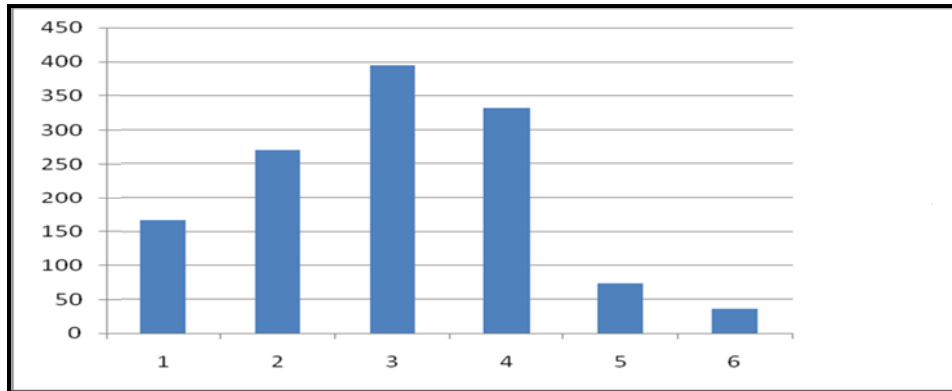


Figure 6.15: Rating the graphics in the game

The majority (65.3%) of players gave a rating of excellent, very good, good (1 to 3) for the graphics in the game. The minority (34.6%) rated the graphics in the game as fair, poor and very poor.

6.4 FEEDBACK ON THE NEED FOR INSTRUCTIONAL GAMES

The characteristics of the net generation are emphasised by the statistical analysis in Chapter 3, section 3.6.1. Oblinger (2005) indicates that games are integrated into the daily lives and studying of the net generation. The way in which the students participated in the case study is consistent with their requests for follow-up games. These requests can be grouped as follows:

- Requests for library-related games
 - Learning to request help from the “helpdesk librarian”
 - Collecting research
 - Putting the full library on a virtual game
 - Databases
 - Finding information.
- Requests for learning-related games
 - Plagiarism
 - Referencing
 - Conversations between lecturer and student
 - The format of assignments
 - Finding information
 - Writing process
 - Navigating the web pages

Requests for new games can be seen as an indication that the specific target group had a positive attitude to games as instruction tools. Players differentiate between their request for library games and their request for learning-related games. Their request for a full virtual library game can be a good indication that students think that game playing can make libraries and library-related products more accessible. Collecting research and learning how to use databases can enhance the current game and take the learner to a deeper learning experience.

The request for learning-related games could imply that lecturers can be role players in game creation in order to guide the game creator in specific subject fields.

Another serious matter that can be addressed by game playing is plagiarism, which is a global phenomenon. A plagiarism game may be suitable for the net generation to help them understand the seriousness of plagiarism. Anti-plagiarism rules and behaviour could be part of such a game.

The above discussion emphasises that games have great potential and will still be relevant in the near future. The *Horizon Report 2012* states that game-based learning could be relevant for higher education to enhance critical thinking and collaboration during the learning process.

6.5 KNOWLEDGE IMPROVEMENT

The learning experience of students is reflected in the analysis of knowledge improvement. Knowledge improvement was tested with challenges during the game and by enquiring about the extent to which the students felt their knowledge had improved.

6.5.1 Assessing performance

Assessing performance can help to confirm that learning did take place. Tests were included in some of the scenes; players scored a point when they pass a test and lost a player life if they failed a test. Players were allowed second chances if they did not pass on the first attempt. The player lost a player life on the first attempt and a player life on the second attempt at passing the test. The player did not score if he passed the test on the second attempt.

Table 6.21 gives an indication of the tests in each scene of the game, the value of the score for the correct answer and the value of the player lives for the incorrect answer.

Scene	Test	Answer correct Score value	Answer incorrect Lose player live(s) value	
One	Choose the right concept source	1	1 1	1 st attempt 2 nd attempt
Two (two tests)	Choose the right keyword choice	2	1 1	1 st attempt 2 nd attempt
	Multiple choice questions	2	1 1	1 st attempt 2 nd attempt
Three (two tests)	Login	1	1 1	1 st attempt 2 nd attempt
	Arrange books on shelves	1	1 1	1 st attempt 2 nd attempt
Four	Find objects	1	Did not lose a player life	
Five	Watch layout	1	Did not lose a player life	
Six	Ticks to evaluate	1	Did not lose a player life	

Table 6.21: Questions and scoring for the tests in the game

The outcomes of the tests are shown in the histogram below (Figure 6.23). The results of each test could not be indicated because of the restrictions of the software. Table 6.21 depicts the questions asked in the game, combined with the score of the game as well as the player's lives that could be lost.

