

**The development and evaluation of an online master's
module using an open-source software package.**

by

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Declaration

I hereby certify that this thesis handed in herewith for the degree of MEd: Computer-Integrated Education at the University of Pretoria is entirely my own work except where I have fully documented references to others, and has not been submitted previously for a degree or examination before at this or any other university.

Feliciana Eduardo
Submitted: April 2007

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Dedication

A special dedication is in memory of my adored father Eduardo, and my beloved mother Sara Ajune Gani. Without them I could not be a being in this world.

May your souls rest in the peace of God.

A dedication is also made to my beloved sisters Maria Eduardo and Augusta Eduardo, for their support, encouragement and total confidence in me.

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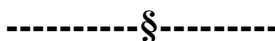
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List of Acronyms

ALN	-	Asynchronous Learning Network
CDDI	-	Center for Investigation and Documentation for Integrated Development
CD-ROM	-	Compact Disc-Read Only Memory
CIUEM	-	Informatics Centre of Eduardo Mondlane University
CMS	-	Course Management System
E-Learning	-	Electronic learning
FacEd	-	Faculty of Education
GIS	-	Geographic Information System
GSIE06	-	Management Information System in Education
HEI	-	Higher Education Institution
HTML	-	Hyper Text Markup Language
ICT	-	Information and Communication Technology
ISCTEM	-	Instituto Superior Ciencia e Tecnologia em Mocambique
ISPs	-	Internet Service Providers
ISPU	-	Instituto Superior Politécnico e Universitário
ISRI	-	Higher Institute for International Relations
ISUTC	-	Higher Institute of Transport and Communications
IT	-	Information Technology / Instructional Technology
LAN	-	Local Area Network
LCD	-	Liquid Crystal Display
LMS	-	Learning Management System
LSS	-	Learning Support System
MEd	-	Masters in Education
MLE	-	Managed Learning Environment
MOODLE	-	Modular Object-Oriented Dynamic Learning Environment
MS-SQL	-	Database Server
PC	-	Personal Computer
PDF	-	Portable Document Format
PU	-	Pedagogical University
SILPA	-	System for Intentional Learning and Performance Assessment
SNE	-	National Education System
VLE	-	Virtual Learning Environment
UEM	-	Eduardo Mondlane University
USIS	-	United States Information Service
WebCT®	-	Web Course Tools
WWW	-	World Wide Web



Summary

This study reports on the development, implementation and evaluation of an online master's module called Management Information Systems in Education, in the specialization phase in the master's course in Administration and Management in Education. The pedagogical and practical issues that have to be addressed when teaching with a Learning Management System (LMS) were explored during the evaluation process of the online environment. It was conducted in the form of a design experiment. The online module was built using *Moodle* software and the study was undertaken at the Faculty of Education of the Eduardo Mondlane University in Mozambique.

An evaluation questionnaire with open-ended questions was developed to evaluate the online component of the module. The questionnaires were completed by a sample of seven adult students who were registered for the optional module and their lecturer. Observations on the *Moodle* site were also conducted. An adaptation of Cronjé's (2006) model of the four quadrants of teaching and learning was used to develop the conceptual framework. An interpretive analysis of the data plotted the answers to the research questions on the adapted Cronjé model.

The findings indicate that the use of an online module designed and delivered through *Moodle* is recommended because it can be accessed at any time and at any place; it provides the opportunity to collaborate with others virtually; it provides an opportunity to learn more; it is an easy way to study; it is a useful educational package that can be adopted by teachers to supplement the teaching and learning process in schools; it assists in solving many problems related to information management at work; it helps in diversifying the learning activities; and it improves communication possibilities.

Keywords: Learning Management System (LMS), Moodle, constructionist, constructivism, competency-based education, flexible practitioners, dynamic society, complex society, online learning.

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CHAPTER 1 – GENERAL ORIENTATION

1.1 Introduction

Today's technology enables students and educators to break with more conventional methods of teaching and learning (Soles & Moller, 2001). Furthermore the possibilities offered by distance learning attract more and more organizations and educational institutions in the light of current educational needs. Universities and schools are supporting traditional classroom-based instruction with electronic learning management systems (LMS) - software which is designed to deliver online learning. Some types of e-learning tools have been adopted by universities, institutions, colleges and schools as an integral part of their strategies for teaching and learning, for distance learning, as well as to enhance face-to-face learning environments.

Wide changes regarding the delivery of learning programs have been observed in recent years, with the speedy growth and popularity of the Internet. Such delivery of learning has shifted from local desktop applications to online learning. Additionally, continual professional development of the existing workforce needs to take place rapidly because of the exponential growth in knowledge and skills required in today's world. In response to this need, employers and corporations are turning to distance learning options for their employees. Most LMSs make extensive use of the Web and include features such as discussion forums, chats, journals, automated testing and grading tools, and student tracking. The challenge in this study was to apply a particular LMS in the Faculty of Education at the Eduardo Mondlane University in Mozambique in such a way as to enhance learning experiences.

The purpose of this study is to develop, implement and evaluate an online master's module using *Moodle* software. The pedagogical and practical issues that have to be addressed when teaching with a Learning Management System (LMS) were explored during the evaluation process of the online learning event. The online master's module was developed for the Faculty of Education at the Eduardo Mondlane

University in Mozambique to improve the quality of teacher training and to encourage lecturers to integrate e-learning as part of their learning strategy. This need was identified because most lecturers in the Faculty currently use only classroom-based instruction. With the addition of this online module, the Faculty of Education and their master's students reap the benefit of twenty-four hour a day access to educational resources.

1.2 Rationale

Learning Management Systems (LMSs) are instructor-oriented and largely concerned with how course content is delivered (Chavan, 2004). Chavan (2004) defines LMS as software used by educators to delivery online learning. According to Chavan (2004) other options used are managed learning environment (MLE), virtual learning environment (VLE), course management system (CMS) or learning support system (LSS). This is supported by Tiarnaigh (2005) who describes CMS as a software system designed and marketed to be used by universities, schools, companies, and students in online education. Klebl (2006), Mutula *et al.* (2006), and Martinez (2001) are some of the researchers who developed online courses using different kinds of LMSs, such as *WebCT*^{®1}, *Moodle*² and *SILPA*^{®3}.

From the literature reviewed, most of the popular LMSs are commercial (e.g. *WebCT*, *SILPA*) and developing countries cannot afford them. A case in point is the study of Muianga (2003), who introduced the *TeleTOP* Course Management System (CMS) in the Faculty of Education in Mozambique, hosted through the University of Twente, The Netherlands. Muianga (2003) argues that the CMS developed and implemented in the Faculty of Education supported the development of lecturers' and students' competencies and contributed to enriching what has been defined as 'competency-based education'. He also maintains that the CMS offered an opportunity to initiate teaching and learning strategies that facilitated the accomplishment of other competencies. Unfortunately it was not possible to maintain the CMS at the Faculty of Education because it carries a high purchase cost. Besides Muianga's (2003) study,

¹ Web Course Tools

² Modular Object-Oriented Dynamic Learning Environment

³ System for Intentional Learning and Performance Assessment

there is limited research in Mozambique focusing on the implementation of an LMS in an educational context.

In this study, I am interested in one popular open source LMS – *Moodle* – which, being an open-source software package, can be downloaded free of charge. It runs under many operating systems like Windows, Linux, and software environments like MS-SQL Server, and developers can make appropriate changes in the source code to adapt it to their needs (Yordanova *et al.*, 2003).

The development of the open source learning management system (LMS) *Moodle* was started by Martin Dougiamas in the 1990's at the Curtin University of Technology in Australia (Nag, 2005). Since then there has been a growing worldwide and local need in the field of education systems for the use of *Moodle*. The growing community of *Moodle* users has reached significant proportions. Currently there are 10 413 sites from 150 countries which have registered with the *Moodle* site, with a total of 73 language packs including Portuguese, in 138 countries (Moodle, 2006).

Moodle might be interesting and suitable educational software that can be adapted for the context of developing countries like Mozambique, especially since it is free of charge. This is one of the opportunities that I explored – using *Moodle* and improving my abilities and knowledge in a module called Management Information Systems in Education (GSIE06) that is taught in the specialization phase of the masters' program at the Faculty of Education at the Eduardo Mondlane University (UEM) in Mozambique. Moreover, I gained experience in dealing with computer programs in the core module Information and Communication Technology (ICT) of the masters' program, which I taught at the Faculty between 2003 and 2004.

With *Moodle* implemented in the Faculty of Education, I had a great opportunity to explore my personal skills in dealing with computer programs and systems. The experience I gained from the modules Theory of Teaching and Training with technology; Evaluation and Assessment of e-learning; Instructional Design; Implementation and Management of e-learning that I completed in the MED (Computer-Integrated Education) during 2005 at the Faculty of Education, University

of Pretoria (South Africa), complements my teaching experience. With *Moodle* introduced into my teaching approach, great results for the students may be achievable. These were some of the reasons that motivated me to choose my research topic.

Moodle is a relatively new tool to be applied in the Faculty of Education in Mozambique. It is expected that the use of *Moodle* at the Faculty will provide solutions to some of the pedagogical and practical issues that have to be addressed when teaching the module Management Information Systems in Education. There is limited research in the Mozambican context focusing on the implementation of learning management systems (LMSs).

In this study, the development of the online module Information Management Systems in Education using *Moodle* among the students enrolled for a master's degree (with specialization in Administration and Management of Education) is explored and evaluated. They participated in a *Moodle* learning environment purposely designed for the development and delivery of information such as the development of competencies for both lecturers and students of the Faculty of Education (UEM) in Mozambique. In the following section, Information and Communication Technology (ICT) in the Mozambican context is explored.

1.3 ICT in higher education in Mozambique

In 1996 Mozambique was the second country to reach complete Internet connectivity through a dial-up connection between the Informatics Centre of Eduardo Mondlane University (CIUEM) and Rhodes University in South Africa (Mario *et al.*, 2003). The CIUEM was initiated in 1990 to provide nationwide e-mail services in Mozambique. Although recently an increase in commercial Internet Service Providers (ISPs) has been observed, the Eduardo Mondlane University (UEM) continues to lead the Internet development and 'Information Society' initiatives in the country (Mario *et al.*, 2003).

In the field of ICT, UEM is more advanced compared with other universities in Mozambique. The UEM developed an ICT strategic plan and began implementation thereof in 1999. The strategic plan supports the use of ICT in the educational system

in terms of the following strategic objectives: administration and management, excellence and quality, and rising admission rates. So far, the faculties of agronomy, architecture, engineering, and medicine at the UEM are the faculties which make wide use of ICTs (Mario *et al.*, 2003).

A well-resourced Higher Education Institution (HEI) in the area of ICT is the Pedagogical University (PU) because of the increasing number of computers with internet connectivity in all departments. Besides the computers located on the main campus of the PU in the Maputo province, computers are also located on the other campuses in the Nampula, Zambezia, and Beira provinces (Mario *et al.*, 2003).

The Higher Institute for International Relations (ISRI) is located in the Maputo province. It contains 12 networked computers with dial-up connections to the Internet. ISRI has a small library, which was set up by the Center for Brazilian Studies. The library computer has a dial-up connection to the Internet (Mario *et al.*, 2003).

In terms of ICT capacity, the Catholic University ranks below UEM, but above the rest of Mozambique's universities, except in the overall area of e-mail/Internet access. Currently e-mail and Internet access at the Catholic University is restricted to dial-up connections. Each campus has a Teledata account; as do a few departments, such as the Center for Investigation and Documentation for Integrated Development (CDDI). The Beira campus of the Catholic University has a computer lab, with 10 networked computers. Although the computers are fairly new, their capacity is very low – 16 Mb of RAM and 1.5 Gb hard drives (Mario *et al.*, 2003).

The library on each of the Catholic University campuses has a computer with Winnebago Spectrum library software containing modules for cataloguing, circulation, users, and materials. “Winnebago was selected on the advice of the US Information Service (USIS) in Maputo and funded by a grant from the Dutch government” (Mario *et al.*, 2003, p.72). Moreover, the library computers came equipped with a six-disc CD-ROM drive. The Beira library has a few CD-ROMs – the *Encarta Encyclopedia* and *English Dictionary*, and the 1986 edition of *Refworld*. With funding from the Austrian government, the Catholic University installed a

sophisticated Geographic Information System (GIS) laboratory within the CDDI on the Beira campus, which has six networked computers (Mario *et al.*, 2003).

The Instituto Superior Politécnico e Universitário (ISPU) in Maputo is well equipped with a local area network (LAN) and a leased line to Teledata for Internet access. There is one computer lab with 10 PC's and a second multimedia lab with 15 computers, speakers, video equipment, and an LCD projector. There are also three computers in the library. Furthermore, the library has computerized its holdings using Access software and the catalogue is available online through the ISPU web site. The library collection is small, with no scholarly journals. But its collection of textbooks and reference books is probably adequate for its needs. The Quelimane campus which uses computers for the library and for administration, uses the same software as the Maputo home campus and links to the Internet through Teledata (Mario *et al.*, 2003).

The Instituto Superior Ciencia e Tecnologia em Mocambique (ISCTEM) runs courses in computer engineering and maintains an excellent laboratory with 30 networked computers. The library is fully computerized and there is considerable awareness of the importance of ICT. The Higher Institute of Transport and Communications (ISUTC) accepted its first 'zero year' students in 2000 and plans to specialize in computer studies with applications throughout the engineering subjects (Mario *et al.*, 2003).

In addition to the above mentioned ICT installations, all public and private universities provide benefits to the students and educators in terms of Internet access, virtual libraries, e-mail access, etc. The Faculty of Education at UEM has two computer rooms each equipped with 25 new computers, all with Internet connectivity. Thus the development, delivery and sustainability of the online master's module using *Moodle* is ensured, which justifies this study.

1.4 The need for the development of an online module

The mission of the Faculty of Education at the Eduardo Mondlane University (UEM) is to innovate, expand, and improve educational activities, taking into account the societal needs of Mozambique. The Faculty also aims at producing higher level professionals capable of undertaking applied educational research. More generally,

the aim of the Faculty is to support the implementation of the UEM Strategic Plan, 1999-2003 and other relevant strategies and policies that pertain to the development of the National Education System (SNE). The target population of the Faculty is prospective teachers and education professionals namely teachers, instructors, lecturers, researchers, education managers and education policy makers. The main activities include research, teaching and learning, innovations in ICT and education, educational services and distance education.

The teaching and learning model adopted by the Faculty of Education is a competency-based curriculum in which ICT is integrated within the teaching and learning process. This approach provides the students with the opportunity to learn and demonstrate the competencies that they need to solve real-life problems. The choice of this approach by the Faculty was based on three fundamental principles:

- Society is seen as more and more dynamic and complex, which in turn demands flexible professionals.
- The concept of knowledge in the knowledge society has shifted from what to know, to how to know.
- Ongoing curriculum reform in the public universities supports competency-based education.

In the curriculum of the UEM Faculty of Education, multimedia and ICT are defined as two of the main components of generic competencies. So far, only one research study has been done focusing on the implementation of Course Management Systems (CMSs) in Mozambique (Muianga, 2003). Online courses need to be developed and delivered in order to facilitate and supplement the process of teaching and learning. Therefore, efforts are being made by the Faculty of Education to find new ways of obtaining low cost educational software to meet the current needs of ICT-enhanced teaching and learning models. From this point of view, the development and delivery of an online module using *Moodle* is an important step in enhancing the experiences and competencies of both lecturers and students. In the following section the aim and objectives of the present study are presented.

1.5 The aim and the objectives

1.5.1 The aim

The aim of this research study is to develop, implement and evaluate an online master's module using *Moodle* for the Faculty of Education (FacEd) of the Eduardo Mondlane University (UEM) in Mozambique.

1.5.2 The objectives

- To develop an online master's module using *Moodle*;
- To implement the online master's module at the FacEd;
- To evaluate the online master's module;
- To make recommendations in order to improve the online master's module.

In the next section the problem statement is discussed.

1.6 Problem statement

Traditional classroom based-instruction is still prevalent in the Faculty of Education of Eduardo Mondlane University in Mozambique. Unfortunately, students who are enrolled in the masters' degree are disadvantaged because they are part-time students with full-time jobs. They are required to be present in the Faculty four times a week from 15:30 pm to 17:30 pm, except on Wednesdays, in order to attend lectures. As a result, students do not have enough time for interacting with the lecturers, for independent work or for cooperative work. This situation renders the process of learning inflexible, particularly for students who work and live far from campus. In order to cope with these problems, to improve the instructional strategy and to meet students' needs, an online master's module was developed and delivered using *Moodle*. Thus the development, which was undertaken and implemented experimentally in 2006 as an innovative course management system, created a flexible and effective online learning environment. The module called Management Information Systems in Education was delivered online during five weeks from 15 May to 11 June 2006.

In view of the above problem, the central research question addressed in this study is the following:

What are the pedagogical and practical issues that have to be addressed when teaching with a Learning Management System (LMS) in the module Management Information Systems in Education?

In order to address the above central research question, the following sub-questions were formulated:

1. To what extent are design features in *Moodle* appropriate for the process of learning in the module Management Information Systems in Education?
2. Is *Moodle* really as constructionist as it claims for the purposes of the online module Management Information Systems in Education?
3. How does *Moodle* support competency-based education?
4. How does *Moodle* help us accommodate a more dynamic and complex society to develop more flexible practitioners?
5. What changes should we make in the design of the online module Management Information Systems in Education using *Moodle* in order to realize an effective learning process?

The first four sub-questions are related to pedagogical issues, and the last one focuses on both pedagogical and practical issues. The literature reviewed for this study included the following questions:

- What features are required of learning management systems to make them appropriate?
- What are the characteristics of constructionist learning?
- What are the requirements of competency-based education?
- How do we develop flexible practitioners in a dynamic and complex society?
 - What complexities and dynamics exist in current society?
 - What are the characteristics of flexible practitioners?
- What are the criteria for effective online learning?

In the following section the research design for this study is described.

1.7 The research design

This research study was conducted in the form of a design experiment, because it employed design, implementation and evaluation of an online master’s module using *Moodle*. The study was undertaken at the Faculty of Education at the Eduardo Mondlane University in Mozambique. The sample consisted of seven adult students registered for the academic year 2006 and the lecturer of the module. The study explored the pedagogical and practical issues that have to be addressed when teaching with the learning management system (LMS) *Moodle*. I adapted Reeves’ (2000) model and applied it to this study. The adapted Reeves model is composed of four phases which are explained as follows:

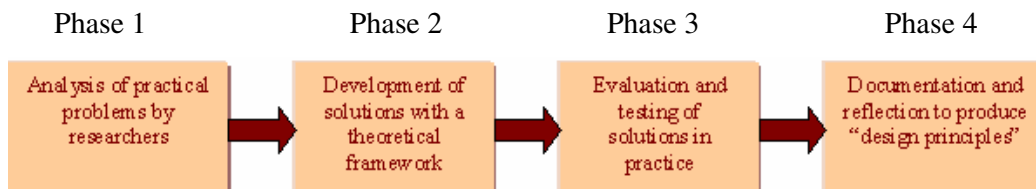


Figure 1.1: Development approach (adapted from Reeves, 2000, p.9)

Phase 1: This consisted of the analysis of the practical problem. The characteristics of the target population and practical problems were identified by means of a questionnaire. The design and plan of the module Management Information Systems in Education were formulated.

Phase 2: This consisted of development and implementation of the module Management Information Systems in Education, which was built using the *Moodle* learning management system.

Phase 3: This consisted of evaluation of the online module. The evaluation focus was the five sub-research questions posed for the context of this study. It was also based on the adapted Cronjé’s (2006) four quadrants of teaching and learning which are described in chapter 2.

Phase 4: This consisted of reflection. Recommendations for further research and improvement in the design of the online module are suggested in chapter 5.

Qualitative data collection instruments were used in this study in order to obtain relevant data. I administered a questionnaire with open-ended questions for students and the lecturer of the module. I used observation in order to find out what happened in the online module, by using the cut and past tool to capture different settings of *Moodle* screens. An interpretive analysis was used for this study because the sample was rather small. This involved organizing and explaining the data; in short, making sense of the data in terms of the participants' definitions of the situation (Cohen, Manion & Morrison, 2000). I used an adapted Cronjé (2006) four-quadrant model as a conceptual framework for this study, which served as an instrument to interpret the data. The four quadrants of teaching and learning on Cronjé's model are Injection, Construction, Immersion, and Integration which formed the four elements for the interpretive analysis.

1.8 Significance of this research

The findings of this study will contribute to valuable knowledge bases, especially for future research studies concerning Learning Management Systems. It also serves as a starting point for encouraging both students and lectures to begin with e-learning at the Faculty of Education at the Eduardo Mondlane University (UEM) in Mozambique. The importance of this research is in providing information for both students and lecturers as to how the practical application of online courses using *Moodle* may take place in a blended learning situation.

I believe that a well designed online master's module using *Moodle* software should offer students a wide variety of possibilities for flexible and participative learning. I also believe that choosing *Moodle* as the platform for the design, implementation and evaluation of the online master's module Management Information Systems in Education at the Faculty of Education will enhance innovation and help other developers in future.

1.9 Limitations of the study

Several limitations were faced during the process of this study:

- Although I intended to include both qualitative and quantitative methods, the latter were not used because the sample was too small to represent the target population. Therefore qualitative data collection methods and interpretive analysis were used.
- The implementation of the online module was frustrating because of the periodic breakdown of *Moodle* and the sometimes slow Internet connection on the days during which the online lessons were planned. Therefore the facilitation of the online module from the postgraduate laboratory at the Faculty of Education at the University of Pretoria, South Africa, where the researcher was located, was impossible.
- Of the seven students who were registered for the module Management Information Systems in Education at the FacEd (UEM) in Mozambique, only five completed and returned the questionnaire. This diminished my expectation of having an ample view of what really happened during the delivery of the online module.

1.10 Summary

This chapter presents an orientation to the study by first providing an introduction to the topic in general, which explains the purpose and the reason for developing an online module using *Moodle*. The background and rationale of this research study were explained. The statement of the problem, research questions and aims of the study were also examined. The research design, data collection and analysis used for this study were then described. The chapter concludes here with a description of the thesis by providing a summary of the remaining chapters.

Table 1.1: Overview of the research report

Chapter 1	Introduction	Discusses the problem and the research questions, and gives an overview of the main topic and context of the study.
Chapter 2	Literature Review	Explores the pedagogical and practical issues regarding the use of an LMS. Specifically investigates the following: <ul style="list-style-type: none"> ▪ Features of an LMS, ▪ Characteristics of constructionist learning, ▪ Competency-based education, ▪ Flexible practitioners in a dynamic and complex society, ▪ Criteria for effective online learning. Proposes the conceptual framework for the study.
Chapter 3	Research Design and Methodology	Describes the type of research methodology as well as data collection techniques, data analysis, validity and ethical considerations.
Chapter 4	Research Findings and Analysis	Presents and analyses the information gathered by using the data collection techniques mentioned in chapter 3.
Chapter 5	Conclusions and Recommendations	Reviews the research questions and provides conclusions based on the findings. Also presents recommendations for the online module and further research.

In the next chapter, the literature review is discussed.

CHAPTER 2 – LITERATURE REVIEW

2.1 Introduction

This chapter outlines the pedagogical and practical issues that have to be addressed when teaching using learning management systems (LMSs), and proposes a conceptual framework for the study. The purpose of this literature review is to investigate and discuss the following issues, which will inform the answers to the research sub-questions:

- What features are required of learning management systems to make them appropriate?
- What are the characteristics of constructionist learning?
- What are the requirements of competency-based education?
- How do we develop flexible practitioners in a dynamic and complex society?
 - What complexities and dynamics exist in current society?
 - What are the characteristics of flexible practitioners?
- What are the criteria for effective online learning?

2.2 What features are required of learning management systems to make them appropriate?

The term ‘Learning Management System’ (LMS) has been defined by a variety of authors in different ways. Chavan (2004) defines an LMS as a software system used to deliver online education. Other terms frequently used are “managed learning environment, virtual learning environment, e-learning, and course management system or learning support system” (Chavan, 2004, p.1). In a similar vein, Tiarnaigh (2005) describes a Course Management System (CMS) as a software system that is designed and marketed for the use of universities and students in online teaching and learning. A CMS is a tool that allows instructors, universities, or corporations to develop and support online education.

For Megías and Itmazi (2004) “an LMS is the software that automates the administration of teaching events” (p.1). All “LMS systems manage the log-in of registered users, manage courses catalogs, track learner activities and results, and provide reports to management. An LMS may include additional functions such as: authoring of content, management of classroom training, learner collaboration tools (chat, discussion groups, etc.)” (Megías and Itmazi, 2004, p.1).

Hiltz (1994) cited by Jaffee (2003) affirms that “this form of instructional technology is variously known as the virtual classroom, asynchronous learning networks (ALNs), virtual learning environments, distributed learning systems, web-based or online courses, e-learning, and online distance learning” (p.2). Jaffee (2003) says that “the defining feature of this instructional technology is the minimization or absence of synchronous (same time/same place) physical classroom meetings between an instructor and students” (p.2). Communication tools are those which promote any kind of interpersonal communication using Internet-based technologies to transmit, present, explain and store information. Some examples of such communication tools are e-mail, bulletin boards, chat rooms, group discussions, conferencing and Internet-based audio applications.