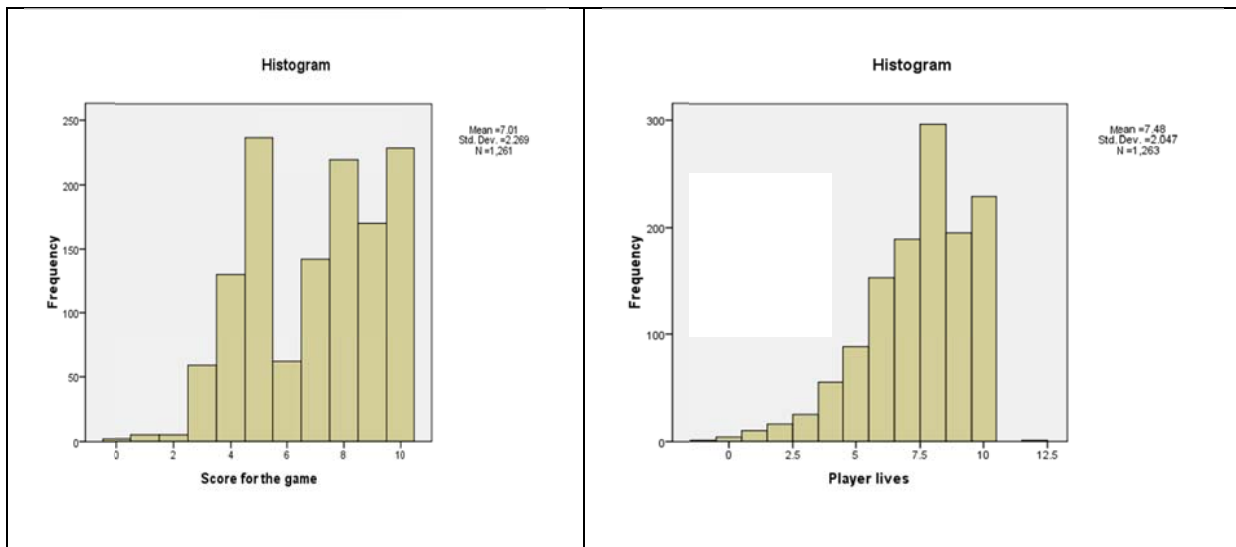


Figure 6.16: Scoring for the tests in the game

As seen in Figure 6.16, on average students had 7.5 player lives left. Player lives were lost both the first and second time they failed. Players did not score if they passed the test a second time around. The average player scored 5 for the game. Two students provided invalid data; see the histogram for player lives. The invalid data did not have a significant effect on the results.

6.5.2 Students' reaction to knowledge improvement

Students also had to rate the extent to which they thought their knowledge had improved.

Question 20: To what extent do you think the game will help you to make better use of the library?

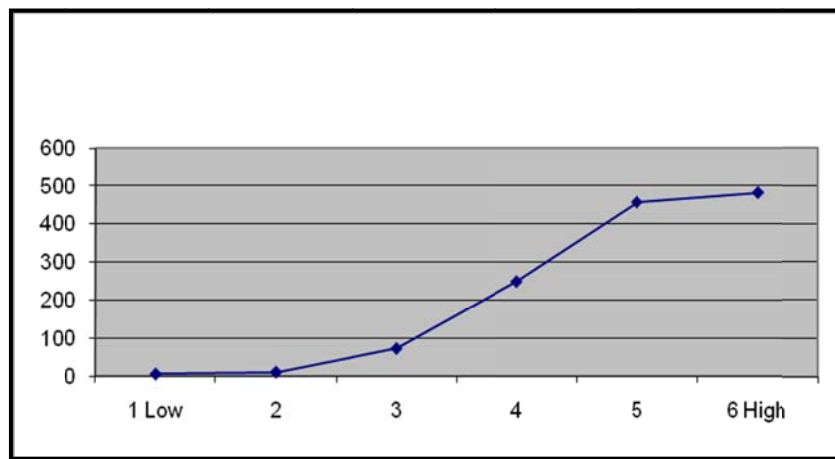


Figure 6.17: Rating scale indicating perceived impact of enabling students to make better use of the library

The majority of students seemed to think that the game would help them to make better use of the library (see Figure 6.24). Only 6.7% (87) of the students indicated that the game would

not help them to use the library effectively. The statistical analysis correlates with the idea that educational games may transfer knowledge and meet the needs of the net generation (De Azevedo Filho, 2006:2; Ebner & Holzinger, 2007:876).

According to Gross and Latham (2007:332), library users with library anxiety can be under the impression that they will not have the ability to use the library and will therefore be hesitant to ask for help in the library or use the technology provided by the library. A competent information-literate individual must have the ability to assess information, evaluate information and use information accurately. Students who are over-confident might not realise that they do not have the necessary skills. The above-mentioned statements confirm the competency theory regarding perceived ability. Research done by Gross and Latham (2007:349) indicated that information literacy training might decrease library anxiety. It is important to emphasise that traditional information literacy training cannot have an effect on the perceived ability of library staff and the ease of use of library technology. Innovative instruction is needed to cater for information literacy training and library anxiety in all its various formats.

6.6 QUALITATIVE DATA

Written comments of students' affective experience were ascertained through open-ended questions forming part of the questionnaire. Most of the quantitative questions were based on the affective experience of game players as revealed in the literature. The questionnaire was completed by 1 284 students. According to Leedy and Ormrod (2013:144) "The data can be scrutinised for underlying themes and patterns that characterised the case more broadly than a single piece of information can reveal". Comments were categorised according to a pattern that was revealed when the data was analysed. The identification of the pattern confirmed the user experience during game play namely motivation, involvement, goal of the game, feedback, satisfaction with the game and the influence of time during game play as well as the negative experience during game play.

The most relevant responses for each category were used for the purpose of the study.

See the table below for the qualitative questions:

Q8	What did you know about the use of libraries before playing the game?
Q12	Please explain why you wanted to learn more or why you did not want to learn more.
Q15	Please explain why you understood the goal.
Q17	Please explain why you found the feedback useful.
Q19	Please explain in your own words why you were satisfied or dissatisfied with the game.
Q23	Which learning content of the game you played today can be expanded through further games?
Q26	Please explain why you think you became involved or did not become involved in the game.
Q30	Is there anything else you want to bring to our attention?

Table 6.22: Qualitative data questions

The responses to Question 8 will not be discussed because of the possible misinterpretation of Questions 4, 5, 6 and 7, since there was no definition or explanation for the qualification of a school library (See Section 6.3.1 for more information). The answers to the questions collecting qualitative data will be analysed based on the theory outlined in Chapter 3.

6.6.1 Motivation

Question 12 assessed students' motivation to learn more by asking:

Please explain why you wanted to learn more or why you did not want to learn more.

Students' responses to this question reflected the theory discussed in Chapter 3. Their answers reflected the potential of game-based learning to motivate and to keep students in the learning process. In Chapter 3, section 3.3.1 it was shown that motivation can be categorised in different categories, namely motivation and autonomy, motivation and competence, motivation and fun. Intrinsic motivation has no obvious rewards and extrinsic motivation rewards students with a prize or money. Since it can be very difficult to keep the attention of students during library instruction (Small, Zakaria & El-Figuigui 2004:98), it is important to keep them in the game and to make sure that they do want to learn more.

Factors that influence intrinsic motivation can be categorised as:

1. Motivation and autonomy

Motivation and autonomy will allow students to feel they can solve problems on their own and be creative. The comments of the students are in their own words:

- “The game is engaging and highly relevant to compiling a survival kit at university”;
- “The game was not boring and it was more like seeing myself go about my school day and doing research for my assignment”;
- “Excellent using a game method while teaching students their way around a library by useful tips when doing my assignment”;
- “I want to learn more to be able to use the library on my own when I need to”;
- “I forget how a library works now I won’t be as lost as before.”