Communication may be *synchronous* (it takes place at the same time) or *asynchronous* (communication is not simultaneous and individuals can retrieve sent messages at their convenience). Individual users may retrieve or send text messages at any time and from any suitable terminal, provided that their computers are connected to the Internet. This point of view is supported by Jaffee (2003) who states that face-to-face instruction which makes use of *synchronous* communication can be supplemented by *asynchronous* communication and interaction which can take place in a web-based learning environment though the use of LMSs like Blackboard[®] and WebCT. In addition, Alessi and Trollip (2001) stress that in web-based learning, different types of interaction are enabled due to the availability of various communication capabilities.

Cronjé (2006) prefers the term ‘digital’ instead of ‘virtual’. He stresses that the various “digital campuses such as *Lotus Learning Space*, *WebCT*, *Moodle*, *Blackboard*, all share

the architectural features exhibited by physical institutions which include an entrance, administration block, lecture halls, library, ancillary services and recreation areas” (p.36).

According to van den Berg (2005), universities are making wide use of LMSs in order to supplement traditional forms of teaching. However, the market favours two particular LMSs, Blackboard and WebCT, because they are seen to be the best; as a result, not many other systems are being used yet.

Most studies contend that there are dozens of LMSs with diverse features and selecting the most suitable LMS platform is a difficult process. Most of the LMSs mentioned in this thesis are commercial except for *Moodle*. Because *Moodle* is an open-source software package, it can be downloaded free of charge. It runs under many operating systems like Windows, Linux, and software environments like MS-SQL Server, and developers can make appropriate changes in the source code to adapt it to their needs (Yordanova *et al.*, 2003; Jensen, 2004). Jensen (2004) provides evidence that he could use *Moodle* for a variety of different types of online training. Additionally, *Moodle* might be interesting and suitable educational software that can be adapted for the context of developing countries like Mozambique.

From the above discussion, it is clear that the literature provides a set of valuable information regarding the features of LMSs. For the purposes of this study I posed the following research sub-question: **To what extent are the design features in *Moodle* appropriate for the process of learning in the module Management Information Systems in Education?** In order to obtain the answer to this question, the module Management Information Systems in Education was designed and delivered through *Moodle* and then evaluated. The answer to this and the other research questions, and a summary of knowledge gathered, will emerge later in this report.

In the next section characteristics of constructionist learning are discussed.

2.3 What are the characteristics of constructionist learning?

According to Papert (1993) “constructionism” is built on the assumption that children will do best by finding (“fishing”) for themselves the specific knowledge they need (p.139). Stager (2003) affirms that “constructionism extends the Piagetian notion of constructivist learning by stating that the best way to ensure learning is through the act of constructing something shareable outside of one’s head” (p.1). Moreover, Papert (1993) advocates that constructionism differs from constructivism in that “it looks more closely than other educational-isms at the idea of mental construction. It attaches special importance to the role of constructions in the world as a support for those in the head, thereby becoming less of a purely mentalist doctrine” (p.143). Most of these studies contend that constructionism was built using constructivist theories of learning.

Gouws (2002) argues succinctly that “constructivism, grounded in the work of theorists such as Piaget and Vygotsky, emphasizes that learners actively construct understanding, that new learning depends on present understanding, that learning is facilitated by social interaction, and that meaningful learning occurs within authentic learning tasks” (p.74). As Papert (1993) says “constructionism also has the connotation of a construction set” (p.142), therefore Gouws’ definition of the concept ‘constructivism’ shows its relationship to constructionism. Thus, constructionism was built based on constructivist approaches of learning that suggest that learning is as an active process in which learners actively build knowledge and understanding based on their previous experiences.

Brooks and Brooks (1993, p.vii) stress that “constructivism is not a theory about teaching...it is a theory about knowledge and learning... the theory defines knowledge as temporary, developmental, socially and culturally mediated, and thus, non-objective.” In a similar vein, Fosnot (1996, p.ix) defines constructivism as “a theory about knowledge and learning which describes what knowing is and how one comes to know.”

Dougiamas (1998), quoted by Berggren (2006), explains that “a constructivist perspective views learners as actively engaged in making meaning, and teaching as that approach which looks for what students can analyze, investigate, collaborate, share, build and

generate based on what they already know, rather than what facts, skills, and processes they can parrot. To do this effectively, a teacher needs to be a learner and a researcher, to strive for greater awareness of the environment and the participants in a given teaching situation in order to continually adjust their actions to engage students in learning, using constructivism as a referent” (p.9).

The above perspective is confirmed by Martin Dougiamas (<http://dougiamas.com/>) in his PhD study entitled “The use of open source software to support a social constructionist epistemology of teaching and learning within Internet-based communities of reflective inquire” (Moodle-Wikipedia, 2006). The same ideas are also supported by Dougiamas and Taylor (2002) who conducted a study about an Internet-based postgraduate course called “Constructivism”. Their study was built for various groups of teachers who were engaged in professional development in distance learning (Dougiamas & Taylor, 2002).

Dougiamas and Taylor’s (2002) study “Interpretative analysis of an internet-based course constructed using a new courseware tool called *Moodle*” was intended “to improve the quality of postgraduate courses and also to prove the ability of *Moodle* as a tool to create online courses that embody and further develop social constructionist pedagogical frameworks” (p.1). In their theoretical perspective, Dougiamas and Taylor (2002) advocate that “the most prevalent theoretical perspectives in research on online learning are those related to constructivism, particularly social constructivism and social constructionism” (pp.2-3). Several researchers such as Amundsen (1993); Bonk & Cunningham (1998); and Jonassen, Peck & Wilson (1999), quoted in Dougiamas & Taylor (2002, p.3) “defend that these” epistemological positions promote collaborative discourse. Furthermore, these “epistemological positions” also privilege the individual development of meaning through construction and sharing of texts and other social artefacts (Ernest, 1995; Gergen, 1995; Papert, 1991, quoted by Dougiamas & Taylor, 2002, p.3).

Another research study that supports *Moodle* as a constructionist system is entitled “Improving the effectiveness of tools for internet based education” by Dougiamas (2000).

The results of this study show that a class of high school teachers learnt about the Internet through an Internet-based course called ‘Internet Overview’, delivered through *Moodle*. The development of such tools used a constructionist approach (Dougiamas, 2000).

Stephenson (2001) in his research entitled “Teaching and Learning Online: Pedagogies for new technologies” developed a “framework for the design of learning technology” (p.19) in which he took into account three fundamental components, namely conceptualization, construction and dialogue. Stephenson (2001) explained these components as follows:

- Conceptualization – this refers to the process of approaching some concepts or theories to an initial understanding through contact with, and exploration of, a new exposition of theories.
- Construction – this involves some activity in which the new ideas, thoughts, and understanding are brought together in order to solve a problem, and thereafter feedback about performance is gained.
- Dialogue – this is the stage that emphasizes the value of discussion and reflection as the new understanding becomes applied to something. In this stage the learners begin to practice the new skills and start to apply the new knowledge and understanding to their real learning situation.

Fahy (2004) argues that in constructivist learning environments the use of technology may differ. Henriques (1997) quoted by Fahy (2004) states that “constructivist teaching tends to be more holistic, more collaborative in method, and more encouraging and accepting of learner initiatives, including greater freedom and variety in assignments and assessments” (p.149) . The instructor’s task also changes in a constructivist environment from “sage on the stage” to “guide on the side” or tutor (Burge & Roberts, 1993; French, *et al.*, 1999 quoted in Fahy, 2004, p.149).

Macdonald (2001) stresses that “assessment forms an integral part of a constructivist approach to learning, by providing an opportunity for students to engage in learning activities, and to integrate their new learning with existing learning and experience. Students may develop a coherent understanding of course content through their writing, and may also practice and reflect on particular skills” (p.1). He adds that in a constructivist environment, dialog is a fundamental element for active participation and for sharing the knowledge and skills in which the collaborative activities are situated. Such collaborative activities are for example, modelling, discourse, and decision-making, which are necessary in order to support the negotiation and construction of knowledge and understanding.

Taking this further, the social constructionist philosophy of *Moodle* builds on constructivism and asserts that such learning takes place mainly in a collaborative environment in which everybody builds collectively (Moodle-Wikipedia, 2006). Mayer (2001) supports this view pointing out that “if one assumes that learners are able to use various coding systems to represent knowledge such as verbal and pictorial knowledge, thus, this view is learner-centered” (p.6). Kelly (2004) supports this claim by saying that “this approach can include drawing out student opinions, knowledge, and problem-solving abilities; facilitating student interaction; and enabling students to learn and develop by self-discovery and personal insight” (p.54).

In addition, Moodle-Wikipedia (2006) indicates that the permissions options tools of *Moodle* allow each user to be teacher or learner. The teacher’s role can change from being a source of knowledge, to an individual who persuades students to take control of their own learning needs, to facilitating discussions and tasks in such a way that the students collectively achieve their learning goals.

The studies discussed above reveal the reality of using *Moodle* as a constructionist tool in various learning experiences. For the purposes of this study, I posed the following research sub-question: **Is *Moodle* really as constructionist as it claims for the purposes of the online module Management Information Systems in Education?** In order to

answer this question, the constructionist approach was applied to the online module that was implemented in the Faculty of Education (UEM).

In the following section requirements of competency-based education are discussed.

2.4 What are the requirements of competency-based education?

In general, competencies are related to highly professional performance and both concepts are directly linked to each other. According to Adendorff (2004) “competencies enable one to focus on clear specified behaviour. Managers are aware of what they are looking for when selecting new employees; staff see what is required of them within their role, and training and development may be provided to address clearly defined needs or deficiencies” (p.13).

Westera (2001) stresses that “...it seems there are two distinct denotations of ‘competencies’ in education. From a theoretical perspective, competency is conceived as a cognitive structure that facilitates specified behaviours. From an operational perspective, competences seem to cover a broad range of higher-order skills and behaviours that represent the ability to cope with complex, unpredictable situations; this operational definition includes knowledge, skill, attitudes, metacognition and strategic thinking, and presupposes conscious and intentional decision making” (p.80) .

From the two definitions above, I understand competency-based education to be the specialized knowledge, abilities or skills, and attitudes that one requires in order to cope with actual changes which occur in society and to be able to progress in the workplace. However not only job skills, but also critical and analytical thinking are necessary. The restructuring and curriculum development program at the Eduardo Mondlane University (UEM) in Mozambique for example, led to the introduction of the notion of ‘competencies’. Moreover, in the policy documents of the restructuring and curriculum development program, the notions of ‘competency’ and ‘ability’ are used alternately, to some level of generality (FacEd/UEM, 2001). The message of the restructuring and curriculum development project is that competency-based education can contribute to the

preparation of a graduate better prepared to answer the needs and demands of Mozambican society (FacEd/UEM, 2001).

A variety of institutions of higher education in Mozambique have defined and described generic competencies, and the Faculty of Education at Eduardo Mondlane University opted for the following (FacEd/UEM, 2001):

- Communication competency – this refers to the ability to communicate ideas and information effectively, using various means, such as verbal and non-verbal expression.
- Information management competency – this refers to the ability to search for information, select what is necessary, present that information in a useful manner, evaluate the suitable information, the sources and methods used, and store it in a way that can be easily accessed when necessary.
- Leadership competency – this refers to the ability to use experience and knowledge in order to take advantage of opportunities and challenges, creating an atmosphere where individual cultures and diverse perspectives can work together in favour of a common mission.
- Project management competency – this refers to the ability to develop and document initial strategies in order to reach objectives of a project, and manage the allocation of resources, time and the contributions of colleagues using a structured approach for all important decisions.
- Social interaction competency – this refers to the ability to interact effectively with others, whether in peers or in groups, in a one-to-one fashion. This includes the understanding of and responding to the needs of others, and working effectively as a member of a group to reach a common goal.

- Reflective competency – this refers to the ability to use or apply deliberately:
 - Self-knowledge, including the knowledge of one’s own style of learning;
 - Self-regulation (orientation, planning, monitoring, evaluation), including knowing how to learn;
 - Reflection-in-sharing (immediate comment, criticizing, reorganizing and evaluating the intuitive understanding of phenomena);
 - Situational understanding (taking into account the varied contexts in which tasks have to be carried out through being capable of transferring, which means selecting and applying the necessary attributes to the new contexts).

- Ethic competency – although not projecting any specific pedagogical activities, not even evaluation in the area of professional ethics, it is still possible to define certain ‘characteristics’ such as:
 - High levels of ethics in one’s personal and professional life;
 - Committing to social justice and acceptance of responsibility and obligations;
 - Defending one’s own rights as well as those of others.

- Design (conception) competency – this refers to the ability to recognize critical incidents or problematic situations in professional practice, and to conceive and develop feasible solutions, applying a methodological approach.

- Inquiry competency – this refers to the ability to apply inquiry strategies deliberately, in situations where the problems and the solutions are clearly evident, demanding critical thinking and a creative, constructive approach to the achieving results.

- ICT and multimedia competencies – this refers to the ability to use information and communication technology including multimedia, to improve learning and increase personal and professional productivity.

McDonald and Horst (2005) in their research about outcomes-based education, state that competency-based education was introduced in America near the end of the 1960s,

because people in the business sector were starting to ask whether graduates were well prepared for life and entry to the workplace. Often graduates lacked the actual knowledge and skills they needed to be able to succeed in the world of work (McDonald & Horst, 2005). McDonald and Horst advocate competency-based education which integrates the following three components:

- Outcomes in terms of specific skills that the students will need in their specific domain;
- Instructional experiences suitable for achieving the outcomes;
- An assessment strategy to ascertain whether the students have achieved the desired outcomes.

However, in practice, competency-based education was reduced to trying out and correcting programmes and this led to failure of this movement. Therefore, McDonald and Horst (2005) suggested a possible definition of the term ‘competency’ to include any of the following: survival or life skills, basic skills, psychomotor skills, professional and vocational skills, intellectual skills, interpersonal skills and personal skills. They state six critical components that characterise a complete competency-based education programme, as follows:

- The learning outcomes should be clear and focus on the required skills which would lead to achieving the desired learning results, and the learners should possess higher level skills to succeed in the assignments and exams (standards for assessment);
- The time allocation should be flexible – this means that the learning time that is needed by the students to do all the activities should not be limited to classroom instruction only;
- The instruction which facilitates the learning should be varied and flexible; in other words the instructional activities should be diverse and take into account different learning styles.
- The measurement of required outcomes should involve explicit, criterion-referenced testing.

- The learner should demonstrate required outcomes before certification is awarded (progress should not be automatic).
- Programmes should be adaptable and managed sensitively to ensure optimum guidance and support for the learner.

Therefore, competency-based education according to McDonald and Horst (2005) is based on the focus of “achievement in specific competencies (often only skills in isolation)” (p.9). They also imply that competency-based education supports the idea that the entire learning process is individual and that the individual, whether the instructor or the learner, is goal-oriented. These authors stress that the process of teaching and learning is facilitated if the instructor knows what the learner should learn and the learner knows exactly what he or she is required to learn.

The above research reveals certain components of the competency-based approach that are critical for effective learning in online modules. For the purpose of this study, I posed the following research sub-question: **How does Moodle support competency-based education in the context of the module Management Information Systems in Education?** In order to answer this question the competency-based approach was applied to the online module that was implemented at the Faculty of Education (UEM).

In the next section, the complexities and dynamics existing in current society and the characteristics of flexible practitioners are investigated.

2.5 How do we develop flexible practitioners in a dynamic and complex society?

Rapid technology change and penetration are becoming ongoing phenomena in today’s world (Woods & Dekker, 2000). Moreover, Lowendahl and Revang (1998), quoted by Navarro and Gallardo (2003), state that “as knowledge and technology become dominant social forces, practitioners of every occupation, despite a significant knowledge base, must keep learning” (p.199). One can view practitioners as being people on the forefront, who determine how technology and organizational change transform work processes in a

society (Woods & Dekker, 2000). Following this outlook, one may ask the following question: What complexities and dynamics exist in current society?

According to Snooks (1996), a dynamic society seeks to unmask the forces of change, not only in work and society, but in life in general. In all areas of work, the characteristics of organizations change under the influence of the increasing importance of knowledge (Teichler, 1999). According to Navarro and Gallardo (2003) “in recent decades the developed world has undergone major social, political, economic, technological, and demographic changes” (p.199). These observed factors are influencing the changes that are taking place in diverse spheres of employment, work and society in general; in that way society is becoming more and more complex and dynamic.

Navarro and Gallardo (2003) emphasize that “in the world today, organizations that are determined to survive and maintain a sustainable competitive advantage must adapt themselves rapidly to continuous change or in other words they must be highly flexible” (p.200). Lawler III (1994) points out that in the work place, changes are being made from job-based to competency-based methods of working. As a result, there is an increasing need to develop knowledge and train practitioners, in order for them to be able to cope with the challenges and changes that are taking place in society today.

The information society for instance, has the potential to improve the quality of practitioners’ lifestyles, as well as the efficiency of our social and economic systems and organizations (Stephanidis, 2000). The acceptability of the emerging information society to all practitioners ultimately depends on its accessibility and usability (Stephanidis, 2000). It is important to develop high quality user interfaces which can be accessible and usable by a diversity of practitioners with different abilities, skills, requirements and preferences, in a variety of contexts of use and through a variety of different technologies (Stephanidis, 2000). Following these ideas one may ask the following question: What are the characteristics of flexible practitioners?

Practitioners must possess appropriate knowledge and skills necessary to be effective in today's society; they are expected to be flexible and adaptable professionals; they must be able and prepared to face those challenges that exist in society that are not necessarily directly related to their specific field of learning. This is because the demand for workers or employees in the knowledge society appears to require new kinds of workers who are more flexible professionals. For the purpose of this study, I posed the following research sub-question: **How does Moodle help us accommodate a more dynamic and complex society to develop more flexible practitioners?** In order to answer this question the online module Management Information Systems in Education was implemented at the Faculty of Education (UEM).

Criteria for effective online learning are discussed in the following section.

2.6 What are the criteria for effective online learning?

Different terminology is used synonymously with online learning such as “e-learning, Internet learning, distributed learning, networked learning, tele-learning, virtual learning, computer-assisted learning, web-based learning, and distance learning” (Ally, 2004, p.4). For Ally (2004) these terms all imply that:

- The students are at a distance from the tutor or instructor and usually use a computer to access the learning materials;
- The students use technology in order to interact with their instructor and their classmates or colleagues, and they need to be provided with some form of support.

A number of different definitions and explanations of online learning may be found in the literature. It is therefore difficult to find precise meanings regarding this construct. According to Ally (2004) online learning is “the use of the internet to access learning materials; to interact with the content, instructor, and other learners; and to obtain support during the learning process, in order to acquire knowledge, to construct personal meaning, and to grow from the learning experience” (pp.4-5).

Duggleby (2000) describes online learning as “a kind of distance education, but it makes considerable use of information and communications technologies such as e-mail, Internet conferencing and the World Wide Web” (p.4). Duggleby also states that the learning material needed for a course can be uploaded onto a web site; interactions between the instructor and students and among students can take place through e-mail; collaboration among the students is enabled; and a learning environment may be built to encourage cooperative work and socialization.

The literature review reveals that online learning is now an integral part of the educational sphere. It represents one of the biggest changes in teaching and learning strategies and is a valuable technology tool that can enhance the process of teaching and learning. Ally (2004) notes that “online learning allows for flexibility of access from anywhere and usually at any time” (p.4). In addition, online learning encourages participation instead of passive interest, and promotes communication, thus reducing the isolation of learners.

According to Ally (2004) some of the benefits of online learning are:

“For learners, online learning knows no time zones, and location and distance are not an issue. In asynchronous online learning, learners can access the online materials at anytime, while synchronous online learning allows for real time interaction between students and instructor. Learners can use the internet to access up-to-date and relevant learning materials, and can communicate with experts in the field in which they are studying. Situated learning is facilitated, since learners can complete online courses while working on the job or in their own space, and can contextualize the learning.

“From the point of view of the instructor, tutoring can be done at any time, and from anywhere; the online materials can be updated in such a way that the learners are able to see the changes at once. When learners are able to access materials on the internet, it is easier for instructors to direct them to appropriate information based on their needs. If designed properly, online learning systems can be used to determine learners’ needs and

current level of expertise, and to assign appropriate materials for learners to select from to achieve the desired learning outcomes” (p.5).

Duggleby (2000) claims that “there is a big demand for distance education and that it provides a high quality of teaching and learning to many people” (p.9). However, Duggleby also states that distance education has serious shortcomings both for tutor and the learners. So, he asks the following question: Can online learning mitigate the disadvantages of distance education? The answer here is “yes, it can”, because of the following advantages:

- **Communication is quick** – communication between tutor and student that may have once taken weeks to transact by post, can be completed in a matter of minutes or hours; students enjoy speedy feedback on completed assignments; clarification can be made easily; and points of confusion can be solved more simply.
- **Communication is of a high quality** – for example, students who may be too shy to ask questions in class may feel more comfortable using e-mail and tutor/student communication which is individualized.
- **Student interaction can take place** – since e-mail is easy and convenient, communication between students becomes practicable; exercises and activities that involve collaboration such as discussion, peer work and group task, can be incorporated into the learning process; social interaction and peer support can take place; courses can incorporate conferencing software that further facilitates debate, discussion, collaboration and social communications; real time (synchronous) communication can be introduced using chat facilities and video-conferencing.
- **Development and maintenance of learning materials is easy** – web-based materials are cheap and quick to produce and need not require a high level of technical expertise; web material can be added to and uploaded in minutes ensuring that the content is always accurate, up-to-date and relevant; the material can be

constantly reviewed and revised in the light of student feedback; there is no need for the providing institution to produce and distribute learning material.

- **Online courses are widely accessible** – computer and internet technology is becoming cheaper and ownership more widespread; there are increasing opportunities for people to access the Internet – even if they do not have access at home, Internet-linked computers can be found at work, in libraries, in cyber cafés and in community centres; students from a wide mix of backgrounds, countries and cultures can participate.

In the same vein, Zhao (2003) points out that there is agreement in the literature on the advantages of online teaching and learning, which include:

- Providing learners with the flexibility of learning at the time, place, and pace they choose (Institute of Higher Education Policy, 2000; cited by Zhao, 2003, p.215);
- Improving the quality of teaching and learning and the quality of services, because online delivery provides the opportunity to increase both the quantity and quality of interaction between teacher and student and among students (Inglis, 1999; cited by Zhao, 2003, p.215);
- Improving access to education and training; reducing the costs of education; improving the cost-effectiveness of education; and empowering learners to know more and learn faster (Zhao, 2003, p.215);
- Accelerating the adoption of new information and new programs (Zhao, 2003, p.215).

According to Jolliffe, Ritter and Stevens (2001), the evaluation of online learning should centre on three issues: the learning that has taken place, the learning materials and the learning environment. Jolliffe *et al.* (2001) describe the criteria and indicators of success for the evaluation of online learning materials in the following table:

Table 2.1: Evaluation of online learning materials (Jolliffe *et al.*, 2001, pp.263-269).

Criterion	Indicators of success
Materials Content	The learning material includes the right amount and quality of information based on the job family or profile map.
Overall Design	The learning is designed in such a way that learners will actually learn. Learners are asked if they would like their pages in a different language.
Interactivity	Learners are engaged throughout the learning process.
Navigation	Learners can determine their own course through the learning materials. There is an exit option available. There is a course map accessible. There is appropriate use of icons and/or clear labels so that learners don't have to read excessively to determine options.
Motivational Components	The materials engage learners through a variety of game elements, testing and unique content.
Media	The materials effectively employ animation, sound and other special, but appropriate, visual effects. The gratuitous use of media elements is avoided.
Assessment	Mastery of each section's content is required before proceeding to later sections. Topic quizzes are used. There is a final exam if appropriate to the needs of the organization and learners.
Look	The materials are attractive and appealing to the eye and ear.
Record keeping	A computer-managed learning component is included as part of the materials and is responsible for record keeping and the collection of learner data. The learner data are automatically forwarded to the course manager.
Tone	The materials are designed in such a way that they avoid being condescending to learners.

The above indicators provide evidence that online learning is a very important technology tool that can supplement and enhance face-to-face education and traditional distance education. A well-established fact of teaching online is that it takes a lot more time and

effort than face-to-face instruction (Kearsley & Blomeyer, 2004). Face-to-face education is understood by Duggleby (2000) as the most “traditional form of delivering instruction and the one with which people will have had direct experience since mainstream schooling throughout the world is taught in this way” (p.3). Both the learners and the instructor are indispensable elements of teaching and learning and they are present in the same physical space and at the same time. For Duggleby (2000), traditional distance education is described as teaching and learning situations in which the learners and the instructor are not necessarily present in the same space and at the same time. In traditional distance education, the instruction and the materials, such as books and paper based materials, are delivered through the post. It may also be complemented by audio-visual materials.

For the purpose of this study I posed the following research sub-question: **What changes should we make in the design of the online module using *Moodle* in order to realize an effective learning process?** In order to answer this question the module Management Information Systems in Education in the Faculty of Education (UEM) was delivered online and evaluated.

In the next section, the conceptual framework for this study is presented.

2.7 Conceptual Framework

In order to answer the five research sub-questions posed at the end of each sub-section above, I needed to understand the following two established theories that have contributed to building the conceptual framework for this study:

- Constructivism;
- Competency-based education.

It is necessary to consider the relationship between these two extremely conflicting theories. Whilst constructivism is based on the construction of own knowledge, the competency-based approach is usually instructivist in nature. McKenna & Laycock (2004) explain that “constructivism, in contrast to instructivism, regards knowledge as a personal

interpretation, individually and actively constructed on the basis of experience rather than transferred from a third party” (p.167).

The model suggested by Cronjé (2006), whereby objectivist and constructivist theories are seen in a two dimension matrix (see Figure 2.1), is thus used to build a framework in which objectivist (=competence-based) and constructivism, as presented in the above paragraph, are combined into a new proposed model for the present study.

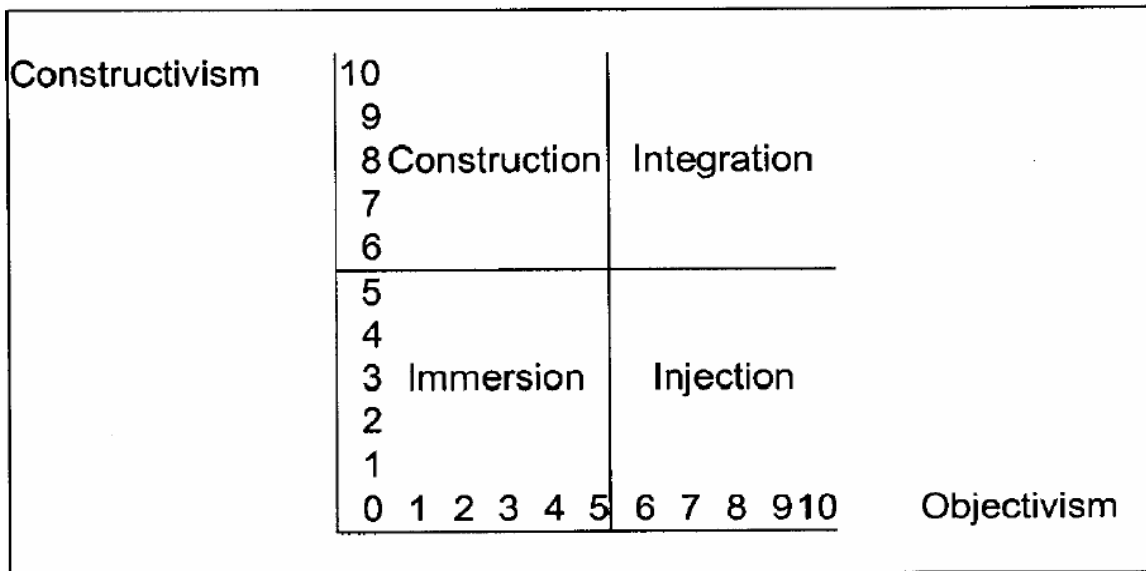


Figure 2.1: Four quadrants of teaching and learning (Cronjé, 2006, p.396).

Figure 2.1 consists of two dimensions: One axis reflects constructivism and the other objectivism. Both axes range from zero to ten. Learning can take place in each of the four quadrants thus formed, which Cronjé names Injection, Construction, Integration, and Immersion. Taking into account Cronjé’s model, I personally believe that it would be most useful to take advantage of the positive elements of both theories. I replaced ‘objectivism’ as shown on the X axis, with ‘competency-based’, while keeping the other elements of the model as shown. The adapted model is shown in Figure 2.2:

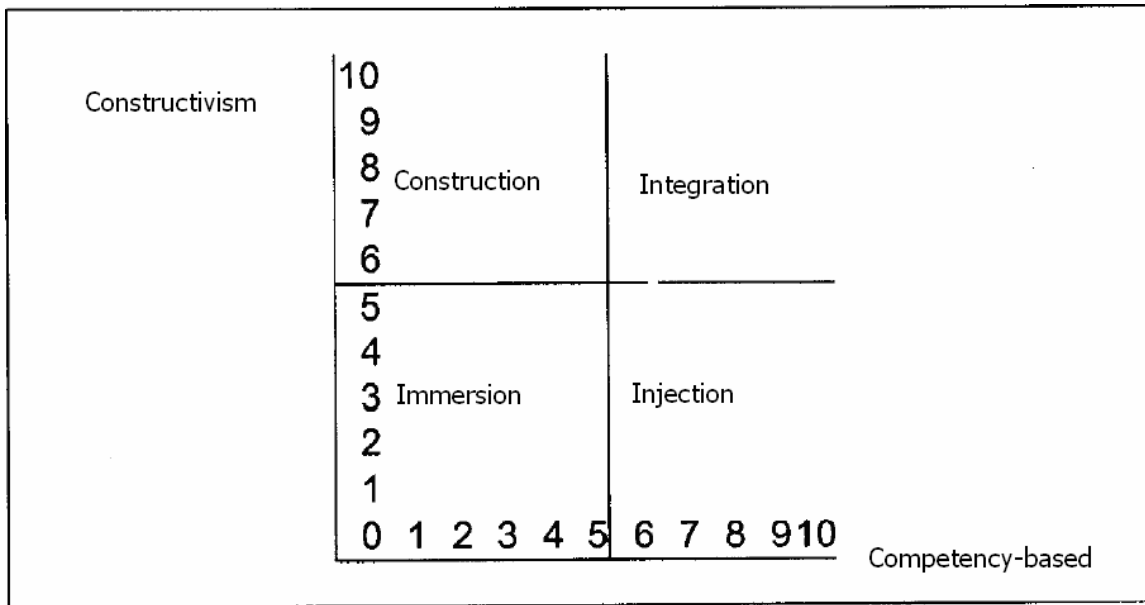


Figure 2.2 Four quadrants of teaching and learning (adapted from Cronjé, 2006)

In the next paragraphs Injection, Construction, Immersion and Integration are explained as these should be understood in the proposed new model (see Figure 2.2). The five research sub-questions are plotted according to the quadrants, in order to obtain the answers.

Injection

According to Cronjé (2006), injection is characterized by the metaphor of medical injections. It means that pre-produced knowledge, skills and attitudes are transferred to the learner in a manner as efficient, pre-determined and pre-digested as possible. As can be seen on the **X** axis in Figure 2.2, the injection quadrant is high in competency-based elements and low in constructivism aspects. It amounts to direct instruction, or teaching along the lines of traditional-based tutorials, for example military training, where the instruction or teaching seeks to optimize efficiency through the transfer of knowledge as a clinical, undiluted and sterile function (Cronjé & Burger, 2006). It is in this quadrant that the following research sub-question is plotted:

How does Moodle support competency-based education in the context of the module Management Information Systems in Education?

Construction

Construction is high in constructivism elements, as seen in Figure 2.2. As the name itself suggests, this quadrant advocates that one constructs or builds knowledge and shapes the truth. This means that students are induced to establish connections between ideas and thus to predict, justify and defend them. By using construction, students intrinsically construct or build their own meaning or understanding, based on their previous knowledge and experiences (Cronjé, 2006). Constructivists such as Papert (1993) and von Glaserfeld (1995) believe that knowledge is constructed by students as they make sense of new experiences. The visualization is that students are not viewed as empty containers waiting to be filled, but active beings looking for meanings through their own experiences. This quadrant is the type where learners are faced with a problem to solve, usually involving finding some solution using their acquired knowledge. Alessi and Trollip (2001) point out that construction is a process which involves students negotiating a goal, making a plan, conducting investigations, building material, and evaluating and revising resources. Following this point of view, it is clear that construction encourages critical and analytical thinking, and allows students to explore and construct their own perspectives about knowledge. The principal advantages of this quadrant are effectiveness and transfer, although it can consume a lot of time (Cronjé, 2006). It is in this quadrant that the following two research sub-questions might find an answer:

To what extent are design features in *Moodle* appropriate for the process of learning in the module Management Information Systems in Education?

Is *Moodle* really as constructionist as it claims for the module Management Information Systems in Education?

Immersion

As Figure 2.2 shows, immersion has low elements of both constructivism and competency-based approaches. In this quadrant, learning is not determined by an outside entity, nor is it placed in any given, predetermined sequence (Cronjé, 2006), but it is

predominantly incidental in nature and usually gained through unplanned circumstances (Cronjé & Burger, 2006). The learner does not construct meaning based on a conscious effort, but through learning experiences. Putting this view simply, learners will acquire learning through their professional career experiences. The following example from Cronjé (2006), which I regard as a “classic example of the immersion quadrant”, shows how learning has clearly taken place in the case of a person driving a motor vehicle:

A person is driving changes lanes without checking his rear-view mirror or signalling. A driver in the lane alongside honks, flashes his lights and curses vociferously. In future, the first driver will probably never forget to look at the mirror and signal before changing lanes. In this example, the driver has learnt something but without planning to, and without formal or even informal instruction. It is probably in this quadrant that the following research sub-question might be answered:

How does *Moodle* help us accommodate a more dynamic and complex society to develop more flexible practitioners?

Integration

This quadrant consists of a synergistic combination of elements from competency-based and constructivism, both at high levels and in appropriate conditions, as Figure 2.2 above illustrates. The learning process in this quadrant is based on goal analysis and the outcomes must be clearly determined (Cronjé, 2006). To achieve the predetermined goals and the outcomes, the designer must select elements from both constructivism and competency-based education.

Constructivism and competency-based approaches have different goals. While competency-based is based on direct instruction or teaching, with a focus on individual learning (McDonald & Horst, 2005), a constructivist approach focuses on active learning (Duffy & Jonassen, 1992). Since constructivism and competency-based are rather contradictory approaches, the adapted Cronjé model (Figure 2.2) seeks to combine these two into a model where they are seen as complementary to one other.

Van Merriënboer's (1997) cited by Kirschner *et al.* (2002) four-components of instructional design model (4C/ID) takes a cognitive-constructivist starting point and aims explicitly at the development of competency-based education. This model focuses basically on real-life problems and leads to a dynamic for learning (Kirschner *et al.*, 2002). In dealing with, and solving those problems which are related to their real-life setting, learners are supported in synthesizing the required knowledge, skills and attitudes which are necessary for them to perform their required tasks efficiently; it also provides them with the chance to learn how to organize the skills that are required for difficult tasks; and to transmit what they have learnt into their every day life or work environment (Kirschner *et al.*, 2002).

Linked to Kirschner *et al.* view (2002), is the view expressed by Doolittle and Camp (1999) that educational programmes are indispensable instruments for the preparation of workers who have to progress in the workplace of the new millennium. Such educational programmes should include not only work skills or abilities, but also critical and analytical thinking skills, as well as teamwork and problem solving skills.

Taking into account the above points, one may say that the constructivist approach takes education beyond terminal capabilities, to understanding the process of learning; and that competencies can be achieved through traditional teaching and also through constructivist teaching strategies. Duffy, Lowyck and Welsh (1993) contend that the constructivist approach can be used to develop competency through action. Fundamental to this approach of learning, is a problem solving capability, which is akin to professional problem solving.

Kirschner *et al.* (1997) argue further that constructed competencies such as skills or abilities allow learners to become aware of and identify new problems in their sphere of influence of study and future occupation or job, and then to solve the identified problems. Van Merriënboer (1999) adds that those learners who have attained competence are able to apply these skills, abilities and attitudes in diverse circumstances, and for the duration

of lifelong learning. Approaches that combine both competency-based and constructivist learning share similar views on learning (Kirschner *et al.*, 2002).

As the two approaches competency-based and constructivism, emphasize the development of thinking skills, one could say that competencies are the ‘outcomes’ that should be achieved by both methods. In addition, the combination of these two approaches will allow learners to be integrated into the community, in particular, and society in general in a much better and harmonious way. This view is supported by Veal, Maj and Duley (2001) who stress that ‘competency’ is the capability to perform in the workplace, thus within a community and or society.

It is in this quadrant that the following research sub-question might find an answer:

What changes should we make in the design of the online module using Moodle in order to realize an effective learning process?

2.8 Summary

This chapter reviewed and discussed the literature regarding the features of Learning Management Systems (LMSs); the characteristics of constructionist learning; the requirements of competency-based education; the complexities and dynamics existing in current society and characteristics of flexible practitioners; and the criteria for effective online learning. The chapter proposes a model adapted from Cronjé (2006) that will allow answering the research sub-questions posed for this study. The conceptual framework reveals that to answer these research sub-questions, we need to investigate the relationship between two concepts: constructivism and competency-based education that are discussed in current literature. Resulting from the combination of these two approaches, we need to consider the following elements: injection, construction, immersion and integration that compose four quadrants of teaching and learning.

In the next chapter the research design and methodology of this study are presented.

CHAPTER 2 – LITERATURE REVIEW

2.1 Introduction

This chapter outlines the pedagogical and practical issues that have to be addressed when teaching using learning management systems (LMSs), and proposes a conceptual framework for the study. The purpose of this literature review is to investigate and discuss the following issues, which will inform the answers to the research sub-questions:

- What features are required of learning management systems to make them appropriate?
- What are the characteristics of constructionist learning?
- What are the requirements of competency-based education?
- How do we develop flexible practitioners in a dynamic and complex society?
 - What complexities and dynamics exist in current society?
 - What are the characteristics of flexible practitioners?
- What are the criteria for effective online learning?

2.2 What features are required of learning management systems to make them appropriate?

The term ‘Learning Management System’ (LMS) has been defined by a variety of authors in different ways. Chavan (2004) defines an LMS as a software system used to deliver online education. Other terms frequently used are “managed learning environment, virtual learning environment, e-learning, and course management system or learning support system” (Chavan, 2004, p.1). In a similar vein, Tiarnaigh (2005) describes a Course Management System (CMS) as a software system that is designed and marketed for the use of universities and students in online teaching and learning. A CMS is a tool that allows instructors, universities, or corporations to develop and support online education.

For Megías and Itmazi (2004) “an LMS is the software that automates the administration of teaching events” (p.1). All “LMS systems manage the log-in of registered users, manage courses catalogs, track learner activities and results, and provide reports to management. An LMS may include additional functions such as: authoring of content, management of classroom training, learner collaboration tools (chat, discussion groups, etc.)” (Megías and Itmazi, 2004, p.1).

Hiltz (1994) cited by Jaffee (2003) affirms that “this form of instructional technology is variously known as the virtual classroom, asynchronous learning networks (ALNs), virtual learning environments, distributed learning systems, web-based or online courses, e-learning, and online distance learning” (p.2). Jaffee (2003) says that “the defining feature of this instructional technology is the minimization or absence of synchronous (same time/same place) physical classroom meetings between an instructor and students” (p.2). Communication tools are those which promote any kind of interpersonal communication using Internet-based technologies to transmit, present, explain and store information. Some examples of such communication tools are e-mail, bulletin boards, chat rooms, group discussions, conferencing and Internet-based audio applications.

Communication may be *synchronous* (it takes place at the same time) or *asynchronous* (communication is not simultaneous and individuals can retrieve sent messages at their convenience). Individual users may retrieve or send text messages at any time and from any suitable terminal, provided that their computers are connected to the Internet. This point of view is supported by Jaffee (2003) who states that face-to-face instruction which makes use of *synchronous* communication can be supplemented by *asynchronous* communication and interaction which can take place in a web-based learning environment though the use of LMSs like Blackboard[®] and WebCT. In addition, Alessi and Trollip (2001) stress that in web-based learning, different types of interaction are enabled due to the availability of various communication capabilities.

Cronjé (2006) prefers the term ‘digital’ instead of ‘virtual’. He stresses that the various “digital campuses such as *Lotus Learning Space*, *WebCT*, *Moodle*, *Blackboard*, all share

the architectural features exhibited by physical institutions which include an entrance, administration block, lecture halls, library, ancillary services and recreation areas” (p.36).

According to van den Berg (2005), universities are making wide use of LMSs in order to supplement traditional forms of teaching. However, the market favours two particular LMSs, Blackboard and WebCT, because they are seen to be the best; as a result, not many other systems are being used yet.

Most studies contend that there are dozens of LMSs with diverse features and selecting the most suitable LMS platform is a difficult process. Most of the LMSs mentioned in this thesis are commercial except for *Moodle*. Because *Moodle* is an open-source software package, it can be downloaded free of charge. It runs under many operating systems like Windows, Linux, and software environments like MS-SQL Server, and developers can make appropriate changes in the source code to adapt it to their needs (Yordanova *et al.*, 2003; Jensen, 2004). Jensen (2004) provides evidence that he could use *Moodle* for a variety of different types of online training. Additionally, *Moodle* might be interesting and suitable educational software that can be adapted for the context of developing countries like Mozambique.

From the above discussion, it is clear that the literature provides a set of valuable information regarding the features of LMSs. For the purposes of this study I posed the following research sub-question: **To what extent are the design features in *Moodle* appropriate for the process of learning in the module Management Information Systems in Education?** In order to obtain the answer to this question, the module Management Information Systems in Education was designed and delivered through *Moodle* and then evaluated. The answer to this and the other research questions, and a summary of knowledge gathered, will emerge later in this report.

In the next section characteristics of constructionist learning are discussed.

2.3 What are the characteristics of constructionist learning?

According to Papert (1993) “constructionism” is built on the assumption that children will do best by finding (“fishing”) for themselves the specific knowledge they need (p.139). Stager (2003) affirms that “constructionism extends the Piagetian notion of constructivist learning by stating that the best way to ensure learning is through the act of constructing something shareable outside of one’s head” (p.1). Moreover, Papert (1993) advocates that constructionism differs from constructivism in that “it looks more closely than other educational-isms at the idea of mental construction. It attaches special importance to the role of constructions in the world as a support for those in the head, thereby becoming less of a purely mentalist doctrine” (p.143). Most of these studies contend that constructionism was built using constructivist theories of learning.

Gouws (2002) argues succinctly that “constructivism, grounded in the work of theorists such as Piaget and Vygotsky, emphasizes that learners actively construct understanding, that new learning depends on present understanding, that learning is facilitated by social interaction, and that meaningful learning occurs within authentic learning tasks” (p.74). As Papert (1993) says “constructionism also has the connotation of a construction set” (p.142), therefore Gouws’ definition of the concept ‘constructivism’ shows its relationship to constructionism. Thus, constructionism was built based on constructivist approaches of learning that suggest that learning is as an active process in which learners actively build knowledge and understanding based on their previous experiences.

Brooks and Brooks (1993, p.vii) stress that “constructivism is not a theory about teaching...it is a theory about knowledge and learning... the theory defines knowledge as temporary, developmental, socially and culturally mediated, and thus, non-objective.” In a similar vein, Fosnot (1996, p.ix) defines constructivism as “a theory about knowledge and learning which describes what knowing is and how one comes to know.”

Dougiamas (1998), quoted by Berggren (2006), explains that “a constructivist perspective views learners as actively engaged in making meaning, and teaching as that approach which looks for what students can analyze, investigate, collaborate, share, build and

generate based on what they already know, rather than what facts, skills, and processes they can parrot. To do this effectively, a teacher needs to be a learner and a researcher, to strive for greater awareness of the environment and the participants in a given teaching situation in order to continually adjust their actions to engage students in learning, using constructivism as a referent” (p.9).

The above perspective is confirmed by Martin Dougiamas (<http://dougiamas.com/>) in his PhD study entitled “The use of open source software to support a social constructionist epistemology of teaching and learning within Internet-based communities of reflective inquire” (Moodle-Wikipedia, 2006). The same ideas are also supported by Dougiamas and Taylor (2002) who conducted a study about an Internet-based postgraduate course called “Constructivism”. Their study was built for various groups of teachers who were engaged in professional development in distance learning (Dougiamas & Taylor, 2002).

Dougiamas and Taylor’s (2002) study “Interpretative analysis of an internet-based course constructed using a new courseware tool called *Moodle*” was intended “to improve the quality of postgraduate courses and also to prove the ability of *Moodle* as a tool to create online courses that embody and further develop social constructionist pedagogical frameworks” (p.1). In their theoretical perspective, Dougiamas and Taylor (2002) advocate that “the most prevalent theoretical perspectives in research on online learning are those related to constructivism, particularly social constructivism and social constructionism” (pp.2-3). Several researchers such as Amundsen (1993); Bonk & Cunningham (1998); and Jonassen, Peck & Wilson (1999), quoted in Dougiamas & Taylor (2002, p.3) “defend that these” epistemological positions promote collaborative discourse. Furthermore, these “epistemological positions” also privilege the individual development of meaning through construction and sharing of texts and other social artefacts (Ernest, 1995; Gergen, 1995; Papert, 1991, quoted by Dougiamas & Taylor, 2002, p.3).

Another research study that supports *Moodle* as a constructionist system is entitled “Improving the effectiveness of tools for internet based education” by Dougiamas (2000).

The results of this study show that a class of high school teachers learnt about the Internet through an Internet-based course called ‘Internet Overview’, delivered through *Moodle*. The development of such tools used a constructionist approach (Dougiamas, 2000).

Stephenson (2001) in his research entitled “Teaching and Learning Online: Pedagogies for new technologies” developed a “framework for the design of learning technology” (p.19) in which he took into account three fundamental components, namely conceptualization, construction and dialogue. Stephenson (2001) explained these components as follows:

- Conceptualization – this refers to the process of approaching some concepts or theories to an initial understanding through contact with, and exploration of, a new exposition of theories.
- Construction – this involves some activity in which the new ideas, thoughts, and understanding are brought together in order to solve a problem, and thereafter feedback about performance is gained.
- Dialogue – this is the stage that emphasizes the value of discussion and reflection as the new understanding becomes applied to something. In this stage the learners begin to practice the new skills and start to apply the new knowledge and understanding to their real learning situation.

Fahy (2004) argues that in constructivist learning environments the use of technology may differ. Henriques (1997) quoted by Fahy (2004) states that “constructivist teaching tends to be more holistic, more collaborative in method, and more encouraging and accepting of learner initiatives, including greater freedom and variety in assignments and assessments” (p.149) . The instructor’s task also changes in a constructivist environment from “sage on the stage” to “guide on the side” or tutor (Burge & Roberts, 1993; French, *et al.*, 1999 quoted in Fahy, 2004, p.149).

Macdonald (2001) stresses that “assessment forms an integral part of a constructivist approach to learning, by providing an opportunity for students to engage in learning activities, and to integrate their new learning with existing learning and experience. Students may develop a coherent understanding of course content through their writing, and may also practice and reflect on particular skills” (p.1). He adds that in a constructivist environment, dialog is a fundamental element for active participation and for sharing the knowledge and skills in which the collaborative activities are situated. Such collaborative activities are for example, modelling, discourse, and decision-making, which are necessary in order to support the negotiation and construction of knowledge and understanding.

Taking this further, the social constructionist philosophy of *Moodle* builds on constructivism and asserts that such learning takes place mainly in a collaborative environment in which everybody builds collectively (Moodle-Wikipedia, 2006). Mayer (2001) supports this view pointing out that “if one assumes that learners are able to use various coding systems to represent knowledge such as verbal and pictorial knowledge, thus, this view is learner-centered” (p.6). Kelly (2004) supports this claim by saying that “this approach can include drawing out student opinions, knowledge, and problem-solving abilities; facilitating student interaction; and enabling students to learn and develop by self-discovery and personal insight” (p.54).

In addition, Moodle-Wikipedia (2006) indicates that the permissions options tools of *Moodle* allow each user to be teacher or learner. The teacher’s role can change from being a source of knowledge, to an individual who persuades students to take control of their own learning needs, to facilitating discussions and tasks in such a way that the students collectively achieve their learning goals.

The studies discussed above reveal the reality of using *Moodle* as a constructionist tool in various learning experiences. For the purposes of this study, I posed the following research sub-question: **Is *Moodle* really as constructionist as it claims for the purposes of the online module Management Information Systems in Education?** In order to

answer this question, the constructionist approach was applied to the online module that was implemented in the Faculty of Education (UEM).

In the following section requirements of competency-based education are discussed.

2.4 What are the requirements of competency-based education?

In general, competencies are related to highly professional performance and both concepts are directly linked to each other. According to Adendorff (2004) “competencies enable one to focus on clear specified behaviour. Managers are aware of what they are looking for when selecting new employees; staff see what is required of them within their role, and training and development may be provided to address clearly defined needs or deficiencies” (p.13).

Westera (2001) stresses that “...it seems there are two distinct denotations of ‘competencies’ in education. From a theoretical perspective, competency is conceived as a cognitive structure that facilitates specified behaviours. From an operational perspective, competences seem to cover a broad range of higher-order skills and behaviours that represent the ability to cope with complex, unpredictable situations; this operational definition includes knowledge, skill, attitudes, metacognition and strategic thinking, and presupposes conscious and intentional decision making” (p.80) .