2. Motivation and competence

In this category students will display whether or not they feel they will be able to put new skills to use and learn new skills. Students’ reaction to motivation and competence was as follows:

- “The game was enjoyable and I wanted to learn to be able to use the library in future”;
- “I enjoyed that it was a unique means of obtaining information and learning and thus was better able to sustain my interest”;
- “The things in the game are very direct and helpful. It explains everything that you need to know about everything”;
- “I learned a lot and feel confident with using the library after the game”;
- “I wanted to learn more because the things I learnt were new and I realised that they could be very helpful to me”;
- “I wanted to know everything I could”;
- “To learn more to use the library more effective[ly]”;
- “I wanted to learn more because it will help me in my studies. And it was easy enough to follow even for a computer idiot like myself.”
-

3. Motivation and fun

In this category students will reflect that they are more motivated if fun is added to the learning process. The fun aspect can help to engage students in the learning process. See Chapter 3, section 3.2 for more information about fun and learning. Students' reaction to the fun factor was as follows:

- "I wanted to learn more because I have questions and also because the game was fun!"
- "They make learning fun";
- "It is amazing, relaxing, and drags attention. Fun"!
- "It did what it was meant for me, it explained while making learning fun";
- "It was helpful with a lot of information but still had a fun element to it";
- "It was fun and adventurous it made me more interested in playing";
- "Because I was showing emotions, I was happy when I won and sad when losing."

4. Extrinsic motivation

- Extrinsic motivation rewards students with a prize or money. No provision was made for extrinsic motivation; students did not receive prizes or rewards. One student was disappointed and commented on the lack of extrinsic motivation, saying: Game had no prize for completing questions.

6.6.2 Involvement

Involvement was assessed by Question 13:

Please explain why you became involved or did not become involved in the game.

In Chapter 3, section 3.3.2 it was explained that factors that influence involvement may be personalisation, contextualisation, learner empowerment and replacement for telling. Students' answers can be classified in the following categories:

1. Involvement and personalisation

Games have the potential to be interactive and student-centred to ensure that control is not taken away from the player by the avatar that represents the player. Humans can feel

empowered when they manipulate tools such as avatars because it feels as if their bodies and minds are involved (Oshita, 2006:14).

Personalisation and manipulation were reflected in students' spontaneous comments to the answer:

- "It was almost as though I was walking and doing all the things done by the avatar";
- "I was involved as I thought I was the man in the PC";
- "I lived myself into the game";
- "Because I felt like I was doing the research physically";
- "It is a visual game that is involving you as a character."

2. Involvement and contextualisation

As explained in Chapter 3, memory is context-dependent. Information received in context can improve memory. Students' understanding can improve because learning was contextualised. In game-based learning, each character or scene can build on previous information obtained.

Student's comments reflected the influence of contextualisation involvement:

- "Because I felt like I was really in the game and indeed to find my way through the library;
- "Being a first person game the sensation of being in the real environment was crafted";
- "The game was not boring and it was more like seeing myself go about my school day and doing research for my assignment";
- "It is a fun way of learning you would always remember it";
- "It kept me concentrated and anxious with what scene (context) was coming next";
- "The game played off almost like I would do in real life in the library."

3. Involvement and learner empowerment

As explained in Chapter 3, sections 3.6.1 and 3.3.10, learner empowerment is one of the important factors of game-based learning. The learner can control his/her own learning environment. The fact that learners were empowered during the game is stated in the following comments:

- “100% of my attention was on the game, I kept on moving my legs to help ‘her’ move faster”;
- “I was in control of the avatar without my help she couldn’t have done it”;
- “My input is required to master the avatar”;
- “The game was very interactive.”

4. Involvement and replacement for telling

As explained in Chapter 3, section 3.3.2, learners will be able to do and not only listen in a game. The teacher does not have to tell, the learner can do.

Students’ reactions to the replacement for telling were reflected in their answers:

- “It was exciting and not boring like normal PowerPoint”;
- “I didn’t particularly feel that I wanted to learn more but because of the use of the avatar it was more exciting than my other media used to learn about the library”;
- “It was presented in an interesting manner and the visual pictures made it easy to know more”;
- “I wanted to learn more because it is a fun way of knowing. It is better than somebody talking and you not paying attention”;
- “Very visual; felt part.”

5. Involvement and interactivity

Interactivity is essential during playing, as explained in Chapter 3, section 3.4. There will be no game without interactivity. Students’ comments reflect their view on interactivity:

- “Game very interactive;
- “I became involved by the instructiveness”;
- “Get more things to do (i.e. shoot)”;
- “It was interactive”;
- “It is fun and interactive and the library is massive and one needs training.”

6. Involvement and flow

As explained in Chapter 3, section 3.6.1, the skill of the player and interaction between the player and system can create flow. The inter-relationships among user, system

and experience can enhance the flow. Student's comments on flow between player and system can be seen below:

- "Trying to navigate the avatar was tough as though it was me trying to move";
- "My avatar got stuck sometimes";
- "Moving around with the lady was quite difficult";
- "Music was too hard and animation was slow";
- "The radar on the top left screen was not very easy to use";
- "Movement of the 'avatar' should be functional with keys 'w', a, s and d for easier movement."

Flow between the player and the system seems to be a positive experience for most of the students. Flow and involvement were disrupted in certain instances.

7. Involvement and incremental learning

Incremental learning in games can take place when the player moves from one scene to another, as explained in Chapter 3, section 3.3.4. Students' comments on involvement and incremental learning reflect the following:

- "I was involved because of the curiosity of wanting to see what is next";
- "As it draws you in and you want to know what happens next";
- "By taking one step at a time and only search for what you need";
- "I was eager to know what happen[s] next (next scene)."

6.6.3 Goal of the game

Students' reactions to the goal of the game were tested with Question 15:

Please explain why you understood the goal of the game.

Games are differentiated by specific goals that give structure to the game. The goal of instructional games will mostly be to allow students to have fun and learn at the same time. It is important that students understand the goal of the game in order to keep them motivated and help them understand the reason why they are playing the game. The goal of "Library Quest" was to guide the player through the Big6 steps of the assignment-writing process.

The goal was clearly stated at the beginning of the game, as depicted in the graphic in Chapter 4, section 4.6. Students' personal comments were:

- “The six steps were clearly indicated therefore you know what to do”;
- “It is not the first time that I have been taught to learn how to use things, it's just like a tutorial on any other game, and therefore I knew its purpose to instruct”;
- “The goals were explained as you went along in the game, it was well laid out”;
- “It was quite clear from the beginning and the pop up messages kind of kept on remind you of the game”;
- “It was stated very clearly what needed to be done and where to get it done.”

6.6.4 Provision of feedback

Feedback during game play was tested with Question 17:

Please explain why you find the feedback useful.

The progress of the player is measured in the game with feedback. Feedback can be categorised in different sections, e.g. feedback as a guideline, feedback as outcomes and feedback as a measurement. In this case feedback will be classified into two different sections:

8. Feedback as a guideline

Feedback can be a guideline to show the player where he is in the game and what he needs to do. Examples of students' comments on the usefulness of feedback are shown below:

- “Because the feedback showed directions about where to go in order to get more score”;
- “Made me notice how I read and if I'm really understanding what I'm reading”;
- “The feedback was easy to understand and helped me to understand the process”;
- “The feedback was relevant to the topic”;
- “You know all the time what is going on around the game”;
- “It was a guideline for me”;
- “The feedback was useful because it was guiding me a lot in what I did not know”;
- “I was well informed of what was required of me; otherwise I would have no idea where to go.”

9. Feedback as outcomes and measurement

Students' reactions to the outcomes and measurement feedback in the game were as follows:

- "It shows how well I did and how much I understood";
- "It made me understand what I have learned better";
- "Because it showed how I was doing";
- "It evaluated our knowledge on computer and library use";
- "Encouraging";
- "It was useful because with it I got to understand what exactly it was they were telling me";
- "Tested what we had just done";
- "To know what my problems are";
- "It reinforces what I learnt and I know if I was on the right track."

6.6.5 Students' satisfaction with the game

Students' satisfaction with the game was tested with the following question:

Please explain in your own words why you were satisfied or dissatisfied with the game.

Students gave various reasons for being satisfied with the game:

- "I was satisfied because it kept me anticipated and on my toes it was exiting!"
- "Highly satisfactory because I know what to expect at the UP library";
- "The game was relevant to a point and absolutely user friendly";
- "It was a nice and fully elaborated and educated game."

6.6.6 Time

As explained in Chapter 3, section 3.6.1.2, time plays an important role in game play. Involvement can lead to a sense of time distortion. It seems as though the timer in the top left-hand corner of the game had a huge effect on players. Players were not informed that they were only allowed a certain time to complete. The timer counted from 30 minutes

backward and could go into a minus time if more than 30 minutes was used. Students' comments about time were:

- “The timer made me rush so I did not want to read everything on the game”;
- “The time is still active while game play is not yet activated at the beginning of each level, some students could find this ‘lost’ time valuable to complete the game”;
- “I wanted to finish the game in record time”;
- “The computer is too slow”;
- “I was involved because there was a timer”;
- “Set the time restriction for different stages – time limit it”;
- “It did not feel as though it was a race and so it was easier to just relax through it”;
- “I got involved because there was a timer.”

6.7 NEGATIVE EXPERIENCE DURING GAME PLAY

Although an attempt was made to meet the criteria set out in Chapter 3, no game can be perfect. Although it needs to cater for different learning styles as, explained in Chapter 3, this is not always easy or possible. In Chapter 3, it was explained that the software for the case study game, “Library Quest”, could not cater for all learning styles and preferences. For this reason negative feedback was recorded, especially that indicating that although students found the game interesting, it did not cater for their preferred learning style.

The following reflects some negative comments that are linked to learning styles (Rapeepisarn, Wong & Khine 2008:506):

- “Took plenty of notes, but was not extremely excited”;
- “I wanted to learn more in a ‘real’ life situation. But the game is a good introduction”;
- “I did not understand the game at all. I am not the computer game type of person. I struggled a lot”;
- “I like the game but I need more excitement and interaction”;
- “It gives relevant information but it would have been better if all the tasks were done in the library so I could find my way around it”;
- “It is a good game, but I am a gamer and it was a bit slow to my liking and the figures weren’t the best”;
- “Did not like the noise did not use my earphones anymore.”

This correlates with the statement by LeCroy (2006:381) that players might find games stressful and may not feel comfortable to play games or find it difficult to learn through a game.

6.8 CONCLUSION

Qualitative and quantitative data were collected in this chapter. Quantitative data were collected with the use of the Likert scale questions to test the students' rating of the game. Qualitative data were collected by means of open questions to test the students' affective experience with the game and library usage.

The library questions might not be reliable, since there was no specific definition of the size or quality of the library. Students might be under the impression that a library can consist of a single bookshelf. The answers to these questions were not analysed and the researcher wants to emphasise that any information gathered from these questions may not be reliable. Students asked for more questions with an instructional purpose. The average score for the game was 5, which confirmed students' test results during the test-writing procedure in the game. Improvement of knowledge was also proven with the quantitative data that were collected with the Likert scale questions. Students had the impression that their knowledge about using the library and the assignment-writing process did improve during the game-playing session.

The effect of the avatar in the game was confirmed by the comments of the students. Students' personal involvement in the game increased. Students' felt empowered because they were able to control the avatar and to find certain objects in the game.

Negative experiences related to the game were also reflected. Not all students enjoyed the game or found it very exciting. This can be due to the fact that specific learning styles do not always correspond with game playing. The software and experience of the researcher as a game designer might have an effect on the satisfaction of the players.

Chapter 7 will be the concluding chapter of this study and will reflect on the purpose of the study, interpreting the findings, answering the research problems and sub-problems and making recommendations for practice, as well as for further research.

CHAPTER 7

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 INTRODUCTION

A report of the data collection and analysis was given in Chapter 6. The purpose of Chapter 7, the concluding chapter, will be to describe the findings and make recommendations for future research. The study can be used as a pilot study for further research based on the findings of this study.