From the two definitions above, I understand competency-based education to be the specialized knowledge, abilities or skills, and attitudes that one requires in order to cope with actual changes which occur in society and to be able to progress in the workplace. However not only job skills, but also critical and analytical thinking are necessary. The restructuring and curriculum development program at the Eduardo Mondlane University (UEM) in Mozambique for example, led to the introduction of the notion of ‘competencies’. Moreover, in the policy documents of the restructuring and curriculum development program, the notions of ‘competency’ and ‘ability’ are used alternately, to some level of generality (FacEd/UEM, 2001). The message of the restructuring and curriculum development project is that competency-based education can contribute to the

preparation of a graduate better prepared to answer the needs and demands of Mozambican society (FacEd/UEM, 2001).

A variety of institutions of higher education in Mozambique have defined and described generic competencies, and the Faculty of Education at Eduardo Mondlane University opted for the following (FacEd/UEM, 2001):

- Communication competency – this refers to the ability to communicate ideas and information effectively, using various means, such as verbal and non-verbal expression.
- Information management competency – this refers to the ability to search for information, select what is necessary, present that information in a useful manner, evaluate the suitable information, the sources and methods used, and store it in a way that can be easily accessed when necessary.
- Leadership competency – this refers to the ability to use experience and knowledge in order to take advantage of opportunities and challenges, creating an atmosphere where individual cultures and diverse perspectives can work together in favour of a common mission.
- Project management competency – this refers to the ability to develop and document initial strategies in order to reach objectives of a project, and manage the allocation of resources, time and the contributions of colleagues using a structured approach for all important decisions.
- Social interaction competency – this refers to the ability to interact effectively with others, whether in peers or in groups, in a one-to-one fashion. This includes the understanding of and responding to the needs of others, and working effectively as a member of a group to reach a common goal.

- Reflective competency – this refers to the ability to use or apply deliberately:
 - Self-knowledge, including the knowledge of one’s own style of learning;
 - Self-regulation (orientation, planning, monitoring, evaluation), including knowing how to learn;
 - Reflection-in-sharing (immediate comment, criticizing, reorganizing and evaluating the intuitive understanding of phenomena);
 - Situational understanding (taking into account the varied contexts in which tasks have to be carried out through being capable of transferring, which means selecting and applying the necessary attributes to the new contexts).

- Ethic competency – although not projecting any specific pedagogical activities, not even evaluation in the area of professional ethics, it is still possible to define certain ‘characteristics’ such as:
 - High levels of ethics in one’s personal and professional life;
 - Committing to social justice and acceptance of responsibility and obligations;
 - Defending one’s own rights as well as those of others.

- Design (conception) competency – this refers to the ability to recognize critical incidents or problematic situations in professional practice, and to conceive and develop feasible solutions, applying a methodological approach.

- Inquiry competency – this refers to the ability to apply inquiry strategies deliberately, in situations where the problems and the solutions are clearly evident, demanding critical thinking and a creative, constructive approach to the achieving results.

- ICT and multimedia competencies – this refers to the ability to use information and communication technology including multimedia, to improve learning and increase personal and professional productivity.

McDonald and Horst (2005) in their research about outcomes-based education, state that competency-based education was introduced in America near the end of the 1960s,

because people in the business sector were starting to ask whether graduates were well prepared for life and entry to the workplace. Often graduates lacked the actual knowledge and skills they needed to be able to succeed in the world of work (McDonald & Horst, 2005). McDonald and Horst advocate competency-based education which integrates the following three components:

- Outcomes in terms of specific skills that the students will need in their specific domain;
- Instructional experiences suitable for achieving the outcomes;
- An assessment strategy to ascertain whether the students have achieved the desired outcomes.

However, in practice, competency-based education was reduced to trying out and correcting programmes and this led to failure of this movement. Therefore, McDonald and Horst (2005) suggested a possible definition of the term ‘competency’ to include any of the following: survival or life skills, basic skills, psychomotor skills, professional and vocational skills, intellectual skills, interpersonal skills and personal skills. They state six critical components that characterise a complete competency-based education programme, as follows:

- The learning outcomes should be clear and focus on the required skills which would lead to achieving the desired learning results, and the learners should possess higher level skills to succeed in the assignments and exams (standards for assessment);
- The time allocation should be flexible – this means that the learning time that is needed by the students to do all the activities should not be limited to classroom instruction only;
- The instruction which facilitates the learning should be varied and flexible; in other words the instructional activities should be diverse and take into account different learning styles.
- The measurement of required outcomes should involve explicit, criterion-referenced testing.

- The learner should demonstrate required outcomes before certification is awarded (progress should not be automatic).
- Programmes should be adaptable and managed sensitively to ensure optimum guidance and support for the learner.

Therefore, competency-based education according to McDonald and Horst (2005) is based on the focus of “achievement in specific competencies (often only skills in isolation)” (p.9). They also imply that competency-based education supports the idea that the entire learning process is individual and that the individual, whether the instructor or the learner, is goal-oriented. These authors stress that the process of teaching and learning is facilitated if the instructor knows what the learner should learn and the learner knows exactly what he or she is required to learn.

The above research reveals certain components of the competency-based approach that are critical for effective learning in online modules. For the purpose of this study, I posed the following research sub-question: **How does Moodle support competency-based education in the context of the module Management Information Systems in Education?** In order to answer this question the competency-based approach was applied to the online module that was implemented at the Faculty of Education (UEM).

In the next section, the complexities and dynamics existing in current society and the characteristics of flexible practitioners are investigated.

2.5 How do we develop flexible practitioners in a dynamic and complex society?

Rapid technology change and penetration are becoming ongoing phenomena in today’s world (Woods & Dekker, 2000). Moreover, Lowendahl and Revang (1998), quoted by Navarro and Gallardo (2003), state that “as knowledge and technology become dominant social forces, practitioners of every occupation, despite a significant knowledge base, must keep learning” (p.199). One can view practitioners as being people on the forefront, who determine how technology and organizational change transform work processes in a

society (Woods & Dekker, 2000). Following this outlook, one may ask the following question: What complexities and dynamics exist in current society?

According to Snooks (1996), a dynamic society seeks to unmask the forces of change, not only in work and society, but in life in general. In all areas of work, the characteristics of organizations change under the influence of the increasing importance of knowledge (Teichler, 1999). According to Navarro and Gallardo (2003) “in recent decades the developed world has undergone major social, political, economic, technological, and demographic changes” (p.199). These observed factors are influencing the changes that are taking place in diverse spheres of employment, work and society in general; in that way society is becoming more and more complex and dynamic.

Navarro and Gallardo (2003) emphasize that “in the world today, organizations that are determined to survive and maintain a sustainable competitive advantage must adapt themselves rapidly to continuous change or in other words they must be highly flexible” (p.200). Lawler III (1994) points out that in the work place, changes are being made from job-based to competency-based methods of working. As a result, there is an increasing need to develop knowledge and train practitioners, in order for them to be able to cope with the challenges and changes that are taking place in society today.

The information society for instance, has the potential to improve the quality of practitioners’ lifestyles, as well as the efficiency of our social and economic systems and organizations (Stephanidis, 2000). The acceptability of the emerging information society to all practitioners ultimately depends on its accessibility and usability (Stephanidis, 2000). It is important to develop high quality user interfaces which can be accessible and usable by a diversity of practitioners with different abilities, skills, requirements and preferences, in a variety of contexts of use and through a variety of different technologies (Stephanidis, 2000). Following these ideas one may ask the following question: What are the characteristics of flexible practitioners?

Practitioners must possess appropriate knowledge and skills necessary to be effective in today's society; they are expected to be flexible and adaptable professionals; they must be able and prepared to face those challenges that exist in society that are not necessarily directly related to their specific field of learning. This is because the demand for workers or employees in the knowledge society appears to require new kinds of workers who are more flexible professionals. For the purpose of this study, I posed the following research sub-question: **How does Moodle help us accommodate a more dynamic and complex society to develop more flexible practitioners?** In order to answer this question the online module Management Information Systems in Education was implemented at the Faculty of Education (UEM).

Criteria for effective online learning are discussed in the following section.

2.6 What are the criteria for effective online learning?

Different terminology is used synonymously with online learning such as “e-learning, Internet learning, distributed learning, networked learning, tele-learning, virtual learning, computer-assisted learning, web-based learning, and distance learning” (Ally, 2004, p.4). For Ally (2004) these terms all imply that:

- The students are at a distance from the tutor or instructor and usually use a computer to access the learning materials;
- The students use technology in order to interact with their instructor and their classmates or colleagues, and they need to be provided with some form of support.

A number of different definitions and explanations of online learning may be found in the literature. It is therefore difficult to find precise meanings regarding this construct. According to Ally (2004) online learning is “the use of the internet to access learning materials; to interact with the content, instructor, and other learners; and to obtain support during the learning process, in order to acquire knowledge, to construct personal meaning, and to grow from the learning experience” (pp.4-5).

Duggleby (2000) describes online learning as “a kind of distance education, but it makes considerable use of information and communications technologies such as e-mail, Internet conferencing and the World Wide Web” (p.4). Duggleby also states that the learning material needed for a course can be uploaded onto a web site; interactions between the instructor and students and among students can take place through e-mail; collaboration among the students is enabled; and a learning environment may be built to encourage cooperative work and socialization.

The literature review reveals that online learning is now an integral part of the educational sphere. It represents one of the biggest changes in teaching and learning strategies and is a valuable technology tool that can enhance the process of teaching and learning. Ally (2004) notes that “online learning allows for flexibility of access from anywhere and usually at any time” (p.4). In addition, online learning encourages participation instead of passive interest, and promotes communication, thus reducing the isolation of learners.

According to Ally (2004) some of the benefits of online learning are:

“For learners, online learning knows no time zones, and location and distance are not an issue. In asynchronous online learning, learners can access the online materials at anytime, while synchronous online learning allows for real time interaction between students and instructor. Learners can use the internet to access up-to-date and relevant learning materials, and can communicate with experts in the field in which they are studying. Situated learning is facilitated, since learners can complete online courses while working on the job or in their own space, and can contextualize the learning.

“From the point of view of the instructor, tutoring can be done at any time, and from anywhere; the online materials can be updated in such a way that the learners are able to see the changes at once. When learners are able to access materials on the internet, it is easier for instructors to direct them to appropriate information based on their needs. If designed properly, online learning systems can be used to determine learners’ needs and

current level of expertise, and to assign appropriate materials for learners to select from to achieve the desired learning outcomes” (p.5).

Duggleby (2000) claims that “there is a big demand for distance education and that it provides a high quality of teaching and learning to many people” (p.9). However, Duggleby also states that distance education has serious shortcomings both for tutor and the learners. So, he asks the following question: Can online learning mitigate the disadvantages of distance education? The answer here is “yes, it can”, because of the following advantages:

- **Communication is quick** – communication between tutor and student that may have once taken weeks to transact by post, can be completed in a matter of minutes or hours; students enjoy speedy feedback on completed assignments; clarification can be made easily; and points of confusion can be solved more simply.
- **Communication is of a high quality** – for example, students who may be too shy to ask questions in class may feel more comfortable using e-mail and tutor/student communication which is individualized.
- **Student interaction can take place** – since e-mail is easy and convenient, communication between students becomes practicable; exercises and activities that involve collaboration such as discussion, peer work and group task, can be incorporated into the learning process; social interaction and peer support can take place; courses can incorporate conferencing software that further facilitates debate, discussion, collaboration and social communications; real time (synchronous) communication can be introduced using chat facilities and video-conferencing.
- **Development and maintenance of learning materials is easy** – web-based materials are cheap and quick to produce and need not require a high level of technical expertise; web material can be added to and uploaded in minutes ensuring that the content is always accurate, up-to-date and relevant; the material can be

constantly reviewed and revised in the light of student feedback; there is no need for the providing institution to produce and distribute learning material.

- **Online courses are widely accessible** – computer and internet technology is becoming cheaper and ownership more widespread; there are increasing opportunities for people to access the Internet – even if they do not have access at home, Internet-linked computers can be found at work, in libraries, in cyber cafés and in community centres; students from a wide mix of backgrounds, countries and cultures can participate.

In the same vein, Zhao (2003) points out that there is agreement in the literature on the advantages of online teaching and learning, which include:

- Providing learners with the flexibility of learning at the time, place, and pace they choose (Institute of Higher Education Policy, 2000; cited by Zhao, 2003, p.215);
- Improving the quality of teaching and learning and the quality of services, because online delivery provides the opportunity to increase both the quantity and quality of interaction between teacher and student and among students (Inglis, 1999; cited by Zhao, 2003, p.215);
- Improving access to education and training; reducing the costs of education; improving the cost-effectiveness of education; and empowering learners to know more and learn faster (Zhao, 2003, p.215);
- Accelerating the adoption of new information and new programs (Zhao, 2003, p.215).

According to Jolliffe, Ritter and Stevens (2001), the evaluation of online learning should centre on three issues: the learning that has taken place, the learning materials and the learning environment. Jolliffe *et al.* (2001) describe the criteria and indicators of success for the evaluation of online learning materials in the following table:

Table 2.1: Evaluation of online learning materials (Jolliffe *et al.*, 2001, pp.263-269).

Criterion	Indicators of success
Materials Content	The learning material includes the right amount and quality of information based on the job family or profile map.
Overall Design	The learning is designed in such a way that learners will actually learn. Learners are asked if they would like their pages in a different language.
Interactivity	Learners are engaged throughout the learning process.
Navigation	Learners can determine their own course through the learning materials. There is an exit option available. There is a course map accessible. There is appropriate use of icons and/or clear labels so that learners don't have to read excessively to determine options.
Motivational Components	The materials engage learners through a variety of game elements, testing and unique content.
Media	The materials effectively employ animation, sound and other special, but appropriate, visual effects. The gratuitous use of media elements is avoided.
Assessment	Mastery of each section's content is required before proceeding to later sections. Topic quizzes are used. There is a final exam if appropriate to the needs of the organization and learners.
Look	The materials are attractive and appealing to the eye and ear.
Record keeping	A computer-managed learning component is included as part of the materials and is responsible for record keeping and the collection of learner data. The learner data are automatically forwarded to the course manager.
Tone	The materials are designed in such a way that they avoid being condescending to learners.

The above indicators provide evidence that online learning is a very important technology tool that can supplement and enhance face-to-face education and traditional distance education. A well-established fact of teaching online is that it takes a lot more time and

effort than face-to-face instruction (Kearsley & Blomeyer, 2004). Face-to-face education is understood by Duggleby (2000) as the most “traditional form of delivering instruction and the one with which people will have had direct experience since mainstream schooling throughout the world is taught in this way” (p.3). Both the learners and the instructor are indispensable elements of teaching and learning and they are present in the same physical space and at the same time. For Duggleby (2000), traditional distance education is described as teaching and learning situations in which the learners and the instructor are not necessarily present in the same space and at the same time. In traditional distance education, the instruction and the materials, such as books and paper based materials, are delivered through the post. It may also be complemented by audio-visual materials.

For the purpose of this study I posed the following research sub-question: **What changes should we make in the design of the online module using *Moodle* in order to realize an effective learning process?** In order to answer this question the module Management Information Systems in Education in the Faculty of Education (UEM) was delivered online and evaluated.

In the next section, the conceptual framework for this study is presented.

2.7 Conceptual Framework

In order to answer the five research sub-questions posed at the end of each sub-section above, I needed to understand the following two established theories that have contributed to building the conceptual framework for this study:

- Constructivism;
- Competency-based education.

It is necessary to consider the relationship between these two extremely conflicting theories. Whilst constructivism is based on the construction of own knowledge, the competency-based approach is usually instructivist in nature. McKenna & Laycock (2004) explain that “constructivism, in contrast to instructivism, regards knowledge as a personal

interpretation, individually and actively constructed on the basis of experience rather than transferred from a third party” (p.167).

The model suggested by Cronjé (2006), whereby objectivist and constructivist theories are seen in a two dimension matrix (see Figure 2.1), is thus used to build a framework in which objectivist (=competence-based) and constructivism, as presented in the above paragraph, are combined into a new proposed model for the present study.

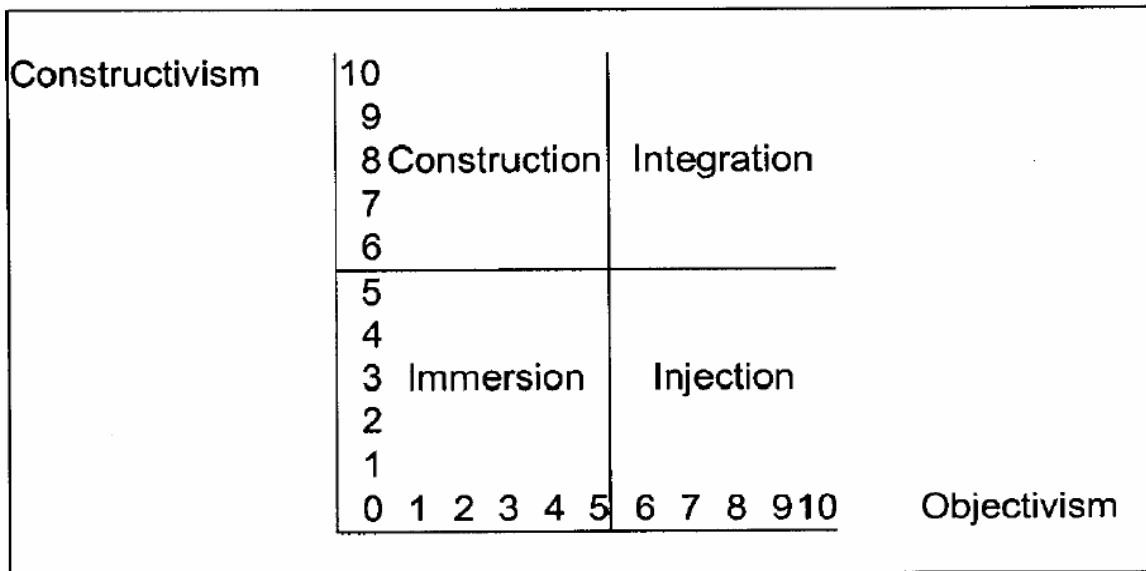


Figure 2.1: Four quadrants of teaching and learning (Cronjé, 2006, p.396).

Figure 2.1 consists of two dimensions: One axis reflects constructivism and the other objectivism. Both axes range from zero to ten. Learning can take place in each of the four quadrants thus formed, which Cronjé names Injection, Construction, Integration, and Immersion. Taking into account Cronjé’s model, I personally believe that it would be most useful to take advantage of the positive elements of both theories. I replaced ‘objectivism’ as shown on the X axis, with ‘competency-based’, while keeping the other elements of the model as shown. The adapted model is shown in Figure 2.2:

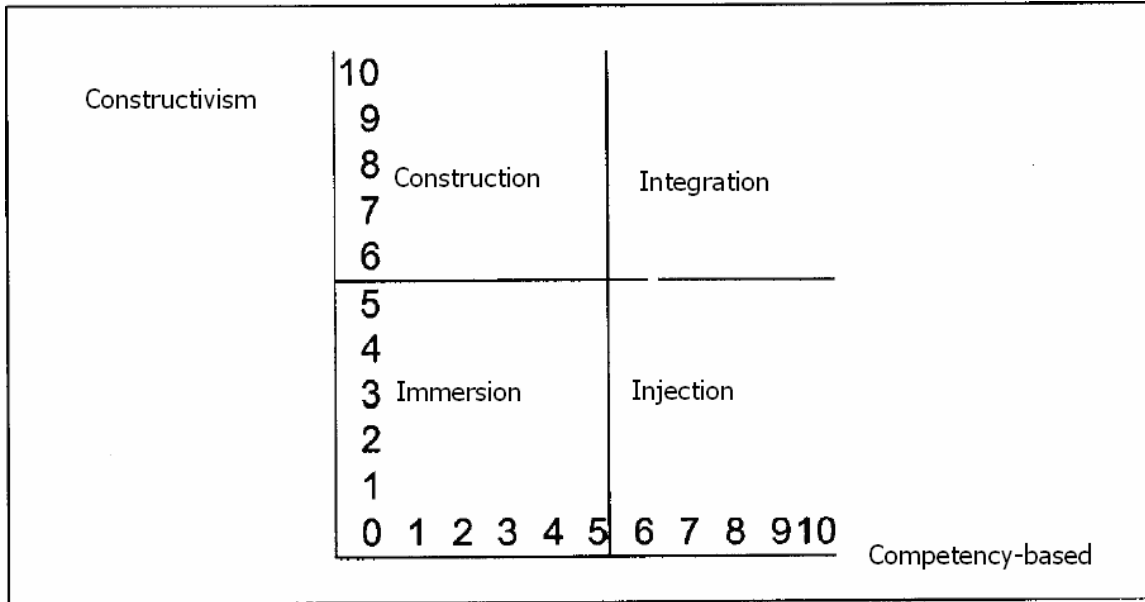


Figure 2.2 Four quadrants of teaching and learning (adapted from Cronjé, 2006)

In the next paragraphs Injection, Construction, Immersion and Integration are explained as these should be understood in the proposed new model (see Figure 2.2). The five research sub-questions are plotted according to the quadrants, in order to obtain the answers.

Injection

According to Cronjé (2006), injection is characterized by the metaphor of medical injections. It means that pre-produced knowledge, skills and attitudes are transferred to the learner in a manner as efficient, pre-determined and pre-digested as possible. As can be seen on the **X** axis in Figure 2.2, the injection quadrant is high in competency-based elements and low in constructivism aspects. It amounts to direct instruction, or teaching along the lines of traditional-based tutorials, for example military training, where the instruction or teaching seeks to optimize efficiency through the transfer of knowledge as a clinical, undiluted and sterile function (Cronjé & Burger, 2006). It is in this quadrant that the following research sub-question is plotted:

How does Moodle support competency-based education in the context of the module Management Information Systems in Education?

Construction

Construction is high in constructivism elements, as seen in Figure 2.2. As the name itself suggests, this quadrant advocates that one constructs or builds knowledge and shapes the truth. This means that students are induced to establish connections between ideas and thus to predict, justify and defend them. By using construction, students intrinsically construct or build their own meaning or understanding, based on their previous knowledge and experiences (Cronjé, 2006). Constructivists such as Papert (1993) and von Glaserfeld (1995) believe that knowledge is constructed by students as they make sense of new experiences. The visualization is that students are not viewed as empty containers waiting to be filled, but active beings looking for meanings through their own experiences. This quadrant is the type where learners are faced with a problem to solve, usually involving finding some solution using their acquired knowledge. Alessi and Trollip (2001) point out that construction is a process which involves students negotiating a goal, making a plan, conducting investigations, building material, and evaluating and revising resources. Following this point of view, it is clear that construction encourages critical and analytical thinking, and allows students to explore and construct their own perspectives about knowledge. The principal advantages of this quadrant are effectiveness and transfer, although it can consume a lot of time (Cronjé, 2006). It is in this quadrant that the following two research sub-questions might find an answer:

To what extent are design features in *Moodle* appropriate for the process of learning in the module Management Information Systems in Education?

Is *Moodle* really as constructionist as it claims for the module Management Information Systems in Education?

Immersion

As Figure 2.2 shows, immersion has low elements of both constructivism and competency-based approaches. In this quadrant, learning is not determined by an outside entity, nor is it placed in any given, predetermined sequence (Cronjé, 2006), but it is

predominantly incidental in nature and usually gained through unplanned circumstances (Cronjé & Burger, 2006). The learner does not construct meaning based on a conscious effort, but through learning experiences. Putting this view simply, learners will acquire learning through their professional career experiences. The following example from Cronjé (2006), which I regard as a “classic example of the immersion quadrant”, shows how learning has clearly taken place in the case of a person driving a motor vehicle:

A person is driving changes lanes without checking his rear-view mirror or signalling. A driver in the lane alongside honks, flashes his lights and curses vociferously. In future, the first driver will probably never forget to look at the mirror and signal before changing lanes. In this example, the driver has learnt something but without planning to, and without formal or even informal instruction. It is probably in this quadrant that the following research sub-question might be answered:

How does *Moodle* help us accommodate a more dynamic and complex society to develop more flexible practitioners?

Integration

This quadrant consists of a synergistic combination of elements from competency-based and constructivism, both at high levels and in appropriate conditions, as Figure 2.2 above illustrates. The learning process in this quadrant is based on goal analysis and the outcomes must be clearly determined (Cronjé, 2006). To achieve the predetermined goals and the outcomes, the designer must select elements from both constructivism and competency-based education.

Constructivism and competency-based approaches have different goals. While competency-based is based on direct instruction or teaching, with a focus on individual learning (McDonald & Horst, 2005), a constructivist approach focuses on active learning (Duffy & Jonassen, 1992). Since constructivism and competency-based are rather contradictory approaches, the adapted Cronjé model (Figure 2.2) seeks to combine these two into a model where they are seen as complementary to one other.