The problem statement of the research was to explore to what extent a game can be used for library instruction. Sub-problems related to the problem statement were asked regarding the criteria needed to create a game. The extent of the application of game-based learning criteria was explored in this study. The role and influence of the restrictions or advantages of the game software were investigated. The content environment will also have an influence on the player and needs to be evaluated.

The affective experience of the players, as well as their learning experience during game play, was a sub-problem of the study. The information gained in the literature reviews was reflected in the report on the data collection analysis.

The research question and sub-questions are outlined below for ease of reference.

To what extent can a game be used as an instructional tool for library instruction?

- What are the criteria for designing an educational game?
- Which of these criteria could be implemented?
 - What are the restrictions based on the software?
 - What are the restrictions based on the content environment?
- To what extent could these criteria be implemented in the design and implementation of the game?
- What is the user experience during the game?
 - What is the affective experience?
 - What is the learning experience?

The research statement and sub-questions are an indication of the research that was needed for this study.

The outline of the different chapters in this study gave an indication of the research that was done in order to gain knowledge related to the research question and sub-questions:

- Background to the problem (Chapter 1)
- Literature review – Information literacy (Chapter 2)
- Literature review – Game-based learning (Chapter 3)
- Research methodology and design (Chapter 4)
- Creation of game as instructional tool for libraries (Chapter 5)
- Report on the data collection analysis (Chapter 6)

It was necessary to follow certain research methods in order to answer the research problem, namely “To what extent can a game be used as an instruction tool for library instruction?”

A summary of the research procedure will be described below.

7.1.1 Information literacy

The purpose of Chapter 2 was to look at the importance of information literacy. Several information literacy standards were investigated in order to find the most appropriate standard to be used for the game. In view of the importance of information literacy, it is also necessary to look at appropriate ways and interventions to give library instruction.

7.1.2 Game-based learning

The literature review in Chapter 3 reveals the value of game-based learning and the influence on the attitude of learners. A list of criteria for game-based learning was created, based on the information that was gained in Chapter 3. The criteria were applied during the creation of the game for this study.

7.1.3 Research methodology and design

The research methodology and design of this study were highlighted in Chapter 4. The research methods for this study consist of:

- **Literature reviews:** A selection of databases as well as books on the topic were consulted.
- **Case study method:** A case study method was the best method to explore the influence of an intervention on the unit of analysis.
- **Instructional design method:** The DODDEL model of McMahon (2009) was used as an instructional design method to create the game for this study.
- **Mixed-methods data collection:** A mixed-methods approach was used to collect data. A questionnaire was designed to test the player's effective and affective experience of the game. Rated answers and open-ended answers were used.
- **Evaluation of the data collected:** Formative evaluation and summative evaluation were applied to ensure that the quality of the game was improved.

7.2 Problem statement and sub-problems

The problem statement of this study is to determine to what extent a game can be used for library instruction. Sub-questions were asked in order to address the problem statement. These sub-questions are addressed in the following sections:

7.2.1 What are the criteria for designing an educational game?

Chapter 3 focused on the pedagogical reasons and principles for game-based learning. The literature review revealed certain criteria that have the potential to increase the usability and effectiveness of the game.

The list of criteria is indicated in Figure 7.1 for ease of reference:

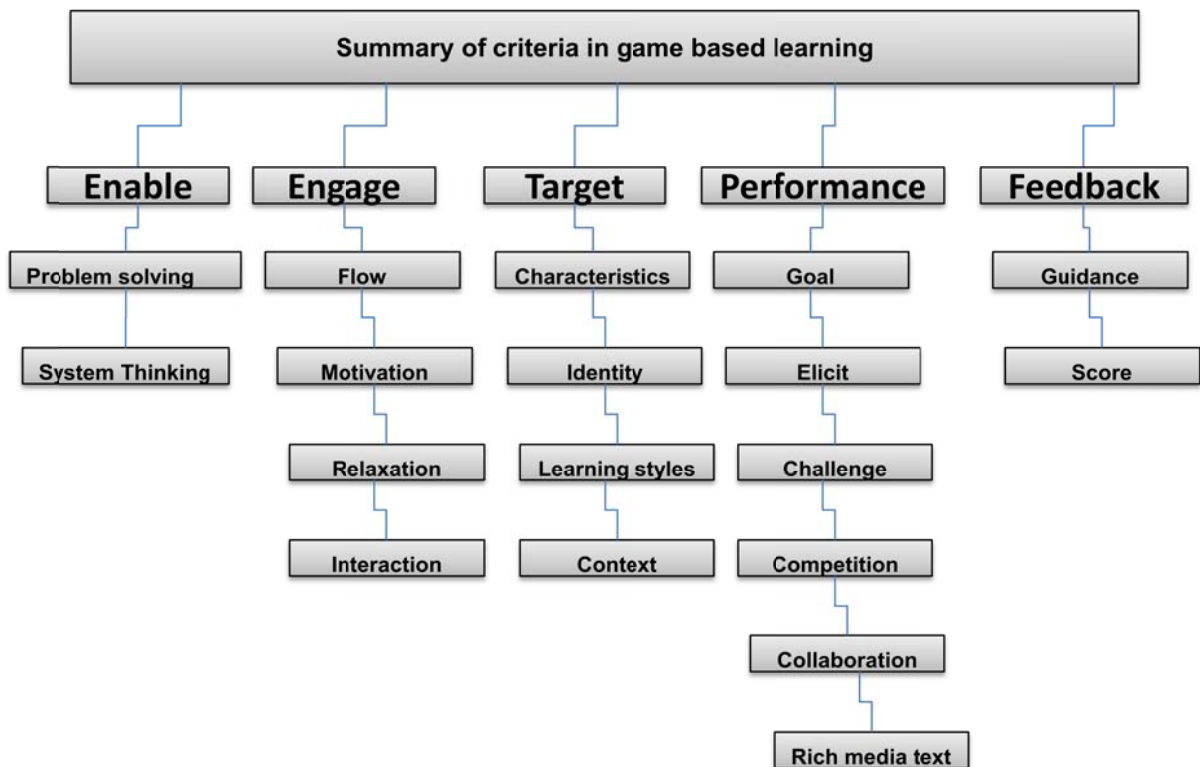


Figure 7.1: Criteria for a game in game-based learning

It was important to create a game grounded in game-based learning criteria to ensure that it had the potential to instruct. Certain aspects influenced the success of the game and will have an impact on its usefulness for library instruction. The information based on the criteria for game-based learning substantiates the possibility that a game can be used as an instructional tool.

The literature review revealed the criteria to be taken into consideration when creating a game for teaching purposes. The main criteria for the purpose of this study are knowledge of the target group, enablement, engagement, performance and feedback.

It is important to consider the target group to facilitate and enhance their learning experience. Accurate interpretation of the needs and characteristics of the specific target group will influence the design and success of the game. A well-defined purpose for the game will give an indication of the necessity of certain tasks during game play. Tasks and interactions elicit good performance from the player. Good performance during game play has the potential to enable the player. Engaging players will keep them in the game and improve their performance. Applicable feedback during the game can influence the learning process and improve the success of the game.

These criteria and sub-criteria were taken into consideration for the purpose of the sub-questions.

7.2.2 Which of these criteria could be implemented?

Chapter 5 focused on the design of the game for this specific study. The application of the criteria determined in Chapter 3 was demonstrated and described in Chapter 5. Most of the game-based learning criteria described in Chapter 3 were embedded in the game that was created for this study.

Detail of the implementation is given below:

- **Enable**

The criteria to enable the player to solve problems and to think systematically were embedded in the game.

- Problem-solving: The player had to perform certain actions to solve problems. An example is the choice of keywords to get the best information.
- Systems thinking: Scenes in the game journey represent six steps of the assignment-writing process. The player was therefore able to see how everything fits into everything else during assignment writing.

- **Engage**

Engagement aspects that were emphasised in the study were the flow of the game, motivation, relaxation and interaction. It was important for the player to be engaged during game play to improve the extent to which a game can be applied during library instruction.

- Engagement and flow: Every attempt was made to improve the flow of the game. The smooth interaction of the player in the game can improve the learning experience.
- Engagement and motivation: Motivational factors were motivation and autonomy, motivation and competence, motivation and fun.
- Engagement and relaxation: Surprise elements and scene changes were some of the aspects that allowed the player to relax during play.

- Engagement and interaction: Players could interact with avatars, non-player characters and certain game objects. Interaction improves the engagement of the player and keeps the player in the game.

- **Target**

The game was created based on the characteristics, identity and certain learning styles of the target group. It was also important that the target group could identify with the learning material in the game.

- Target group and characteristics: Special provision was made to cater for the characteristics of the target group – in this case the net generation.
- Target group and identity: The game was personalised with the use of an avatar. Players invest more in the learning process if they take on a new identity.
- Target group and learning styles: Different learning styles were taken into consideration in the creation of the game. It was, however, impossible to cater for all learning styles.
- Target group and context: The context in the game added value to the learning experience of the target group, since it provided just-in-time information at the beginning of the academic year.

- **Performance**

Performance during game play is important to ensure that learning takes place.

- Performance and goal: A clear goal for the game ensured that the player knew what was expected of him/her.
- Elicitation: Certain aspects elicit good performance from the player. Conversations, choices, drag-and-drop tasks and checklists add to the performance and action of the player.
- Performance and challenge: Each scene in the game poses with new challenges to the player. In this game players had to pass the test in one scene before they could move on to the new scene.
- Performance and competition: The loss of player lives and scoring during game play enhanced the challenge during play.

Players received instruction messages and results during game play. These aspects ensured that they knew what was expected of them. Immediate outcomes, for example time, score and player lives, encouraged players to improve their performance.

Collaboration: The intent of the researcher was to create a single-player game, since assignment writing is an individual experience for students.

Rich media text: Rich media text was added to enhance the player experience. Sound, animations and movie-like experiences in the game are an example of some of the rich media text.

- **Feedback**

Feedback was categorised into different sections:

- **Guidance:** The player received instruction messages and results during game play. These aspects ensured that the player knew what was expected of him/her.
- **Score:** Immediate outcomes, for example time, score and player lives, encouraged the player to improve his/her performance.

7.2.3 What are the restrictions based on the software?

The usefulness and the capability of the software used for this game were very high. However, the software had certain restrictions that could influence the success of the game and its application.

A limited number of interactions were available in the software library. The possibilities were therefore limited during game creation. The researcher was restricted to the choice of game worlds and game characters that were available in the software library. Metaphors were used to increase the usefulness and possibility of the game worlds. The restrictions in the software could have had an influence on the game creation and game play experience.

7.2.4 What are the restrictions based on the content environment?

Memory is context-dependent (Wang & Ahmed, 2003:8). It was therefore important to use the right environment to enhance the content and improve the learning experience. Although the player got an indication of the general process and procedures of assignment writing, it will be necessary to expose the learner to a real life situation. The game must therefore be seen as a preparatory tool for what is to come during the real process of assignment writing.

Basic tips about the assignment-writing process were given. The player could not apply or experience the writing skills that are necessary during the actual assignment-writing process. The fact that the player was not able to use the computers as if in real life could have been a restriction on the content environment.

The evaluation of the necessary steps in the assignment-writing process was done on a very basic level because of the restrictions on the content environment. A few basic multiple-choice questions and drag-and-drop tests might not be enough to evaluate whether learning did take place.

Collaborative searching will be a good contribution to the content environment. The restrictions in the software did not make provision for collaboration.

7.2.5 To what extent could these criteria be implemented in the design and implementation of the game?

The game-based learning criteria, as described in Chapter 3, could be implemented to a large extent. The literature study in Chapter 2 gave valuable insight into information literacy standards and the need and importance to become information literate and was used as a foundation for the game. The game was based on the information literacy standard of Eisenberg and Berkowitz (2008 a).

Game-based learning criteria were embedded into the game to enhance the engagement of the player and to enable the player to apply the knowledge that was gained. The hidden programming in the software allowed the researcher to create certain interactions without programming experience.