Van Merriënboer's (1997) cited by Kirschner *et al.* (2002) four-components of instructional design model (4C/ID) takes a cognitive-constructivist starting point and aims explicitly at the development of competency-based education. This model focuses basically on real-life problems and leads to a dynamic for learning (Kirschner *et al.*, 2002). In dealing with, and solving those problems which are related to their real-life setting, learners are supported in synthesizing the required knowledge, skills and attitudes which are necessary for them to perform their required tasks efficiently; it also provides them with the chance to learn how to organize the skills that are required for difficult tasks; and to transmit what they have learnt into their every day life or work environment (Kirschner *et al.*, 2002).

Linked to Kirschner *et al.* view (2002), is the view expressed by Doolittle and Camp (1999) that educational programmes are indispensable instruments for the preparation of workers who have to progress in the workplace of the new millennium. Such educational programmes should include not only work skills or abilities, but also critical and analytical thinking skills, as well as teamwork and problem solving skills.

Taking into account the above points, one may say that the constructivist approach takes education beyond terminal capabilities, to understanding the process of learning; and that competencies can be achieved through traditional teaching and also through constructivist teaching strategies. Duffy, Lowyck and Welsh (1993) contend that the constructivist approach can be used to develop competency through action. Fundamental to this approach of learning, is a problem solving capability, which is akin to professional problem solving.

Kirschner *et al.* (1997) argue further that constructed competencies such as skills or abilities allow learners to become aware of and identify new problems in their sphere of influence of study and future occupation or job, and then to solve the identified problems. Van Merriënboer (1999) adds that those learners who have attained competence are able to apply these skills, abilities and attitudes in diverse circumstances, and for the duration

of lifelong learning. Approaches that combine both competency-based and constructivist learning share similar views on learning (Kirschner *et al.*, 2002).

As the two approaches competency-based and constructivism, emphasize the development of thinking skills, one could say that competencies are the ‘outcomes’ that should be achieved by both methods. In addition, the combination of these two approaches will allow learners to be integrated into the community, in particular, and society in general in a much better and harmonious way. This view is supported by Veal, Maj and Duley (2001) who stress that ‘competency’ is the capability to perform in the workplace, thus within a community and or society.

It is in this quadrant that the following research sub-question might find an answer:

What changes should we make in the design of the online module using Moodle in order to realize an effective learning process?

2.8 Summary

This chapter reviewed and discussed the literature regarding the features of Learning Management Systems (LMSs); the characteristics of constructionist learning; the requirements of competency-based education; the complexities and dynamics existing in current society and characteristics of flexible practitioners; and the criteria for effective online learning. The chapter proposes a model adapted from Cronjé (2006) that will allow answering the research sub-questions posed for this study. The conceptual framework reveals that to answer these research sub-questions, we need to investigate the relationship between two concepts: constructivism and competency-based education that are discussed in current literature. Resulting from the combination of these two approaches, we need to consider the following elements: injection, construction, immersion and integration that compose four quadrants of teaching and learning.

In the next chapter the research design and methodology of this study are presented.

CHAPTER 3 – RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This research study was conducted in the form of a design experiment which employed design, implementation and evaluation of an online master's module using *Moodle* in the Faculty of Education (UEM) in Mozambique. The pedagogical and practical issues that have to be addressed when teaching with a Learning Management System (LMS) were explored during the evaluation process of the online learning event. A design experiment was applied in the context of this study as a research strategy in order to accomplish the aims of the study and answer the research questions posed in chapter 1. This chapter provides an overview of the design and development process of the online masters' module Management Information Systems in Education. The following section provides an explanation and discussion of design experiments in general.

3.2 Design experiments

Research which involves instructional technology is characterized by action goals that focus on a particular program, product, or method with the purpose of describing, improving, or estimating its effectiveness and value (Reeves, 2000). Such research is mainly used by researchers with development goals in mind. Design experiments were developed as a way of conducting formative research for testing and refining educational problems, methods and solutions (Reeves, 2000; Stigler & Hiebert, 1999).

In the same vein, Collins, Joseph and Bielaczyc (2004) define “design experiments as a way of carrying out formative research to test and refine educational designs, based on principles derived from prior research” (p.1). For Collins *et al.* (2004) “design experiments or design research are two terms used interchangeably. The approach of progressive refinement in design involves putting a first version of a design into the world to see how it works. Then the design is constantly revised based on experience, until all the ‘bugs’ are solved” (p.1).

Reeves (2000) points out that it is difficult to find good examples of design experiments and other forms of development research. However, Reeves has identified the development work of Jan Herrington and her colleagues at Edith Cowan University in Australia as rare examples (Herrington & Knibb, 1999; Herrington & Oliver, 1999, quoted by Reeves, 2000, p.9).

For the context of this study it is important to note that instructional technology, in particular the online module that was developed and delivered through *Moodle* for masters students at the Faculty of Education in Mozambique, is likely to provide alternatives to real-life settings. According to Reeves (2000) “there are major differences between the philosophical framework and goals of methods of development research and research approaches” (p.9). The following figure illustrates the differences between research conducted with traditional empirical goals and that inspired by development goals.

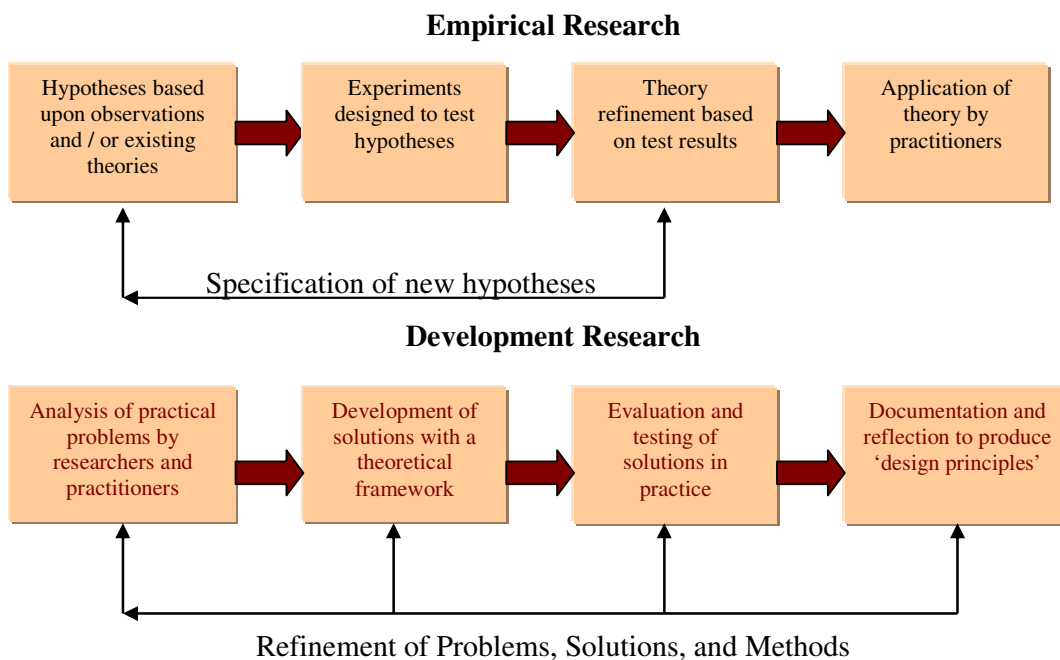


Figure 3.1: Empirical and development approach to IT research (Reeves, 2000, p.9)

3.3 The design experiment in the context of this study

Part of Reeves’ model illustrated above was adapted in order to carry out the design and development of the online master’s module in this study, as illustrated in Figure 3.2.

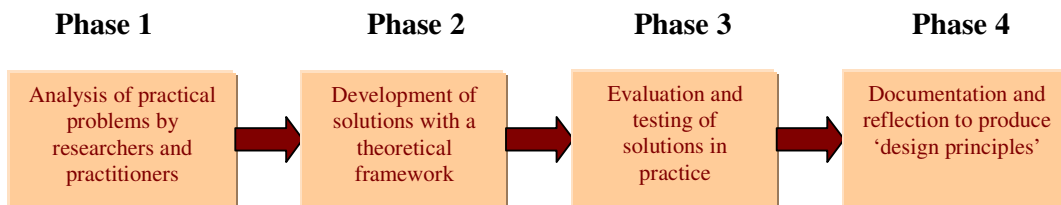


Figure 3.2: Development approach (adapted from Reeves, 2000, p.9)

A pilot experiment was undertaken following the four stages illustrated in Figure 3.2, as explained in the next section.

3.3.1 Phase 1 – Analysis of the practical problem

A questionnaire was administered in order to obtain a detailed description of the characteristics of the participants in the study. These characteristics are described in the following section.

3.3.1.1 Target population

The population consisted of twenty-two (22) adult students registered for the academic year (2005/2006) in the master's program in Administration and Management in Education. Of the twenty-two students, only seven (7) registered for the optional module Management Information Systems in Education, which is part of the specialization phase offered in the second year of the program. The fact that the module is optional, meant that few students enrolled for it, probably because they are part-time students with full-time jobs and may have wanted to dedicate their time to other modules and their jobs. The seven (7) students who registered for this module were interested in learning the new subject because they wanted to apply it in their professional careers.

In terms of gender, three (3) of the students were female and five (5) were male, including the lecturer for the module. All were black with ages ranging from 35 to 50. All participants had higher qualifications in the field of education, that is an Honors

degree in Administration and Management in Education, and the lecturer had a Master's degree in Telematics Applications in Education and Training.

All seven (7) students combined part-time study with a full-time job, which placed additional burdens on them. They were required to attend lectures in the Faculty four times a week from 15:30 pm to 17:30 pm, except Wednesdays. As a result, students did not have enough time for interacting with their lecturers, for strengthening their skills, or for independent and cooperative work. This situation rendered the process of learning nonflexible, particularly for students who work and live far from campus. In order to cope with these problems, improve the instructional strategy and meet students' needs, an online environment was developed and delivered using *Moodle* software. In the following section the design and plan are presented.

The selection of this module to be developed and delivered online for the masters students is explained in the next sub-section.

3.3.1.2 The selection of the module

This study is also part of an ICT project undertaken by the Academic Development Department in the Faculty of Education, which started in August 2005 and ended in June 2006. Masters students were eligible to participate in this investigation. Therefore this study is one of the outputs of the ICT project.

One module was selected, developed and delivered via *Moodle* software in the first semester of the academic year 2006. The researcher chose this module because it was unique and had to be taught at the same time that the ICT investigation was to take place in the Faculty of Education.

The first contact with the instructor of the module was made on 10 January 2006. The researcher (me) and the instructor discussed the design plan related to the module and the tools to be used in the *Moodle* software. The instructor decided to start with the design in February 2006. He also decided that after designing the first version of the module, he would send it to me via e-mail in order to obtain my contribution. We also decided about various roles to be undertaken during the research project. The following important aspects were agreed upon:

- Collaboration between the lecturer and me on the design and implementation process: the lecturer designed the paper version of the content that was to be uploaded to *Moodle* and I revised it.
- The lecturer and I created the online module on *Moodle*. In order to add content, html programming skills were required. Both the lecturer and I have those skills, so there was no problem. Content modules were created; resources in pdf files, such as relevant articles related to the module, documents written in Microsoft Word, and lessons in Microsoft PowerPoint were all uploaded.
- The lecturer had two different roles namely, being the server administrator and facilitator of the online module. I also had the role of facilitator, but because I could not log into *Moodle* from the post-graduate computer lab at the University of Pretoria (South Africa) on the days in which the online lessons for the module took place, I could not facilitate the students.

The second contact with the instructor took place on 10 March 2006. We discussed the design of the module in *Moodle*. We decided about the module structure and the tools to be used such as discussions, assignments, resources, and grades. In order to avoid disrupting the schedule of the module, the lecturer and I decided to run the online lessons in a blended learning mode with face-to-face instruction, according to the following timetable:

- **Week 1:** from 15 May - 21 May 2006, two lessons were facilitated online;
- **Week 2:** from 22 May - 28 May 2006, one lesson was facilitated online;
- **Week 3:** from 29 May - 4 June 2006, two lessons were facilitated online;
- **Week 4:** from 5 Jun - 11 June 2006, the last lesson was facilitated online.

Training for the instructor and the students was not included in this plan because the instructor/lecturer was an instructional technologist and we assumed that the students had already acquired basic skills in the use of ICT in their curriculum during the first year of the core program (February 2005). Nevertheless, a preliminary questionnaire was given to the students to be completed before the beginning of the module, in order to collect more evidence about their skills in ICT. The questionnaire was completed by the students on 10 May and returned on 11 May 2006. The results from

the questionnaire revealed that all seven students had access to computers with Internet access at several places such as the Faculty of Education, at work, at home, and at Internet cafés. The results also revealed that all students used computers frequently for the purposes of completing their work; for searching for information on the Internet for the purposes of their studies; to communicate with their families, colleagues, lecturers and others via e-mail; to receive feedback on their assignments and other activities via e-mail.

Furthermore, the questionnaire revealed that all students had diversified computer literacy skills such as:

- Drawing tables, charts and images using Microsoft Word;
- Typing texts and reports, inserting images and graphics into text documents through Microsoft Word;
- Using Microsoft Excel or other spreadsheets for analysing data;
- Creating Microsoft PowerPoint presentations;
- Using a virtual library;
- Using e-mail and chatting online;
- Checking announcements or listservs;
- Searching for information through the WWW for the course in general.

The range of information obtained from the preliminary questionnaire helped the lecturer and me to proceed to stage 2, which was the development of a solution within a theoretical framework. The lecturer and I used the *Moodle* learning management system to create the online module. In the following sub-section the development and implementation process is presented.

3.3.2 Phase 2 – Development and implementation

Module GSIE06

The module can be accessed at the following address <http://196.3.96.61/moodle/>. It is structured as follows:

- Blocks in three columns;
- Content column in the centre;

- Content organized by week.

The building of the module (GSIE06) using *Moodle* took approximately three months (from February to April) of part-time work in order to complete the development before the beginning of the course. A tutorial/manual in Portuguese was used as a guide in order to create the module. The tutorial explains step-by-step how to experiment with designing material on *Moodle*. All the content was created in html. The following screen illustrates a screen from the manual used to develop the module.

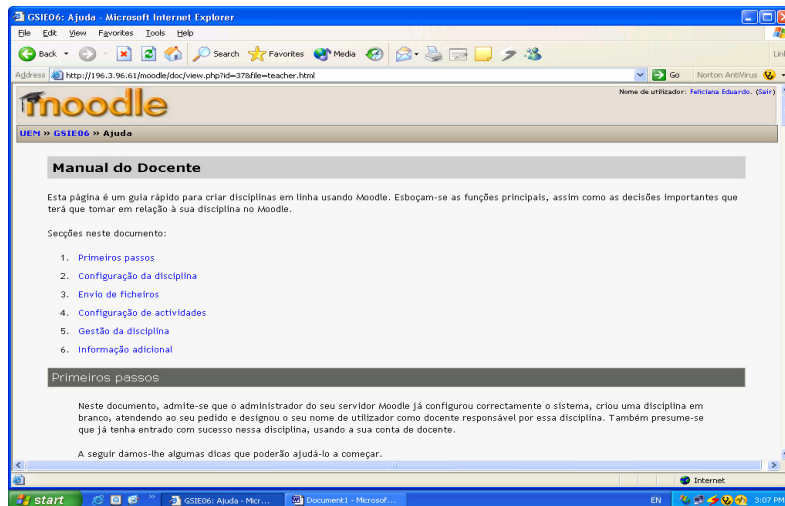


Figure 3.3: Portuguese teacher's guide

The following screens illustrate the home page and the group of disciplines. Figure 3.4 is a general welcome screen to the *Moodle* site in Portuguese. From this site, the Faculty of Education can be accessed. The link to the module Management Information Systems in Education is shown in Figure 3.5, including the respective lecturers/facilitators, who are shown in the first block with a key, indicating security.

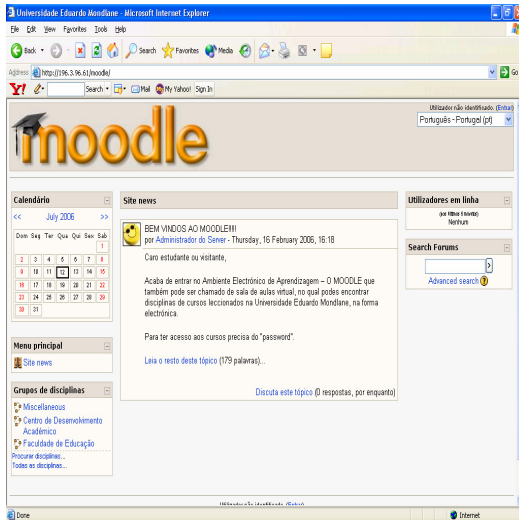


Figure 3.4: Moodle home page



Figure 3.5: Group of disciplines

The online module was constructed and organized based on the following structure:

Weekly structure: The module layout was based on a 4-week structure and the main module page provided an outline of the module with links to everything. The screens below illustrate how the lessons were structured and edited. Figure 3.6 shows the manner in which text is edited and configured. Figure 3.7 shows the weekly structure that was used to design the four lessons.

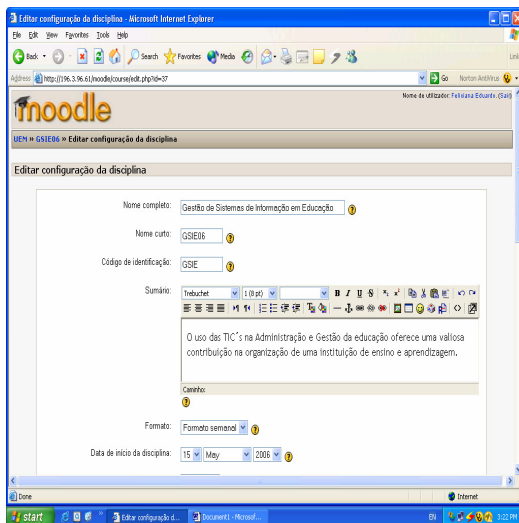


Figure 3.6: Editing configuration



Figure 3.7: Weekly structure

Week1: The first week was from 15 May - 21 May, during which two lessons took place, on Monday and Thursday. In the first lesson on Monday, an introduction to the module objectives was presented and discussed and everyone introduced themselves. In the second lesson that took place on Thursday, the focus was on a discussion about the outcomes and results of the first assignment, and introduction of the issue of electronic business and marketing.

Week 2: The lessons took place from 22 May - 28 May. In this week, students were occupied in doing independent and cooperative tasks. The students were required to search for information on the Internet and in the library, related to the topics which were assigned to them in groups.

Week 3: The lessons took place from 29 May - 4 June. This week was characterised by presentations and discussions of the tasks.

Week 4: This was the last week of lectures and the lessons took place from 5 June - 11 June. The students were expected to complete their final project.

The screens below show the lessons 1, 2, 3 and 4, with links to access the tasks and resources (in pdf files, lessons presented in MS PowerPoint, references in MS Word). Figure 3.8 shows the lessons and Figure 3.9 shows the resources.

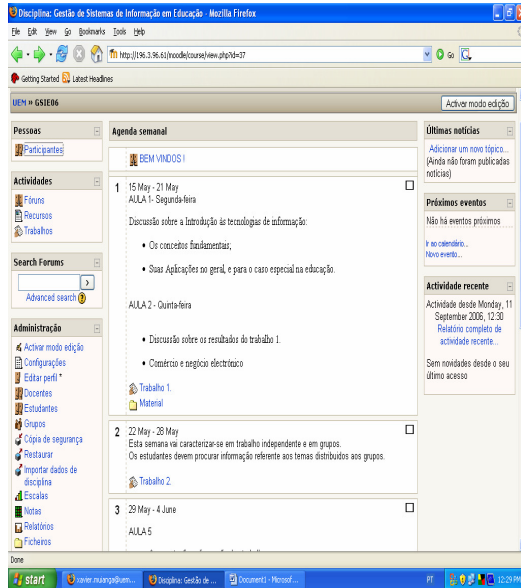


Figure 3.8: Lessons (1, 2, 3 and 4)

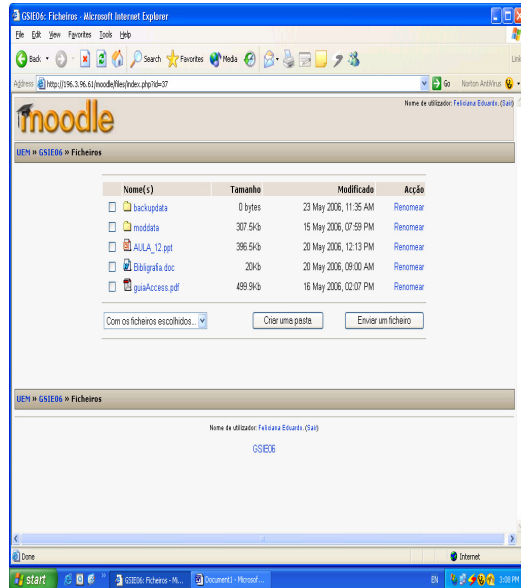


Figure 3.9: Resources/material

The screens below show assignment tasks. Figure 3.10 shows the individual assignment and Figure 3.11 shows the group assignment for week 2.

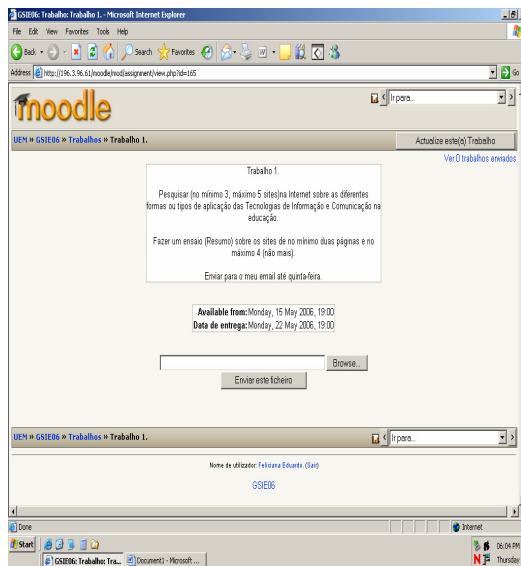


Figure 3.10: Individual task

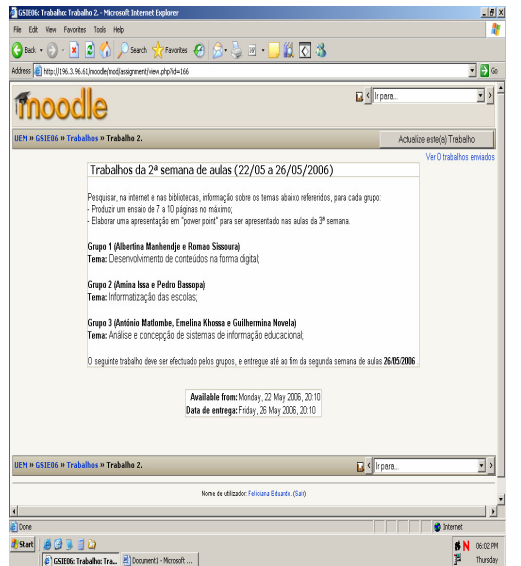


Figure 3.11: Group task week 2

The following screens, Figure 3.12 and Figure 3.13, illustrate respectively the group assignment for week 3 and the final project.

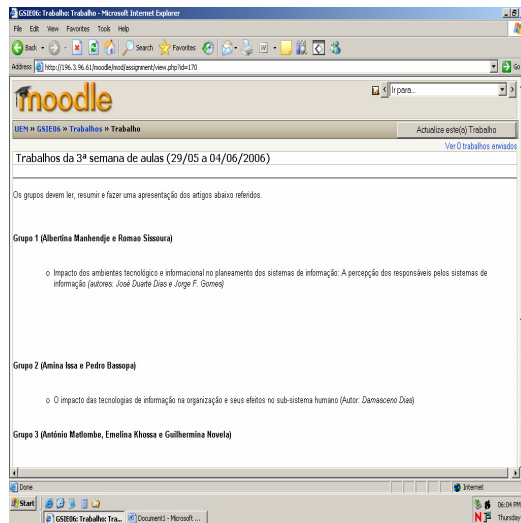


Figure 3.12: Group task week 3

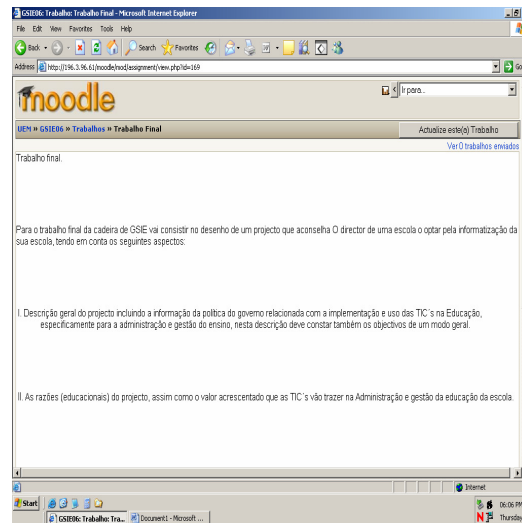


Figure 3.13: Final project

The following screens, Figure 3.14 and Figure 3.15, show respectively the possible facilitators and the seven students registered for the module.

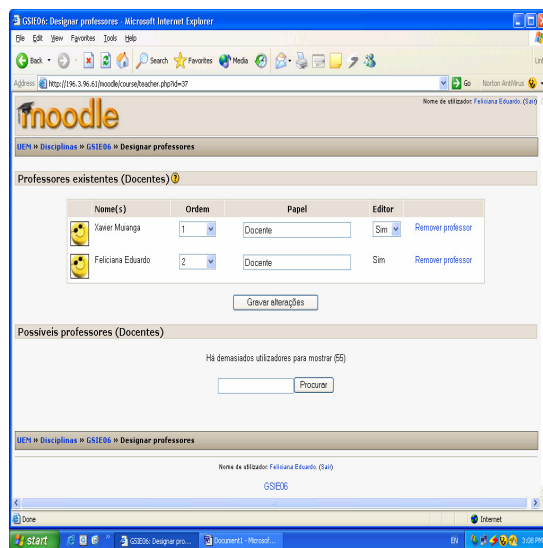


Figure 3.14: Facilitators

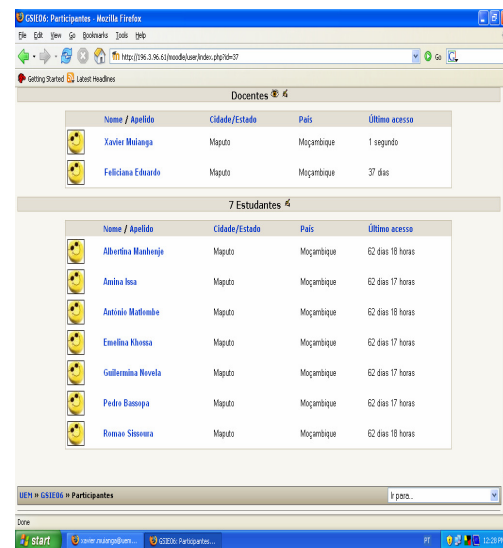


Figure 3.15: Participants

The screens below show assignments uploaded by the students and the grade book. Observations show that the students only uploaded the final project. Figure 3.16 shows the students' uploaded final project and comments provided by the facilitator. Figure 3.17 shows the grades of each student.

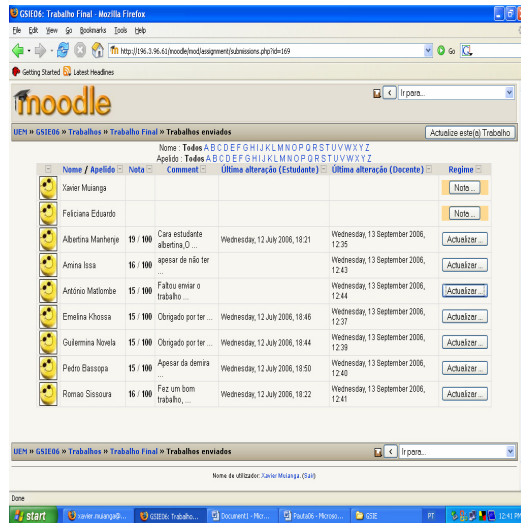


Figure 3.16: Final project uploaded

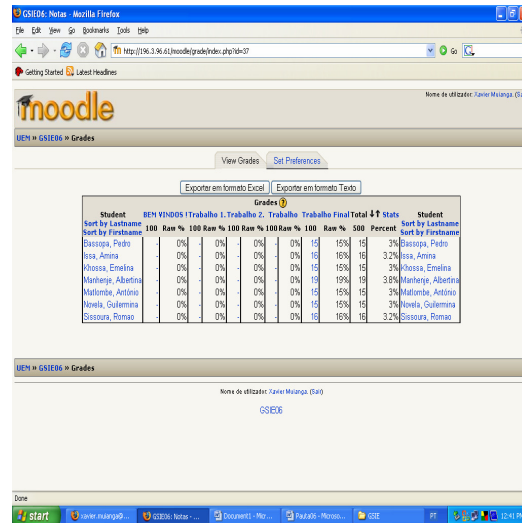


Figure 3.17: Grade book

In the next section the evaluation process is explained.

3.3.3 Phase 3 – Evaluation and testing of solution in practice

The development and experimental use of the online module Management Information Systems in Education was dedicated to the exploration of the pedagogical and practical issues that may be addressed when teaching with *Moodle* in the Faculty of Education (UEM). The main focus was on the practical use of the online module in teaching and learning scenarios, and thus on the realization and application of lessons in the context of the normal schedule for the program. The evaluation process focused on the following five sub-research questions:

1. To what extent are design features of *Moodle* appropriate for the process of learning in the module Management Information Systems in Education?
2. Is *Moodle* really as constructionist as it claims for the purposes of the online module Management Information Systems in Education?
3. How does *Moodle* support competency-based education?
4. How does *Moodle* help us accommodate a more dynamic and complex society to develop more flexible practitioners?

5. What changes should we make in the design of the online module Management Information Systems in Education using *Moodle* in order to realize an effective learning process?

These subsidiary questions reflect the central research question presented in chapter 1: **What are the pedagogical and practical issues that have to be addressed when teaching with Learning Management System (LMS) in the module Management Information Systems in Education?**

The concepts derived from the subsidiary research questions were explored in chapter 2 and the information serves as a base for supporting my analysis in chapter 4.

Two final evaluation questionnaires with open-ended questions were addressed to the lecturer of the module and to the students registered for the optional module Management Information Systems in Education. Before I administered these questionnaires to the specific sample for the purposes of this study, I piloted them with the lecturer and ten students of the online masters module ‘The use of ICT in the curriculum’, which was also designed and delivered through *Moodle*, for students enrolled in the first year of the core program of the Faculty of Education (February 2006). The lecturer’s questionnaire was sent via e-mail to the Netherlands to be completed. The lecturer completed it without any problem and sent it back to my e-mail box within five days. Of the ten students, nine completed and returned the questionnaire to me within a week. Both the lecturer and the students who returned the questionnaires affirmed that the questionnaire was easy to complete. In my informal conversations about what they thought in relation to the number of questions in the questionnaire, they did not point out any problem.

The student evaluation questionnaire comprised 28 open-ended questions (see appendix 5), all of which were derived from the sub-research questions mentioned above. The lecturer evaluation questionnaire comprised 11 open-ended questions (see appendix 4) and all of them also related to the sub-research questions. These questionnaires were planned to be completed within a day, but because of lack of time and the students being so busy with their activities from school and their work, they asked for more time. Thus we negotiated that the questionnaire should be completed between 10th and 21st July 2006. This was the strategy I had to adopt to get the

questionnaires properly completed because the students complained about the number of questions to be answered, although they affirmed that the questions were easy to answer. Even still, of the seven participants, two of them did not return the questionnaire. I encouraged them by making a call via cell phone to each student in order to find out why they were not returning the questionnaire and they said that the questionnaire was difficult to answer. I then adopted another strategy in order to convince them to answer the questions through an interview at any time and place decided by them. They accepted this initiative, but they did not appear on the arranged day. The results of the evaluation are presented in chapter 4 of this study – Research Findings and Analysis.

3.3.4 Phase 4 – Reflection

Based on the feedback obtained from the evaluation questionnaires, recommendations are suggested in Chapter 5, in order to improve the online module (the product).

In this study, the installation of *Moodle* was not included because it was hosted on the server of the Centre for Informatics by the team who initiated the project named “Information and Communication Technology (ICT) as strategies for student-centred learning” in February 2006. The re-design of the online module was not included because of the limited time for the research and the schedule in which the module took place at the FacEd (UEM). The online module was implemented in a blended learning scenario, incorporating face-to-face instruction. In the next section data collection methods are presented.

3.4 Data collection methods

At the beginning of this study, I decided to use both quantitative and qualitative methods of gathering data, but because the sample was too small (seven students and one lecturer) I could not use quantitative methods. From the literature reviewed, most studies related to my topic of investigation used a survey with closed questions. In the case of my research study, I used a questionnaire with open-ended questions, as well as observations of activities in the online module using *Moodle*. From the online module several screens were presented earlier in this chapter as evidence of sources of data. The online observations were conducted not only to facilitate the learning of the

students, but also to provide evidence that they were using *Moodle* to supplement their learning. My online observations included whether the students were logging in to *Moodle* to upload assignments; downloading resources like articles in pdf files, lessons in MS PowerPoint, references related to the module in MS Word format; consulting instructions for each lesson and the schedule; checking the grade worksheet; using chat for discussion topics; and using chat to interact with the lecturer and with other students. It emerged that the students did not use chat for the discussions.

The evaluation questionnaire was first designed in English and submitted to my supervisor for comments and then I made changes where necessary. After my supervisor approved the questionnaire I took it to an editor who speaks both languages, Portuguese and English, in order to translate it to Portuguese. I chose an editor who speaks Portuguese as the first language and English as a second language, in order to avoid bias. I was present when the editor was translating the questionnaire, in order to make it clear if he did not understand the questions well. I wanted to be sure that the questions were translated with the same connotation as existed in English. In the following section the data analysis is explained.

3.5 Data analysis

An interpretive analysis was used for this study because the sample was too small for a quantitative analysis. This involved organizing and explaining the data; in short, making sense of the data in terms of the participants' definitions of the situation (Cohen *et al.*, 2000).

3.6 Confidentiality, anonymity and trust

The researcher had an ethical responsibility to recognize and protect the human rights of the research participants. During the process of this study, attention was given to the following human rights issues:

- Permission to conduct this study was obtained from the Ethics Committee of the Faculty of Education at the University of Pretoria (see appendix 1).
- Written permission to collect data for this study was obtained from the Dean of the Faculty of Education, Eduardo Mondlane University in Mozambique (see appendix 2).

- Informed consent for the lecturer as well as the masters students registered for the module Management Information Systems in Education was secured by means of a letter in Portuguese (see appendix 3). The lecturer and students read and signed it in order to confirm that they were completing the questionnaire voluntarily.
- In the consent letter I explained that personal information about the participants would not be revealed, in order to ensure anonymity and confidentiality.
- The researcher respected the rights of intellectual property and privacy of the participants.

The validity of the study is explained in the following section.

3.7 Validity of the study

There are several strategies that can be used to enhance validity (McMillan and Schumacher, 2006; Cohen *et al.*, 2000). In this research study the following strategies were used in order to increase validity:

- According to Cohen *et al.*, (2000) two or more instruments of data collection can be used in order to triangulate data. Triangulation of questionnaire, and observations to the *Moodle* site were used to validate the emerging findings.
- Member checking. The findings of this study were sent to the lecturer module via e-mail in order to give comments, correct errors, and give further information.
- Participant review. The participants were asked to review and clarify the answer from the questionnaire data for accuracy.

3.8 Summary

This chapter outlines the research design employed to design, implement and evaluate an online master's module using the *Moodle* LMS for the FacEd (UEM), in Mozambique. It provides the meaning and explanation of a design experiment, based on the perspectives of different authors. It explains step-by-step how the study was undertaken following the adapted Reeves model. The methods adopted for data gathering and analysis have been clarified. The confidentiality, anonymity and trust procedures that were used in this study were also explained. Lastly, the validity of the study is described.

The findings of the study are analysed and discussed in chapter 4.

CHAPTER 4 – FINDINGS AND ANALYSIS

4.1 Introduction

This chapter provides an overview and analysis of the findings related to the research questions. The data was collected by means of a questionnaire administered to seven students and one lecturer in the module Management Information Systems in Education. The aim of the evaluation was to obtain feedback from the students and the lecturer about the online module and thus to obtain answers to the research questions.

The major research question explored in this study was the following:

What are the pedagogical and practical issues that have to be addressed when teaching with Learning Management System (LMS) in the module Management Information Systems in Education?

To ascertain the pedagogical and practical issues when implementing an online master's module via *Moodle* at the FacEd, several research sub-questions were derived from the central question, namely:

1. To what extent are design features in *Moodle* appropriate for the process of learning in the module Management Information Systems in Education?
2. Is *Moodle* really as constructionist as it claims for the purposes of the online module Management Information Systems in Education?
3. How does *Moodle* support competency-based education in the context of the module Management Information Systems in Education?
4. How does *Moodle* help us accommodate a more dynamic and complex society to develop more flexible practitioners?
5. What changes should we make in the design of the online module Management Information Systems in Education using *Moodle* in order to realize an effective learning process?

The findings of the evaluation questionnaires are analyzed and discussed below according to the adapted Cronjé (2006) four quadrants model of Injection, Construction, Immersion and Integration, which was discussed in chapter 2:

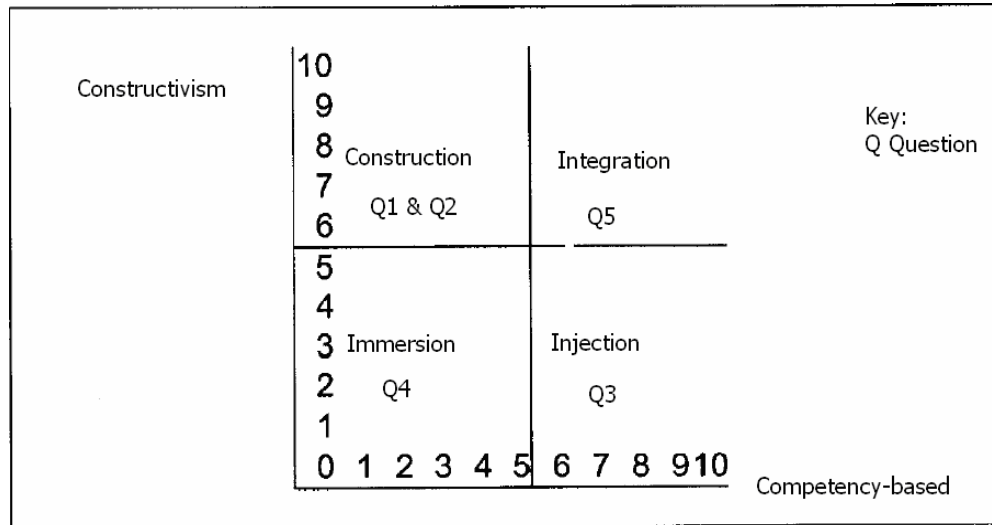


Figure 4.1: Evaluation questionnaire plotted on the adapted Cronjé (2006) model

Figure 4.1 shows how the answers to the five research sub-questions were plotted in the four quadrants, namely Injection, Construction, Immersion and Integration.

In order to obtain answers to the central research question and the research sub-questions, evaluation questionnaires were addressed to the students and the lecturer, as discussed in chapter 3. The student evaluation questionnaire was composed of 28 open-ended questions (see appendix 5), while the lecturer evaluation questionnaire comprised 11 open-ended questions (see appendix 4). Different clusters of questions can be distinguished, each related to one of the research sub-questions.

In the following paragraphs the findings regarding the research sub-questions are discussed and analyzed, taking into account Injection, Construction, Immersion, and Integration elements of teaching and learning, as shown in Figure 4.1. In presenting and examining the findings of this study, pseudonyms are used for the participants, as shown in Table 4.1, in order to protect their anonymity.

Table 4.1: Participants' pseudonyms

Participants	Pseudonyms				
Students	A	B	C	D	E
Lecturer	Lecturer of the module				

4.2 The construction quadrant and research sub-question 1

The first research sub-question explored was:

To what extent are design features in *Moodle* appropriate for the process of learning in the module Management Information Systems in Education?

This research sub-question was answered in the construction quadrant, by means of a questionnaire with open-ended questions. Two questions related to this research sub-question were posed to the seven students (see appendix 5) who followed the module, and to the lecturer of the module (see appendix 4). However of the seven students, only five returned the completed questionnaire.

Students A, B, C, D and E pointed out that features of *Moodle* such as forum, discussion, assignment, chat, choice, dialogue, journal, quiz, resource (content managing), survey, workshop, grade, and help are important and effective communication tools to be considered in future directions of the design, because they promote interpersonal communication. This answer is supported by the lecturer who stressed that these communication tools are in fact very important tools to be used for the process of teaching and learning.

Communication tools such as forum, discussion, chat, dialogue and workshop promote interaction among the users (e.g. the discussion tool allows interaction between students, as well as between students and lecturer or vice-versa). Such interactive tasks fall into the construction quadrant of the adapted Cronjé model (2006) shown in the Figure 4.1, because students and the lecturer were expected to chat, think critically, and construct meanings in order to make the discussion more constructive, interesting and meaningful to others. This agrees with the literature which says that the epistemological positions privilege the individual development of

meaning through construction and sharing of texts and other social artifacts (Ernest, 1995; Gergen, 1995; Papert, 1991, quoted by Dougiamas & Taylor, 2002, p.3).

The students and the lecturer argued that not all of these features were used; only assignment, resource, grades, and help tools were used during the implementation phase, although they all affirmed that they would like to make use of more tools offered in *Moodle*. This spirit of positive insight shown by both students and the lecturer agrees with Papert's (1993) viewpoint which states that people do best by discovering for themselves the specific knowledge they need. On the contrary, Reigeluth (1996) quoted by Alessi and Trollip (2001), argues that the pure discovery environments of the 1950s and 1960s which present constructivist thinking, emphasize guided or even structured discovery episodes, with students and lecturers being partners in the inquiry experience.

The best answer to this question was from student A who said "these tools are important in such a way that they promote interpersonal communication; they can promote more investigation in each student by making a wide use of them; when well used they help in time management; students can exchange information with lecturer as well as between themselves; the lecturer can use these tools to give feedback to students. For instance our lecturer gave us different topics to investigate and then to be discussed in group, the task allowed each student to navigate through the Internet to search relevant articles or information regarding to such topic". This is a typical example that can be found in the construction quadrant where students are faced with a problem to solve (i.e. a topic to be investigated), usually involving finding some solutions (e.g. searching for relevant articles and books related to the topic, through the Internet and the library), and then organizing, analyzing and summarizing the information in order to produce a critical and meaningful document (Cronjé, 2006). This agrees also with Alessi and Trollip (2001) who argue that construction requires students negotiating a goal, making plans, doing research, creating materials, evaluating and revising them.

Student B was of the opinion that dialogue will be a useful tool for future communication; the use of a journal in future designs would enable students to have more chances to obtain articles or diversified information; the assignment tool is

useful for uploading assignments; the resource tool is also very useful. The point of using the resource tool in *Moodle* was supported by student D who affirmed that it helped him to do individual and collaborative tasks without having to make an appeal to the lecturer. Furthermore, student E was of the opinion that she could have obtained all the materials and resources such as articles, the lesson plan and others by means of resource tool, if she had used it.

The strongest answer was given by student C who responded that these tools require an intervention and direct involvement of users (students and lecturer) in order to gain abilities or skills; they help students to build and construct their own knowledge as they have to do all the tasks given by the lecturer using the different tools of the *Moodle*; they help to open the minds of the students; they require a great deal of dedication for both students and lecturer; they help to develop competencies of information and communication management and problem solving for both students and lecturer. This was supported by the lecturer who argued that in general these tools enhance interaction and improve communication between students as well as between the lecturer and students; they promote teamwork and group work. For example, the help function can encourage students to learn to solve their own problems; the forum tool stimulates thinking and discussion about a topic; the assignment tool uploads assignments (preferably authentic tasks about a real, existing topic) which show whether students are able to understand and apply what they have learned; the journal is useful; the effectiveness of the quiz tool depends on the type of questions (very often quizzes are too simple). These comments agree with Jensen (2004) who used *Moodle* for a variety of different types of online training.

In general, I conclude that *Moodle* has many features expected from an e-learning platform including forums, resources, quiz, assignment, chat, choice, survey, workshop, journal, grades, and help. *Moodle* provides important and powerful communication tools to be considered in future directions of the design, which can improve and enhance the process of teaching and learning. Although many of the tools were not used, assignment, resource, grades, and help tools were effective. Jensen (2004) found that *Moodle* allows anyone to easily upload and add any file as a course resource, or link to other websites, for students to access these files or websites;

it allows courses to be improved with learning materials produced in MS Word, PowerPoint, Excel, Flash, or virtually any other software program.

It is imperative to stress that although the real construction which was anticipated by means of the discussion or chat tools in *Moodle* did not take place, it would be higher in constructivist elements (Cronjé, 2006) if students and their lecturer had used these tools and features more extensively.

In the next section, the findings related to *Moodle* as a constructionist environment are discussed.

4.3 The construction quadrant and research sub-question 2

The second sub-question explored was:

Is *Moodle* really as constructionist as it claims for the purposes of the online module Management Information Systems in Education?

This research sub-question was answered in the construction quadrant. Six open-ended questions were posed in the questionnaire to the seven (7) students (see appendix 5), one open-ended question was posed to the lecturer (see appendix 4), and observation on *Moodle* was conducted. Only five students returned the questionnaire. Constructionist aspects such as group discussions, group interaction, contributions to group discussions, integration of the assignments in *Moodle*, opinions about workload, and instructions for the assignments were investigated. In the following paragraphs these issues are described in turn, in more detail.

Group discussions:

According to my observations on the *Moodle* site, three group discussions were set up during the first lecture. The groups were composed of two (2) to three (3) members. The following figure shows how the seven student groups were composed:

Trabalhos da 2ª semana de aulas (22/05 a 26/05/2006)

Pesquisar, na internet e nas bibliotecas, informação sobre os temas abaixo refereridos, para cada grupo:
 - Produzir um ensaio de 7 a 10 páginas no máximo;
 - Elaborar uma apresentação em "power point" para ser apresentado nas aulas da 3ª semana.

Grupo 1 (Albertina Manhendje e Romao Sissoura)
Tema: Desenvolvimento de conteúdos na forma digital;

Grupo 2 (Amina Issa e Pedro Bassopa)
Tema: Informatização das escolas;

Grupo 3 (António Matombe, Emelina Khossa e Guilhermina Novela)
Tema: Análise e concepção de sistemas de informação educacional;

O seguinte trabalho deve ser efectuado pelos grupos, e entregue até ao fim da segunda semana de aulas **26/05/2006**.

Available from: Monday, 22 May 2006, 20:10
Data de entrega: Friday, 26 May 2006, 20:10

Figure 4.2: Screen with the composed groups

Figure 4.2 shows the different topics or themes assigned to each of the three groups, namely:

- Digital development of content;
- Computerized school information;
- Analysis and conception of educational information systems.

This arrangement was confirmed by each of the students A, B, C, D, and E, who said that at the beginning of the class, group work was organized by the lecturer, by giving each group a different topic to be investigated and discussed. They also mentioned that in the groups each individual had the responsibility of finding information related to the topic through the materials uploaded into *Moodle*, through the Internet, and through resources in the library of the Faculty of Education. The figure below shows the resources uploaded into *Moodle*.

Neste directório podem encontrar algum material da disciplina, tais como apresentações feitas nas aulas, etc....

Nome(s)	Tamanho	Modificado
 AULA_12.ppt	396.5Kb	20 May 2006, 12:13
 Bibliografia.doc	20Kb	20 May 2006, 09:00
 backupdata	0 bytes	23 May 2006, 11:35
 guiaAccess.pdf	499.9Kb	16 May 2006, 14:07

Figure 4.3: Resources uploaded into *Moodle*

Students A, B, C, D and E stressed that the group discussions were positively encouraged by the lecturer once he had guided them on how to find additional material beside that which was in *Moodle*. The figure below shows the lecturer's message encouraging student participation.

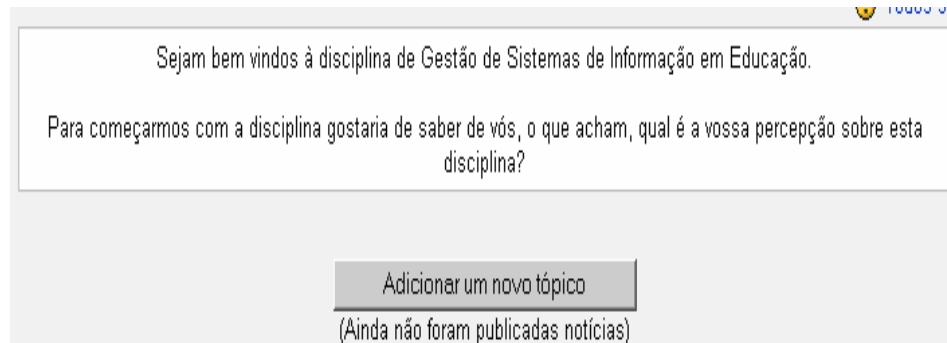


Figure 4.4: Forum (lecturer's message encouraging participation)

The message shown in the Figure 4.4 means the following:

“Welcome to the module Management Information Systems in Education.

In order to begin with the module, I would like to know from you:

What do you think, and what are your perceptions about this module?”