The design of the game and the application of the game-based learning criteria were described in Chapter 5. The game-based learning criteria could not be applied in all the scenes. It was important that the game-based learning criteria had to scaffold the learning context and experience of the player. The specific learning context restricted the application of some of the criteria to a certain extent. Rich media text was not always suitable for the learning context. The right balance of rich media text was especially necessary during certain scenes, for instance the library world. The library experience had to be similar to a real-life library. Extensive use of rich media text, for instance sound and animations in a library, would be out of context. Loud music is not allowed in a real-life library and would therefore be out of context in the game library. The library is still seen as a place of research

and study – noise is kept to a minimum. It will be important to evaluate the effect of rich media text on the player. Further research on the use of rich media text in games can be a valuable contribution.

The intent of the researcher was to create a single-player game. A single-player game would allow the player to experience the assignment-writing process on his/her own. A single-player experience for the purpose of this study was therefore more suitable for the learning context.

The game did not fit all learning styles and it was therefore impossible to create a game that would be satisfactory to all learners.

7.2.6 What is the user experience during the game?

The qualitative and quantitative analysis of the players' experience gave valuable insight into their experience during the game.

- **Affective experience**

The affective experience of game players was tested with qualitative and quantitative questions.

Players were asked to describe their affective experience during game play in their own words. Rating scale questions were included. The open-ended questions are listed below:

- Please explain why you wanted to learn more or why you did not want to learn more.
- Please explain why you understood the goal of the game.
- Please explain why you found the feedback useful.
- Please explain in your own words why you were satisfied or not satisfied with the game.
- Please explain why you think you became involved or did not become involved in the game.

The rating scale questions are given below:

- To what extent did you feel that you wanted to learn more while you were playing the game?

- To what extent did you understand the goal of the game?
- To what extent did you find the feedback that was given useful during game play?
- To what extent did the game hold your attention during game play?

The researcher came to the conclusion that the comments and rating of the players confirmed and supported the game-based learning theory and criteria as explained in Chapter 3. It seems as if the players had a positive experience during game play. The comments of the players are discussed in Chapter 6. The players confirmed that they were motivated, involved and engaged during the game. The majority of the students were satisfied with the game. The level of satisfaction of the players may be an indication that the players were of the opinion that games can work during library instruction.

- **Learning experience**

Players had to rate their learning experience during the game based on a rating scale from 1 to 6. The questionnaire was divided into different sections, namely experience with game playing, satisfaction with the game as an effective way to learn, knowledge improvement, immersion and reaction to the game. The players had to rate their learning experience during game play based on open-ended and closed-ended questions.

The open-ended questions are listed below:

- Do you feel that games are an effective way to learn?

The rating scale questions are indicated below:

- To what extent do you think the game would help you to make better use of the library?
- To what extent do you think the game would help you with the assignment-writing process?

Most students rated their learning experience during game play as high. The analysis of the rating scale of the learning experience of the players was discussed in Chapter 6. Most of the students were of the opinion that games are an effective way to learn, although there are restrictions on the content environment. The restrictions on the content might be a reason why the game could not be used to its fullest extent as a teaching tool.

7.3 SUCCESS OF THE STUDY

Valuable information was gained based on the sub-questions asked during the case study. The information addressed the problem statement of the study, namely.

To what extent can a game be used during library instruction?

The analysis in Chapter 6 proved that the majority of players were positively influenced by the game. The rating scale confirmed that players were engaged during game play. Players were under the impression that the game helped them to make better use of the library. The knowledge improvement histogram, Figure 6.23 in Chapter 6, can be an indication that players gained knowledge to do certain tasks. The feedback during game play had a positive effect on the players.

The fact that most students indicated that games can be an effective way to learn suggests that games could be used more often for instruction purposes. Students indicated that the game enabled them to make better use of the library and improved their ability to write assignments. These facts and the requests of students for follow-up library games are a good indication that games can be used as a library instruction tool.

According to the statistical analysis, it was clear that students had a clear understanding of the goal of the game. Understanding the goal of the game can improve the learning experience of game players, because the purpose of playing the game to gain knowledge is defined at the start of the game.

Possible restrictions based on the software could influence involvement in the game. Players indicated that they would prefer “shortcut keys” and the ability to shoot and jump during game play.

Open-ended and closed-ended questions were asked, based on the motivational experience of players during game play. The answers of the respondents confirmed their experience with motivation and autonomy, motivation and competence, motivation and fun, and extrinsic motivation. The players confirmed their personal involvement and empowerment during game play. The context of the game had an effect on the affective involvement of the students. The interactivity of the game improved the involvement of the students to a certain extent. The majority of the players made positive comments about the game.

There were mixed reactions to the time factor in the game. The time factor had a negative and positive influence on the players. Some players felt that they wanted to finish the game in record time, while others felt that they had enough time to relax and become so immersed in the game that they forgot about time.

Participants felt that the game evaluated their knowledge of computer and library use. The feedback in the game confirmed whether students were on the right track.

Negative aspects are part and parcel of any instruction tool. Some of the players indicated that they were not the game-playing type and therefore struggled during game play.

The research done for the purpose of this study indicates that a game can be used to a large extent during library instruction. Games have the potential to add value and excitement to library instruction and improve the player's knowledge.

7.4 Recommendations for further research

The purpose of this study was to explore the possibility of using games as instruction tools during library instruction. The value of an information-literate person and the information overload on society became evident during the information literacy research in Chapter 2. More research needs to be done to find a solution to the problem of information overload and its impact on society. Skills to use information tools, to evaluate and analyse information and the application of research skills can never be overestimated. Games as instruction tools can be valuable to teach these important skills.

Serious game-based learning can be improved with continuous and extensive research. According to Squire (2005), Van Eck (2006) and Wu *et al.* (2012), more research needs to be done to convince educators that games are not only for entertainment purposes. Wu *et al.* (2012) suggest that future research can include learning theories and the engagement factor of game-based learning. Case studies can also have a positive influence on the research on game-based learning (Wu *et al.* 2012).

The influence of rich media text during game play is important. Game players indicated that they did not like the sound that was used for the creation of the game.

Abundant use of animation might also influence the flow and learning experience during game play. Further research is necessary to explore the possibilities and influence of rich media text during game play to enhance the learning experience of the player.

The importance of collaborative learning and information-sharing cannot be overestimated (Fourie & Bothma, 2006:15). It is therefore important to enable higher education students to share knowledge and do collaborative searching to find the right information. Multi-player online games can allow students to share their learning experience. More research needs to be done to explore the value of multi-player online games for information-literacy training purposes.