The students pointed out that during the group work, each individual had to bring what they had investigated about the topic in order to be discussed among the group; they had to produce the final document of seven to ten pages, and then make a presentation in PowerPoint to be presented in the classroom. Student C affirmed that although the discussion took place during face-to-face instruction, all the students seemed very positive about their topics of discussion and the fact that they had to work collaboratively. This was supported by students A, B, and D who expected that working collaboratively on their topics would make problem solving easier and the presentations would probably be of better quality than if it had been individual work. This is supported by the literature which describes constructivist theory as emphasizing that students actively construct understanding, that new learning depends on present understanding, that learning is facilitated by social interaction, and that meaningful learning occurs within authentic learning tasks (Gouws, 2002). Dougiamas (1998) cited by Berggren (2006, p.9) supports the idea that in a constructivist learning environment, students are actively engaged in making meaning,

and teaching with that approach seeks what students can analyze, investigate, collaborate, share, build and generate, based on what they already know. The construction quadrant is high in constructivist elements, as seen in the adapted Cronjé (2006) model (Figure 4.1). Following this line of thinking, I argue that the group discussions were composed of various elements of learning such as investigating, collaborating, sharing and building that are paramount in the construction quadrant of teaching and learning. However, the real discussions did not take place through the online discussion tool; they took place in the face-to-face sessions.

Group interaction:

The strongest answer about group interaction was from student A who said that beside the interaction which occurred during the work group and face-to-face instruction, he personally interacted with *Moodle*. He said “*I log onto Moodle and I was able to find assignments such as new topics for the investigation and discussion which belonged to the following lesson.*” This reflects the opinion of Alessi and Trollip (2001) who claim that the web opens up an entirely different type of interaction by virtue of its communication capabilities – this is, over and above interaction between student and computer. This was supported by students B and C who said that although the real discussion did not take place through *Moodle* because it was in a learning mode blended with face-to-face instruction, the topics to be investigated and discussed were posted in *Moodle* and each student was able to log onto *Moodle* to familiarize themselves with the topic of investigation. They recognized that the learning process was basically student-centered because the lecturer posted a topic to be investigated, namely a problem to be solved by the teams. Alessi and Trollip (2001) indicate that the web can support traditional types of interaction such as question asking and answering, problem solving, simulation control, and game playing.

Students B and C explained that the topics were presented to the class to be discussed and to exchange views and receive contributions from students in other groups. Furthermore, students D and E pointed out that sometimes as they accessed *Moodle* in order to interact with some content or learning materials, they faced difficulties and different perceptions about the same content or materials. This shows that they experienced the need to interact with other students, enticing them to reach interesting discussions about the relevance of the online module. This is an example of

Duggleby's statement (2000) that in online learning, communication between students becomes practicable, and exercises and activities that involve collaboration, such as discussions, peer work and group tasks, can be incorporated into learning. Inglis (1999) quoted by Zhao (2003, p.215) points out that online learning can improve the quality of teaching and learning and the quality of services, because online delivery provides the opportunity to increase both the quantity and quality of interaction between lecturer and student, and among students. However, the students in this study indicated that during the running of the online module, not enough information was exchanged amongst students.

Contributions to group discussions:

All five students A, B, C, D and E argued that they contributed positively to group discussions. Student A affirmed that his contribution was to encourage his peers to log onto *Moodle* when they failed to log on for the first time, and he continued to do so several times when they desisted. Student B argued that he commented and contributed constructive and relevant ideas to the topics of discussion in his group, and also during the discussion on other group topics in the face-to-face sessions. This was supported by students C, D and E, who said that once the topics were given to the groups, each individual had the responsibility of searching for relevant information related to the topic, and then making a presentation to be presented and discussed in the face-to-face classroom. They also stressed that during the discussions they shared meaningful thoughts that helped each group to improve their work group.

The lecturer response about the encouragement of participation in the group discussions revealed that most group discussions were stimulated during the contact sessions. In order to encourage student participation in group discussions and group work, he allocated topics to each group discussion. Each group was evaluated and the marks counted towards the final marks of the course. The figure below shows the final assignment marks uploaded into *Moodle*.

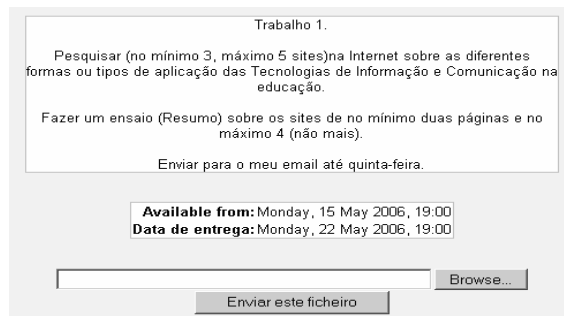
Student Sort by Lastname Sort by Firstname	Grades ?												Student Sort by Lastname Sort by Firstname
	BEM VINDOS !		Trabalho 1.		Trabalho 2.		Trabalho		Final		Total	↓↑ Stats	
	100	Raw %	100	Raw %	100	Raw %	100	Raw %	100	Raw %	500	Percent	
Bassopa, Pedro	-	0%	-	0%	-	0%	-	0%	15	15%	15	3%	Bassopa, Pedro
Issa, Amina	-	0%	-	0%	-	0%	-	0%	16	16%	16	3.2%	Issa, Amina
Khossa, Emelina	-	0%	-	0%	-	0%	-	0%	15	15%	15	3%	Khossa, Emelina
Manhenje, Albertina	-	0%	-	0%	-	0%	-	0%	19	19%	19	3.8%	Manhenje, Albertina
Matlombe, António	-	0%	-	0%	-	0%	-	0%	15	15%	15	3%	Matlombe, António
Novela, Guilermina	-	0%	-	0%	-	0%	-	0%	15	15%	15	3%	Novela, Guilermina
Sissoura, Romao	-	0%	-	0%	-	0%	-	0%	16	16%	16	3.2%	Sissoura, Romao

Figure 4.5: Final assignment marks per student

Figure 4.5 shows the marks from the final assignment which were uploaded by the seven (7) students. Although only five (5) students completed and returned the questionnaires, all of them performed positively the module.

Integration of assignments:

All five students A, B, C, D and E responded that the assignments were well integrated in *Moodle*. Each lesson had assignments to be completed, some of which were individual, and other were group assignments. The following figures show the individual assignments that were placed in *Moodle*.



Trabalho 1.

Pesquisar (no mínimo 3, máximo 5 sites) na Internet sobre as diferentes formas ou tipos de aplicação das Tecnologias de Informação e Comunicação na educação.

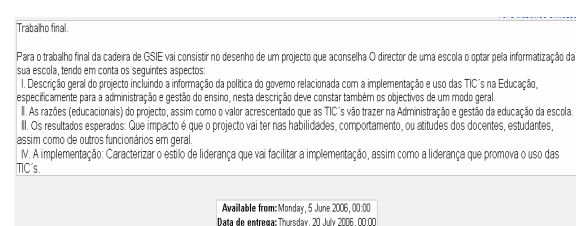
Fazer um ensaio (Resumo) sobre os sites de no mínimo duas páginas e no máximo 4 (não mais).

Enviar para o meu email até quinta-feira.

Available from: Monday, 15 May 2006, 19:00
Data de entrega: Monday, 22 May 2006, 19:00

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Figure 4.6: First individual work



Trabalho final.

Para o trabalho final da cadeira de CSIE vai consistir no desenho de um projecto que aconselha O director de uma escola a optar pela informatização da sua escola, tendo em conta os seguintes aspectos:

- Descrição geral do projecto incluindo a informação da politica do governo relacionada com a implementação e uso das TIC's na Educação, especificamente para a administração e gestão do ensino, nesta descrição deve constar também os objectivos de um modo geral.
- As razões (educacionais) do projecto, assim como o valor acrescentado que as TIC's vão trazer na Administração e gestão da educação da escola.
- Os resultados esperados: Que impacto é que o projecto vai ter nas habilidades, comportamento, ou atitudes dos docentes, estudantes, assim como de outros funcionários em geral.
- A implementação: Caracterizar o estilo de liderança que vai facilitar a implementação, assim como a liderança que promova o uso das TIC's.

Available from: Monday, 5 June 2006, 00:00
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Figure 4.7: Final examination project

In the self-assignment shown in the Figure 4.6, students were asked to:

- Search the Internet for three to five web sites related to types applications of Information and Communication Technology (ICT) in Education;
- Produce a brief document, between two and four pages;
- Send the document to the lecturer's e-mail address.

In the final examination project shown in the Figure 4.7, the students were asked to design a proposal advising the head of a school on how to implement computerization of the information in his school. The aspects to be considered in the proposal were:

- General project description including information regarding the policy for implementing ICT;
- Justification of the project, as well as the additional value that ICT would bring in the educational management and administration of the school (including for the workers in general);
- The expected outcomes (what the impact of the project would be on the abilities, behavior or attitudes of the teachers and the students, as well as on other workers in general);
- Implementation (characterize the leadership style that would facilitate the implementation of the project, as well as the leadership required to promote the use of ICT).

Student B argued that although the assignments were well integrated among the lessons in *Moodle*, some of the topics seemed unrelated to the module Management Information Systems in Education, because the module itself was too diverse. This was opposed by student A, who said the assignments were well integrated because each lesson had assignments to be done, which were related to the topic of the lesson. Student D supported this view, saying that the assignments were well integrated in *Moodle*, but he needed an entire understanding of the tools in order to make wide use of *Moodle*.

Student E said that although the assignments were well built into *Moodle*, there was no instruction on how to submit them via *Moodle*. Thus she could not learn how to submit the assignments online, although she received the generic feedback for all of them. She advised that it could have been very fruitful if she could have submitted the assignments via *Moodle*. On the contrary, student C affirmed that he could upload his assignments and he could work with *Moodle* in general, although it was his first time using the system. According to my observations in *Moodle*, I confirmed that five (5) students uploaded some of the assignments into *Moodle* and records were kept automatically by the system, as shown in the figure below:

	Albertina Manhenje	19 / 100	Cara estudante albertina,O ...	Wednesday, 12 July 2006, 18:21	Wednesday, 13 September 2006, 12:35	Atualizer ...
	Amina Issa	16 / 100	apesar de não ter ...		Wednesday, 13 September 2006, 12:43	Atualizer ...
	António Matlombe	15 / 100	Faltou enviar o trabalho ...		Wednesday, 13 September 2006, 12:44	Atualizer ...
	Emelina Khossa	15 / 100	Obrigado por ter ...	Wednesday, 12 July 2006, 18:46	Wednesday, 13 September 2006, 12:37	Atualizer ...
	Guilermína Novela	15 / 100	Obrigado por ter ...	Wednesday, 12 July 2006, 18:44	Wednesday, 13 September 2006, 12:39	Atualizer ...
	Pedro Bassopa	15 / 100	Apesar da demira ...	Wednesday, 12 July 2006, 18:50	Wednesday, 13 September 2006, 12:40	Atualizer ...
	Romao Sissoura	16 / 100	Fez um bom trabalho, ...	Wednesday, 12 July 2006, 18:22	Wednesday, 13 September 2006, 12:41	Atualizer ...

Figure: 4.8: Assignments uploaded

Workload:

Students expressed the following opinions about the workload, for example, the number of assignments and the required readings in terms of the hours allocated:

Student A stressed that more time could have been allocated for completing the assignments in particular and for the module in general. In some cases it was not possible to explore all the content considered relevant in the module, because of lack of time. There was a lot of information available in *Moodle* that could be engaged with. He mentioned that he was extremely motivated and wanted to use *Moodle*, but in the circumstances he did not have enough time.

Student D supported this view saying that the load of tasks was very heavy for him because *Moodle* was new to him and he was not familiar with the system. Furthermore, he did not have enough time to use it fully, because he has a full-time job and is a part-time student. Student B said that at the beginning, it seemed that the time was short and there was a lot of work to be done, but actually the time, load of assignments, and articles to be read were well balanced. Students C and E supported this view, saying that the load of work and deadline for submission of assignments were all well balanced. Although there was a slight problem with the final project, it was negotiated with the lecturer, who extended the deadline for submission.

Instructions for the assignments:

Students C and E were satisfied that the instructions for the assignments were very clear. They had been into *Moodle* before the lessons began, where there were clear explanations about what to do in each lesson, and the materials to be used for each

assignment were also available on *Moodle*. The following figure shows one of the group assignments with the respective instructions:

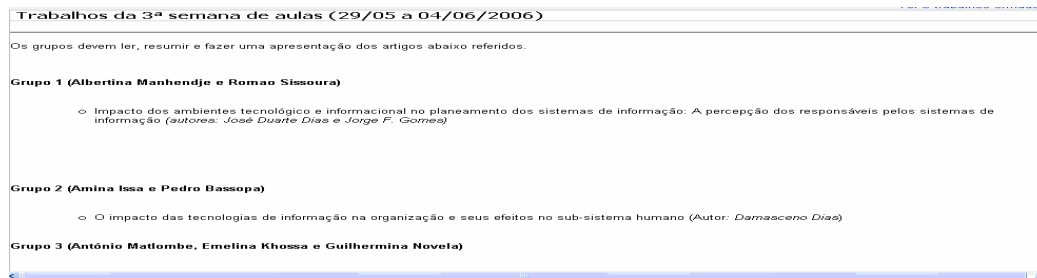


Figure 4.9: Group assignment for third week of lectures

In the group assignment shown in Figure 4.9, each group of students was asked to read, summarize, and produce a presentation in MS PowerPoint about the following articles:

- **Group 1:** Impact of technological and informational environments in the planning of information systems: The perception of the ones responsible for information systems. (Authors: José Duart Dias & Jorge F. Gomes).
- **Group 2:** The impact of information technologies on the organization and its effect in human subsystems. (Author: Damasceno Dias).
- **Group 3:** The evaluation of information systems. (Author: Conceição de Matos).

The students again said that of all the instructions available in the *Moodle*, the only one they could not find was about how to deliver or upload assignments to the lecturer through *Moodle*. Students A and B said that the assignment instructions were very clear because they did not face any problems at all; however they missed knowing how to deal with the tools of *Moodle* because it was their first time using it and they needed very detailed and clear instructions on how to do so. They added that such instructions could have advantaged them in terms of delivering and receiving assignments, and getting feedback about them from the instructor. Student D contradicted this, saying that for him there was no doubt about how to log into *Moodle*, access information and upload assignments. He defended the point, indicating that the lecturer trained them on how to use *Moodle* during the first lesson. But later, when some of them tried to use *Moodle*, they realized that they did not understand how to manage it.

In general, the findings presented above support the claim in the literature that a well-established fact of teaching online, is that it takes a lot more time and effort than traditional classroom instruction or face-to-face instruction (Kearsley & Blomeyer, 2004). These authors point out that some of the considerations associated with this factor include providing student feedback; keeping up with technology which requires a lot of time and effort; and learning strategies to manage one's workload. As a result, teachers may want more compensation for online teaching.

In the next section, the findings related to competency-based education are discussed.

4.4 The injection quadrant and research sub-question 3

The third sub-question explored was:

How does *Moodle* support competency-based education in the context of the module Management Information Systems in Education?

The answer for this research sub-question was obtained in the injection quadrant. Twelve (12) open-ended questions were posed to the students (see appendix 5) and three (3) to the lecturer (see appendix 4). Competency-based aspects such as the benefits of *Moodle*, competencies, timetable efficiency, materials/resources posted on *Moodle*, interaction with classmates, contribution to the discussions in general, and additional modes of communication, were posed. A diversity of answers was given by the students and the lecturer, which are discussed below.

Benefits of *Moodle*

There were several benefits of using *Moodle* in the module Management Information Systems in Education, which supported competency-based education. The strongest answers were from students A, B and D who gave evidence that learning through *Moodle* saved time by not having to travel to the University in order to submit assignments or meet with the lecturer. However, sometimes the network connection was down. This was not a big problem for one student, because he contacted the lecturer by cell phone to find out why *Moodle* was not working at that time. The lecturer solved it immediately by allowing the student to email the assignment directly to him.

The lecturer supported the benefit of time saving, by saying that more time could be spent on the course itself, without students have to waste time traveling from the workplace to the university and back to their homes. Although students still had to travel for face-to-face sessions, those who were absent could read and download all the information they needed. They could also look back at the information provided in the weeks before, as well as having access to many other resources. Blended learning stimulates student-centered learning: more self-study, problem solving, use of higher order thinking skills; less memorizing and less repeating what the lecturer says.

Students C and E argued that *Moodle* is very practical because it allowed for the submission of assignments; it allowed them to focus on their field of investigation; it allowed them total control of their own work or tasks in the absence of the lecturer; it enhanced interaction and information exchange amongst students and between students and the lecturer; it enabled timely accessing of the materials required for assignments. This was supported by the lecturer, who said that the biggest benefit was the improved didactic quality of the course. Students are less dependent on information provided by the lecturer; they can search and explore the information they find themselves; they can apply what they read by doing tasks; and the lecturer can focus more on the process of learning. He continued to say that the course becomes more flexible. Students can work on the module at different places (home, workplace, computer laboratory) and at different times (morning, at night, etc). This is very convenient for part-time students who also have full-time jobs.

Competencies developed through *Moodle*

Students A, B, C and E said that *Moodle* aroused and created curiosity of learning more and more every time they accessed it. Students and the lecturer pointed out that using *Moodle* helped them to develop competencies that allow them to be professional in their workplaces. For example, during the learning experiences, *Moodle* provided the opportunity to improve their technology skills. They said that they gained the advantage of the skills of using a system such as *Moodle* for the first time in their life, and that they really appreciated improving their time management skills through using *Moodle*. This was supported by student D, who said that learning with *Moodle* helped a lot in developing different skills such as thinking analytically, solving problems, etc.

Student D is at present negotiating with the Information Technology technician at his workplace to use *Moodle* to make information available about what is happening internally. However, he said that in order to explore such an idea further, he would need to know much more about the tools. So far everything he experienced on *Moodle* was positive.

The responses given by the lecturer revealed that the use of ICT helped the students to develop communication competencies that can be used in their professional careers, as well as in other aspects of society and their lifestyles. Using *Moodle* stimulated the lecturer to think more about the learning process of the students and how as a lecturer, he can stimulate that process. One of the biggest problems he experiences in teaching, is that students find it difficult to analyze, to reflect, and to think in a more abstract manner, and that as a lecturer, it is difficult to promote these competencies. Using *Moodle* made him more aware of this challenge, because he gave personal feedback to the students' contributions.

Efficiency of the timetable

Since competency-based education is related to the efficiency of the timetable set up for an online module in terms of time allocated for the completion of individual and collaborative assignments, the final project and lesson content, it was imperative to ask the students about this aspect. Of the five (5) respondents, three (3) responded negatively and two (2) positively. Students B, C and E responded that the timetable was not efficient because the time set to complete the assignments was insufficient, especially for the collaborative tasks. They felt that the group members could have participated more and or could have learnt much more, but there was not enough time. Since collaboration requires participation of all group members in the discussions, it requires time. Regarding the final project, the time allocated was sufficient and they were able to finish on time. On the contrary, students A and D said that the time allocated for the completion of the tasks, either individual or collaborative, was acceptable.

Material and resources posted on *Moodle*

The figures below show materials and resources posted on *Moodle*.





Nome(s)	Tamanho	Modificado
 AULA_12.ppt	396.5Kb	20 May 2006, 12:13
 Bibliografia.doc	20Kb	20 May 2006, 09:00
 backupdata	0 bytes	23 May 2006, 11:35
 guiaAccess.pdf	499.9Kb	16 May 2006, 14:07

Figure 4.10: Materials on *Moodle*

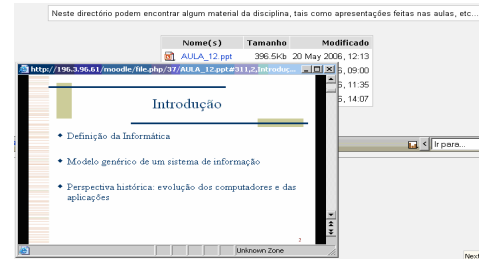


Figure 4.11: Sample lesson

Student B said that the material and resources posted in *Moodle* were not sufficient, but that the lecturer provided the necessary minimum. He commented that a module like this requires a lot of materials to learn from, not only during the course, but also to be able to apply them during one's professional career. On the other hand, students A, C, D, and E said that the materials were sufficient and were valuable, although because of lack of time they could not learn how to access some of them. They said that the materials and resources available provided interesting information that motivated them to learn and helped them to complete their assignments and the final project. Moreover, they requested more resources to allow them to acquire additional skills or abilities such as the use of the chat, journal and other tools in *Moodle*.

Interaction with classmates

The students described in a several ways how they experienced interaction with their classmates. Students A, B, C and D said that it was a very interesting experience for them – they had many good discussions together, although sometimes they had to deal with issues outside of their domain. They stressed that it is important to note that the information discussed in the groups was searched through the Internet. Student E pointed out the lack of time and the fact that being part-time students with full-time jobs was one of the biggest constraints in the interaction between students and the lecturer.

The lecturer responded that he could interact with his students at any time, at any place, even when he was abroad. Online interaction with students was found to be time consuming for the lecturer, even though he stated it was good because he could have personal contact with everybody. One of the reasons for it being time consuming was attributed to the fact that as students asked more questions, the lecturer was

expected to give feedback to maintain the interaction. Group interaction was easier to organize during face-to-face instruction. The lecturer found that besides the discussion that took place in the collaborative group tasks, all students contributed to the general discussions. Several reasons were given for stimulating student contributions, such as to enrich the information provided by colleagues; to achieve excellent marks; to learn from each other; and to consolidate their competencies acquired in communication, writing skills and view points.

Alternatives modes of communication

Students mentioned several reasons for using e-mail, face-to-face instruction and cell phones as alternatives and suitable modes of communication during the running of the module Management Information Systems in Education. Student A said that he made use of e-mail and face-to-face modes in order to communicate with fellow students and the lecturer. He also said that he used e-mail as an alternative during the times that *Moodle* was off-line, in order to get explanations of some tasks which he could not understand and to exchange opinions or views with his colleagues as well as the lecturer. The face-to-face mode of communication was basically used during the contact sessions to obtain instructions from the lecturer and to interact during group discussions.

These views were supported by students B, C, D and E who said that they used e-mail, face-to-face and cell phones as alternatives modes to communicate with their classmates and the lecturer. When *Moodle* was off-line, they turned to e-mail in order to deliver assignments and to get feedback from the lecturer. They used cell phones to expose problems found with *Moodle* like breakdowns or slowing down of the *Moodle* connection. They used face-to-face communication to receive instructions from the lecturer, and to interact with classmates and the lecturer.

In answering research sub-question 3, *Moodle* in the module Management Information Systems in Education, supported competency-based education in different ways: it saved time for the students because they could submit assignments and interact with the lecturer without having to travel to the University; it had benefits such as more self-study, problem solving, use of higher order thinking skills, and less memorizing. The course becomes more flexible because students can work at the

module at different places and at different times, which is particularly convenient for part-time students who have a full-job. The use of *Moodle* helped students to develop competencies like working in teams, thinking analytically, improving their writing skills, and solving problems, all of which can promote professionalism in their workplaces. These findings agree with Westera (2001) who states that competencies cover a broad range of higher-order skills and behaviors which represent the ability to cope with complex, unpredictable situations, including gaining knowledge, skills, attitudes, metacognition and strategic thinking, which presupposes intentional decision making.

In the curriculum of the Faculty of Education of the Eduardo Mondlane University (2001), ICT and the use of multimedia is one of the main competencies that students should acquire. *Moodle* helped students to develop and improve these ICT competencies which can be applied over an unrestricted period of time (lifelong learning). Kirschner *et al.* (2002) claim that approaches to competency-based learning share a constructivist view of learning (i.e. *Moodle*). This agrees with the adapted Cronjé (2006) model (Figure 4.1) which shows that the injection quadrant is high in competency-based elements, as reported in this section of this study.

In the following section, the findings related to the development of flexible practitioners in a dynamic and complex society are discussed.

4.5 Immersion quadrant and research sub-question 4

The fourth research sub-question explored was:

How does *Moodle* help us accommodate a more dynamic and complex society to develop more flexible practitioners?

This research sub-question was answered in the immersion quadrant. Four (4) open-ended questions were posed to the students (see appendix 5) and one (1) open-ended question to the lecturer (see appendix 4). In this question I considered issues related to personal skills and knowledge acquired by students and the lecturer as a result of using the online module developed and delivered through *Moodle*.

Students A and D said that learning via *Moodle* enabled them to be more flexible because it allowed them to learn to manage and integrate all the available information and to take total control of the leaning process. It allowed them to be more creative, to think critically, and to solve problems assigned by the lecturer. Student D pointed out that he acquired skills of searching for information on the Internet, downloading materials onto *Moodle*, and developing critical thinking through the readings. He also improved his writing skills by using MS Word and making MS PowerPoint presentations of the assignments provided through *Moodle*. Moreover, he developed skills in consulting the resources posted in *Moodle*.