Waelchli (2011) describes his experience with the modification of “Elder Scrolls”. “Elder Scrolls” was modified to use as an instruction tool during information-literacy training. Research on the modification of all types of games can be a valuable contribution to the game-based learning environment.

The possibilities and benefits of game creation in itself to improve subject knowledge need to be explored and researched. Students can be allowed to create their own games in order to experience information literacy and the value of information literacy skills in a unique way. The negative aspects of game creation must be considered. Game creation can be time-consuming and will not always be suitable for the specific target group. Basic knowledge of the specific subject is also a prerequisite for the creation of a serious game. Future research needs to be done in order to determine the benefits of game creation

The needs and characteristics of the target group cannot be overestimated. The importance of the target group and their specific needs was emphasised in the game-based learning literature review. Game creators will have to be willing to change and customise games according to the specifications of the client. Every attempt must be made to balance the challenge according to the ability of the target group. Overestimating the ability of the target group can lead to frustration during game play. Underestimating its ability can be an insult to the target group. Consideration of the target group during game creation is important and needs to be explored and researched.

Rapid game creation is needed but must be balanced with the agility of the game creators to customise and improve games according to the client’s standards. Research on the agility and ability of game creators and the influence on the quality of the game can be a valuable guideline for future researchers.

Provision must be made to balance fun and learning during game creation. Learning and fun must be equal during game play. Game designers can benefit from research to scale learning and engagement. Empirical evidence of the value of games as a serious learning tool and not only an entertainment tool can add value to the game-based learning environment.

7.5 CONCLUSION

Serious game-based learning can never be seen as an effortless learning process (Ebner & Holzinger 2007). Games might not be suitable for all learning styles, target groups or subjects.

However, it became clear in this study that there are positive aspects of game-based learning. According to the *Horizon Report 2012*, game-based learning can improve certain skills, such as collaboration, problem-solving, communication, critical thinking and digital literacy. Critical thinking, system thinking and collaboration are very important skills for the 21st century. These skills can be beneficial for higher education students to prepare them for the industry.

Game-based learning has the potential to inspire learners to change their attitude to learning. A positive attitude to learning is best described in the title of Prensky's (2006) book, "Don't bother me mom - I am learning!"

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APPENDIX A

Informed consent form

(Form for research subject's permission)

(Must be signed by each research subject, and must be kept on record by the researcher)

- 1 **Title of research project: Library instruction and game-based learning.**
- 2 I hereby voluntarily grant my permission for participation in the project as explained to me by

Bettie de Kock
- 3 The nature, objective, possible safety and health implications have been explained to me and I understand them.
- 4 I understand my right to choose whether to participate in the project and that the information furnished will be handled confidentially. I am aware that the results of the investigation may be used for the purposes of publication.
- 6 Upon signature of this form, you will be provided with a copy.

Signed: _____ Date: _____

Witness: _____ Date: _____

Researcher: _____ Date: _____

APPENDIX B

Library instruction and game based learning

Researchers contact detail: Bettie de Kock 420 4719

A: Personal information and background:

1. Student number:

2. Cellphone number:

3. Score for the game:

(Game score will be checked by floor walkers)

4. Did you have access to a school library at your school?

Yes	No
-----	----

If YES:

5. How often did you use the library?

Once a week	Once a month	Seldom (i.e. less than once a month)	Never
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6. For what purpose did you use the school library? Please explain briefly:

7. Did you have access to any other libraries? Please explain:

8. What did you know about the use of libraries before playing the game?

B: Experiences with the game

9. Have you played computer games before?

Yes	No
-----	----

If **NO**, please answer questions 10 - 11:

10. Were you able to find the objects in the game?

Yes	No
-----	----

11. Were you able to "walk" around in the game?

Yes	No
-----	----

B: SATISFACTION

In order to determine the effectiveness of the game we need your input. Please evaluate the following criteria on a scale form 1-6 where 1 is low and 6 are high.

12. To what extent did you feel that you wanted to learn more while you were playing the game?

Low

High

1	2	3	4	5	6
---	---	---	---	---	---

13. Please explain why you wanted to learn more or why you did not want to learn more.

14. To what extent did you understand the goal of the game?

Low

High

1	2	3	4	5	6
---	---	---	---	---	---

15. Please explain why you understood the goal

16. To what extent did you find the feedback that was given useful during game play?

Low

High

1	2	3	4	5	6
---	---	---	---	---	---

17. Please explain why you found the feedback useful.

18. To what extent did the game hold your attention during game play?

Low

High

1	2	3	4	5	6
---	---	---	---	---	---

19. Please explain in your own words why you were satisfied or unsatisfied with the game.

--

C: Knowledge Improvement

20. To what extent do you think the game would help you to make better use of the library?

Low

High

1	2	3	4	5	6
---	---	---	---	---	---

21. To what extent do you think the game would help you with the assignment writing process?

Low

High

1	2	3	4	5	6
---	---	---	---	---	---

22. Do you feel that games are an effective way to learn?

--

23. Which learning content of the game you played today can be expanded through further games?

--

D: Immersion

24. To what extent did you forget time passing while playing the game?

Low

High

1	2	3	4	5	6
---	---	---	---	---	---

25. To what extent did you become involved in the game?

High

1	2	3	4	5	6
---	---	---	---	---	---

26. Please explain why you think you became involved or not involved in the game:

--

E: REACTION

27. How do you rate the game?

Excellent	Very Good	Good	Fair	Poor	Very Poor
-----------	-----------	------	------	------	-----------

28. How do you rate the descriptions in the game?

Excellent	Very Good	Good	Fair	Poor	Very Poor
-----------	-----------	------	------	------	-----------

29. How do you rate the graphics in the game?

Excellent	Very Good	Good	Fair	Poor	Very Poor
-----------	-----------	------	------	------	-----------

30. Is there perhaps anything else you want to bring to our attention?

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Thank you for your participation!

We intend holding focus group interviews with a number of students during the next two months to follow up on the data obtained from the questionnaires.

Would you be willing to be a member of such a focus group interview?

Yes	No
-----	----