Student C said that he acquired abilities and skills on logging into *Moodle* and using it to control his activities schedule and the deadlines for submission of assignments. He also mentioned that he had never before used a system like this to communicate and exchange his thoughts about academic issues, and he had never realized that information for the students can be provided in such an easy way. Student B said that the advantage he gained by using *Moodle* was the fact that he used a variety of different tools to communicate with classmates and the lecturer at any time, from different places, which made life easier for him. On the contrary, student E pointed out that because her team work was not well organized, she did not obtain the necessary help in developing some abilities and skills, such as uploading assignments via *Moodle*. She also mentioned that because of the lack of time, most of the skills that she developed were via cell phone and e-mail.

Application of the skills and knowledge in professional life

Students A, C and D responded that they will apply the experiences achieved through the online module in their workplace, as they already work as teachers in public or private education institutions. For example, student A said that if he continues working as a lecturer at the UEM, he will explore *Moodle* widely, in order to develop it in his Faculty to supplement his lessons. Students C and D pointed out that they would like to promote the use of *Moodle* in schools with computer rooms and Internet connections, as *Moodle* can be downloaded free of charge. This suggestion was supported by student E who said that she will use the acquired knowledge and skills in her own individual work, like building her own site with relevant information. She continued by saying that in the case of team work, she will consider opinions and

contributions from others without neglecting her own opinion, since other opinions might be constructive and valuable. Student B responded that his sincere concern is that it will be very hard for him to use the knowledge acquired through the module, as up to now there is no Internet network at his workplace; thus, he is at risk of forgetting how to use his newly-acquired skills.

The lecturer said that the reasons which motivated him to use *Moodle* in his professional career were that it is free open-source software, it has a Portuguese interface, there is a manual in Portuguese and an active *Moodle* community in Brazil. Furthermore he decided to teach in a blended learning mode for various reasons, such as gaining experience in using ICT in education, greater flexibility and transparency in the planning of the module, more emphasis on active thinking (deep learning), and more opportunities for teachers to coach and monitor the learning of students.

The findings above agree with Navarro and Gallardo (2003) who claim that practitioners of every occupation must keep learning because knowledge and technology are becoming dominant social forces in today's dynamic and complex society. In general, *Moodle* allowed students to develop and improve different competencies as indicated in the above discussion (e.g. communication skills, management and integration of all the available information, own control of the leaning process, creativity, critical thinking, and problem solving). This finding agrees with Woods and Dekker (2000) who view practitioners as human beings who are the body of the work force, capable of transforming and managing technology, and dealing with organizational changes that take place in society.

Some students experienced problems due to lack of time. However, the adapted Cronjé (2006) model (Figure 4.1) indicates that this quadrant (immersion) has low elements of both constructivism and competency-based education. Therefore, I conclude that the students will acquire more experience through their professional careers. As stated by Teichler (1999), the characteristics of work organizations change under the influence of the increasing importance of knowledge in all areas of employment and work.

In the next section, the findings related to the online learning changes are discussed.

4.6 The integration quadrant and research sub-question 5

The fifth research sub-question explored was:

What changes should we make in the design of the online module Management Information Systems in Education using *Moodle* in order to realize an effective learning process?

This research sub-question was answered in the integration quadrant. Four open-ended questions were posed to students (see appendix 5) and two to the lecturer (see appendix 4). Opinions about materials, time, and problems experienced by the students were gained, as well as issues related to problems experienced by the lecturer and proposed solutions.

Student C said that although the materials were related to the module Management Information Systems in Education and were interesting, comprehensive and clear, he thought that they did not cover the topics fully. The references provided by the lecturer were not enough in order to gain a wide knowledge about the specific topics. The materials and resources (e.g. pdf files, reading list) available in *Moodle* were suitable, although they were limited to one article per topic. He also said that he did not use the chat/discussion tool because he lacked skills in using the tools in *Moodle*, and because *Moodle* was sometimes off-line when he wanted to practice in order to improve his abilities. This was supported by student B who said that the materials posted on *Moodle* were interesting, comprehensive and clear but they did not cover the content fully. So the *Moodle* environment could have been designed in order to provide more information about the module Management Information Systems in Education.

Students A, B, D and E said that sometimes they experienced problems such as logging on to *Moodle*, uploading assignments, and downloading some materials from *Moodle* because the system was too slow and sometimes off-line. They also said that although the problem of logging on to *Moodle* was sorted out by their lecturer providing an alternative, they suggested that the lecturer should always pay attention to the system in order to check whether the network is on or not, so as to avoid delays

in the submission of tasks from students. They continued by saying that there was insufficient time to familiarize themselves with all the tools available in *Moodle*. They suggested that more time should be allocated in terms of the timetable, and that tutorials about how to use *Moodle* should be available for the students in printed version as well as in *Moodle*.

The lecturer response revealed that discussions via *Moodle* were not used because the students lacked sufficient skills and abilities to deal with *Moodle*. The lecturer suggested therefore that students should receive a short training course or workshop (one day) on how to use *Moodle* before using the system. A longer training session would not be necessary, because it would be better for them to continue learning while doing. He agreed that many changes are required in the next version of the online module. The students are not used to the new student-centered method of teaching; thus he suggested promoting the new approach of teaching and learning by providing training and information on how to use it. The literature that points out that this new student-centered approach can include drawing out student opinions, knowledge, and problem-solving abilities; facilitating student interaction; and enabling students to learn and develop by self-discovery and personal insight (Kelly, 2004).

The lecturer confirmed that the biggest problem, however, which is difficult to solve, was the hosting of the system. *Moodle* was installed on a server outside the Faculty – at the Centre of Informatics (CIUEM). Contacts with the technicians at the center are not always easy. Often the lecturer had no access to *Moodle* and it was difficult to have the server reset, since there was no technician at the Center of Informatics to connect the server. Sometimes the lecturer had to go to the Center of Informatics specifically to connect the server; at other times he had to call the technician in order to connect the server. These problems affected the students because they could not log into *Moodle*. The lecturer suggested that it would be better for the Faculty to host the Learning Management System (LMS) (*Moodle*) on its own server. Furthermore, the Eduardo Mondlane University (UEM) needs to improve the Internet connections and the network speed.

In general the implementation of the module Management Information Systems in Education via *Moodle* showed that the students and the lecturer experienced discomfort and irritation with several problems they faced. Therefore, I would say that working with *Moodle* requires a lot of support for both students and lecturers. Kearsley and Blomeyer (2004) suggest that this support may include technical assistance; administrative assistance; instructional design assistance; counseling; and help for special needs. Moreover, these authors emphasize that while the lecturer and instructional designer should not be expected to provide these different types of support, they are usually the first contact that students make when they experience problems. As Cronjé (2006) points out in his original model, integration is a synergetic combination of elements of instructivism (competency-based education) and constructivism, both at high levels and in appropriate conditions, which implies that improvements to the online learning module should be made in the next design.

The next section synthesizes the findings of this study.

4.7 Synthesis

This section is a synthesis of the findings which answered the research questions that were investigated in this study.

Moodle includes features such as forum, discussion, assignment, chat, choice, dialogue, journal, quiz, resource, survey, workshop, grade and help. Of these features, only the assignment, resource, grades, and help tools were used in this study. Although the real construction which was expected to happen through the discussion or chat tool did not take place though *Moodle*, constructivist elements (Cronjé, 2006) would have been higher if students and their lecturer had used these tools. Using these tools could enhance interaction and improve communication between students as well as between the lecturer and students.

Papert (1993) stresses that constructionism is based on the theory that students will do best by finding for themselves the specific knowledge they need. Although the online discussion tool was not used in this study, discussions took place during face-to-face sessions, during which students had to work collaboratively in groups that were created by the lecturer to investigate different topics uploaded onto *Moodle*. The

materials uploaded onto *Moodle* promoted discussions among these groups. Students had to search for other supportive material through the Internet and the library of the FacEd and discuss it within their groups. During the presentation of the topics in the classroom, students shared interesting discussions and meaningful thoughts that helped each group to improve their work group. As Cronjé (2006) stresses, the construction quadrant is high in constructivism elements. The group discussions for example, were composed of various elements of learning such as investigating, collaborating, sharing, and building that are found in the construction quadrant. Thus the real discussion did not take place through the discussion tool; it took place in face-to-face sessions.

Moodle supported competency-based education in different ways: it saved time for the students because they could submit assignments and interact with the lecturer without having to travel to the University; it offered benefits in the form of more self-study, problem solving, the use of higher order thinking skills, and less memorizing. The course was flexible because students could work on the module at different places and at different times. This is very convenient for part-time students who work full-time. Using *Moodle* in the module helped students to develop competencies like working in teams, thinking analytically, improving their writing skills, and solving problems, all of which enable them to be more professional in their workplaces.

Moodle allowed students to become flexible practitioners by learning to manage and integrate all the available information, to take total control of their learning process, to be more creative, to think critically, to solve problems assigned by their lecturer, to develop skills or abilities, to improve their writing skills by using MS Word, and to create MS PowerPoint presentations of the assignments. Although some students faced problems due to lack of time, Cronjé (2006) indicates that the immersion quadrant has low elements of both constructivism and competency-based education. It can be assumed that students will acquire more experience through their professional careers.

In general, the use of the online course designed and delivered through *Moodle* is recommended. As Cronjé (2006) points out in his original model, integration is a synergetic combination of elements of instructivism (competency-based education)

and constructivism, both at high levels and in appropriate conditions, which implies that improvements to the online learning module should be made in the next design.

In the next chapter, conclusions and recommendations are presented.

CHAPTER 5 – CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter synthesizes the findings from the data that was collected by means of an evaluation questionnaire composed of open-ended questions, and observations in *Moodle*, and focuses on answers to the central research question. A summary of the findings and discussion of what can be learnt from this study are also presented. The chapter concludes with recommendations.

5.2 Summary of the study

The teaching strategy that has been used for centuries is lecturing, which means an expert telling a group of students what they should know (Stephenson, 2001). Nowadays technology makes it possible for learners and educators to break free of the more traditional educational models. Universities and schools are supplementing conventional instruction with Learning Management Systems (LMS) – software designed to deliver online education.

The purpose of this study was to develop, implement and evaluate an online master's module using *Moodle* software. The pedagogical and practical issues that have to be addressed when teaching with a Learning Management System (LMS) were explored during the evaluation process of the online learning event. The reason for developing an online master's module using the LMS – *Moodle* for the Faculty of Education at UEM in Mozambique, was to improve the quality of teacher training in the Faculty and to encourage lecturers to embrace e-learning development as part of their teaching and learning strategy. This is because most lecturers in the Faculty are currently using only classroom-based instruction.

This study focused on the following research question:

What are the pedagogical and practical issues that have to be addressed when teaching with a Learning Management System (LMS) in the module Management Information Systems in Education?

In order to find an answer to the central research question, various subsidiary research questions were posed:

1. To what extent are design features in *Moodle* appropriate for the process of learning in the module Management Information Systems in Education?
2. Is *Moodle* really as constructionist as it claims for the purposes of the online module Management Information Systems in Education?
3. How does *Moodle* support competency-based education?
4. How does *Moodle* help us accommodate a more dynamic and complex society to develop more flexible practitioners?
5. What changes should we make in the design of the online module Management Information Systems in Education using *Moodle* in order to realize an effective learning process?

Chapter 2 explored the literature pertaining to the various research sub-questions. It was necessary to conduct a design experiment at the Faculty of Education of the Eduardo Mondlane University in Mozambique in order to establish what really happened during the delivery of the online module Management Information Systems in Education. The literature review did not identify a new set of skills and knowledge required for the online module Management Information Systems in Education. From the information retrieved, a conceptual framework was established based on the relationship between two theories adapted from Cronjé (2006): constructivism and competency-based education. Cronjé's (2006) model of teaching and learning was the fundamental construct used to build the conceptual framework which I used for analyzing the findings of this study.

Chapter 3 presented the detailed research design, which was undertaken in the form of a design experiment adapted from Reeves' (2000) model, because this study employed the design, implementation and evaluation of an online master's module called Management Information Systems in Education. The design experiment was built using *Moodle* software and followed four steps of the adapted Reeves model which are analysis of the practical problem, development and implementation, evaluation, and reflection. The building of the module took approximately three months of part-time work; the implementation took four weeks and ran by means of blended learning with face-to-face instruction; and data collection took approximately two weeks. The instrument used for data collection was a questionnaire with open-ended questions and observations within *Moodle*.

Chapter 4 presented and analyzed the findings of the study, and was designed to arrive at the answers to the research sub-questions, according to the four quadrants (Figure 4.1). Collectively, the answers contributed to answering the central research question.

5.3 Discussion

This section discusses the benefits of this study. Methodological, substantive and scientific reflections are presented.

Methodological reflection

The study was based on a design experiment approach. The experiment was built using *Moodle* software and followed the four phases of Reeves' (2000) adapted model. Data were analyzed in accordance with the conceptual framework based on Cronjé's (2006) adapted model of the four quadrants of teaching and learning. Although both qualitative and quantitative methods were planned for this study, only the first method was used because the target population was very small. *Moodle* did not work as expected because of breakdowns and slow Internet connections. Although *Moodle* was being used at the Faculty of Education, it was installed at the Informatics Centre of Eduardo Mondlane University (CIUEM), which made the administration of *Moodle* very difficult. The limited technical support via CIUEM was not anticipated. These were the biggest problems that contributed to the malfunctioning of *Moodle* and consequently, students did not experience *Moodle* as it was intended. The use of

only one instrument for data collection (a questionnaire with open-ended questions) was not efficient because it did not allow generalization of the results. Although the study was faced with numerous problems, I managed to collect important information that helped to achieve the desired results.

Substantive reflection

Although *Moodle* was not exactly as constructionist as it claims, for the purpose of this study, it was concluded that if the discussion or chat tools had been used during the online module Management Information Systems in Education by students and the lecturer, it could have been more constructionist. The discussion tool would have allowed the construction of knowledge and the development of critical thinking. This is in accordance with the findings of Dougiamas (1998) quoted by Berggren (2006, p.9) who explains that in a constructivist perspective, learners are viewed as actively engaged in making meaning, and teaching with that approach seeks what students can analyze, investigate, collaborate, share, build and generate based on what they already know, rather than what facts, skills and processes they can parrot.

Moodle helped students to develop communication competencies that can be used in their professional careers as well as in other aspects of society and their lifestyles. It promoted more self-study, problem solving, the use of higher order thinking skills, and less memorizing. Learners will be able to apply these acquired competencies, skills and attitudes in a variety of situations (transfer) and over an unrestricted period of time (lifelong learning) (Van Merriënboer, 1999).

Scientific reflection

Scientific reflection focuses on the contribution of this research study to the scientific body of knowledge in terms of process and methodology.

In future studies, the use of the discussion tool must not be neglected, because it is one of the most important parameters for promoting communication and interaction between students as well as between students and the lecturer, thus making *Moodle* constructivist and developing various competencies for students. *Moodle* as the platform for the design, implementation and evaluation of online master's modules at the Faculty of Education, enhances innovation and will help other developers in future.

I also believe that although *Moodle* was not as successful as expected, it provided an incentive for lecturers to begin with e-learning as a supplementary mode of teaching and to enhance their competencies in ICT.

5.4 Conclusions

This section provides the answers to each of the research sub-questions which were designed to answer to the central research question of this study.

5.4.1 To what extent are design features in *Moodle* appropriate for the process of learning in the module Management Information Systems in Education?

The *Moodle* module included the following design features: forum, discussion, assignment, chat, choice, dialogue, journal, quiz, resource, survey, workshop, grade and help. Of these features, only the assignment, resource, grades and help tools were used. Good assignments (preferably authentic tasks _ about a real existing topic) showed whether students are able to understand and apply what they had learned; from the resource tool students could download materials; grades was important for the students to be able to find out their marks; the help function stimulated students to learn to solve their own problems. In general these tools enhanced interaction; improved communication between students as well as between the lecturer and students; and promoted teamwork.

5.4.2 Is Moodle really as constructionist as it claims for the purposes of the online module Management Information Systems in Education?

Constructionism is based on the theory that students will do best by finding for themselves the specific knowledge they need (Papert, 1993). Although the discussion tool was not used, discussions took place during face-to-face sessions, during which students worked collaboratively in teams that were created by the lecturer to investigate different topics uploaded onto *Moodle*. The materials uploaded onto *Moodle* promoted discussions amongst the groups. Students had to search for other supportive material through the Internet and the library of the Faculty of Education and discuss it within their groups. During the presentation of topics in the face-to-face classroom, students shared interesting discussions and meaningful thoughts that helped each group to improve their group work. Therefore it can be concluded that for the purpose of this study, *Moodle* was not really as constructionist as it claims.

However, I believe that if the discussion and chat tools had been used consistently by the students and the lecturer, *Moodle* could have been sufficiently constructionist for the purposes of this learning environment.

5.4.3 How does *Moodle* support competency-based education?

The use of *Moodle* in the module Management Information Systems in Education supported competency-based education in different ways: *Moodle* saved time for the students because they could submit assignments and interact with the lecturer without having to travel to the University; it promoted more self-study, problem solving, the use of higher order thinking skills, and less memorizing. The course was flexible because students could work on the module at different places (home, work, computer lab) and at different times (morning, night, etc). This is very useful for part-time students who have full-jobs. Using *Moodle* in the module helped students to develop competencies which will enable them to be professional in their workplaces: *Moodle* gave them the opportunity to improve their skills in dealing with technology, and how to manage time efficiently.

5.4.4 How does *Moodle* help us accommodate a more dynamic and complex society to develop more flexible practitioners?

Knowledge and technology are becoming dominant social and business forces, which imply that practitioners in every occupation, despite a significant knowledge base, must keep learning (Navarro & Gallardo, 2003). *Moodle* allowed students to learn to manage and integrate all the available information, to take total control of their learning process, to be more creative, to think critically, to solve problems assigned by their lecturer, to develop skills and abilities (e.g. to search for information on the Internet, to download materials and files from *Moodle*), to improve their writing skills by using MS Word, and to create MS PowerPoint presentations of the assignments. Therefore it can be seen that *Moodle* as a technology platform, helps students and lecturers to be more flexible practitioners and to mould their working environment into a more dynamic and complex system that could benefit society. The skills acquired through the use of the online module can be applied in a different manner in the professional field (e.g. an informatics researcher). Therefore it can be concluded that *Moodle* helps to develop high quality professionals with different abilities and skills in ICT that can be useful in a dynamic and complex society.

5.5 Recommendations for the online module

What changes should we make in the design of the online module Management Information Systems in Education using *Moodle* in order to realize an effective learning process?

This question summarizes the changes that have to be considered in future designs of the online module using *Moodle* in order to achieve a more effective learning process.

The following aspects should be taken into account:

- In order to have a wide enough knowledge to complete the assignments, materials (e.g. pdf files, reading list) that fully cover the content must be delivered to the students by the lecturer.
- More time should be allocated in terms of the timetable and tutorials, because there was insufficient time for students to familiarize themselves with all the tools available into *Moodle*. In addition, the discussions tool in *Moodle* was not used because the students did not have enough skills and abilities to deal with *Moodle*. A short training session on how to deal with *Moodle* should be considered. The students are not used to the new student-centered method of teaching which should be promoted by providing training and information on how to use it.
- The implementation of the online module using *Moodle* should require a constant attention by the lecturer because the Internet system was often very slow or off-line. This created problems for the students to log in to *Moodle* and resulted in delays in the submission of the tasks, problems in uploading assignments and downloading some materials.
- The forum, discussion, chat, choice, dialogue, journal, quiz, survey and workshop features are important communication tools to be considered in future designs of the module Management Information Systems in Education, in order to make the use of *Moodle* more efficient and to enhance the interaction between students and/or lecturer. In addition, the use of *Moodle* should be a standard mode of teaching and become the philosophy of the Faculty and of all lecturers. That implies that the Faculty management must support and authorize the use of online software in all courses.

- *Moodle* should be integrated in to all masters' modules. It is a good strategy to supplement face-to-face instruction, in that it provides opportunities to learn more and more, at any time and at any place. Students can profit from it and it can improve the quality of teaching depending on the program; the way the *Moodle* functions are used, the feedback of the teachers; and the group discussions.

In general, the use of an online course designed and delivered through *Moodle* is recommended because it can be accessed at any time and at any place; it provides the opportunity to collaborate with others virtually; it provides the opportunity to learn more; it is an easy way to study; it is a useful educational package that can be adopted by teachers to supplement the teaching and learning process in schools; it is a way of solving many problems related to information management at work; it helps in diversifying leaning activities; and it improves communication possibilities.

5.6 Recommendations for further research

Every lecturer in the Faculty of Education at UEM who teaches modules in the master's program should be involved in further research on *Moodle*, so that they can improve and enhance their competencies in ICT and their teaching strategies. A team for managing and administering the online learning environment should be established. The use of the discussion and chat tools should be widely explored by both students and lecturers.

The central research question of this study was: What are the pedagogical and practical issues that have to be addressed when teaching with a Learning Management System (LMS) in higher education? It would be well to explore the same question again, but with a large sample and by considering both *Moodle* and face-to-face strategies of teaching and learning. A mixed methods approach should be used in order to have a wide range of information sources and to enable the use of quantitative research methods.

REFERENCES

- Adendorff, D.E. (2004). An investigation into roles and competencies of an online facilitator. PhD study. University of Pretoria.
- Alessi, S.M., & Trollip, S. R. (2001). *Multimedia for learning: Methods and Development*. (3rd Ed.). Boston: Allyn & Bacon.
- Ally, M. (2004). Foundations of educational theory for online learning (Chapter 1). In Anderson, T. & Elloumi, F. (Eds.), *Theory and Practice of Online Learning*. Athabasca University, Canada. Available online from http://www.cde.athabascau.ca/online_book
- Berggren, A. (2006). Theoretical and practical implications for ICT-supported learning communication. Master's Thesis. Uppsala University.
- Brooks, J. G., & Brooks, M. G. (1993). In *Searching of Understanding: The case for constructivist classrooms*. Alexandria, VA: ASCD Publications.
- Chavan; A. (2004). Open-Source Learning Management with Moodle, *Online LINUX JOURNAL*. Retrieved: February 14, 2006, from <http://www.linuxjournal.com/article/7817>.
- Cohen, L., Manion, L., & Morrison, K. (2000). *Research Methods in Education*. (5th Ed.). London and New York: Routledge Falmer.
- Collins, A., Joseph, D. & Bielaczyc, K. (2004). Design Research: Theoretical and Methodological Issues. *The Journal of the Learning Sciences*, 13(1), 14-24
- Cronjé, J. (2006). Paradigms Regained: Toward Integrating Objectivism and Constructivism in Instructional Design and the Learning Sciences. *Educational Technology Research and Development*, Vol. 54, No. 4, pp. 387-416.
- Cronjé, J. C. (2006). Real learning in virtual environments. Ch3, pp 34 – 41 in Martin, A. & Madigan, D. (Eds). *Digital Literacies for Learning*. London: Facet Publishing ISBN-13 978-1-85604-563-6; ISBN-10 1-85604-563-3
- Cronjé, J. C., & Burger, D. (2006). Learning from a free-access digital information Kiosk in Africa: An Objectivist-Constructivist investigation. *Aslib Proceedings: New Information Perspectives*, Vol. 58, No.3, pp.218-236.
- Doolittle, P. E., & Camp, W. G. (1999). Constructivism: The Career and Technical Education Perspective. *Journal of Vocational and Technical Education*, Vol.16, No.1, pp.1-12.
- Dougiamas, M. (2000). Improving the effectiveness of tools for Internet based education. In A. Herrmann and M. M. Kulski (Eds.), *Flexible futures in Tertiary*

Teaching. Proceedings of the 9th Annual Teaching Learning Forum, 2-4 February 2000. Perth: Curtin University of Technology. Retrieved: March, 14, 2006 from: <http://lsn.curtin.edu.au/tlf/tlf2000/dougiamas.html>

Dougiamas, M. & Taylor, P.C. (2002). Interpretative analysis of an internet-based course constructed using a new courseware tool called Moodle. Curtin University of Technology, Perth, Australia: Dougiamas & Taylor.

Duffy, T. M., & Jonassen, D. H. (1992). Constructivism: New Implications for Instructional Technology (pp.1-16). In Thomas M. Duffy & David H. Jonassen (Eds.), *Constructivism and the Technology of Instruction: a conversation*. New Jersey, London: Lawrence Erlbaum Associates, Inc.

Duffy, T.M., J. Lowyck & T. M. Welsh (1993). Designing environments for constructive learning. Berlin: Springer Verlag.

Duggleby, F. (2000). How to be an online tutor. England: The Sheffield College. Gower Publishing Limited.

FacEd/UEM (2001). Programas de Mestrado em: Educaçao em Ciências Naturais e Matemática; Desenvolvimento Curricular e Instrucional; Educação de Adultos. Maputo, Moçambique.

Fahy, P.J. (2004). Media Characteristics and Online Learning Technology. In Anderson, T. & Elloumi, F. (Eds.), *Theory and Practice of Online Learning*. Athabasca University, Canada. Available online from http://www.cde.athabascau.ca/online_book

Fosnot, C. T. (1996). Constructivism: Theory, Perspectives, and Practice. New York: Teachers College Press.

Gouws, A. (2002). Turning information into accurate and useful knowledge. In *Psychology for teaching and learning: what teachers need to know*, pp.61-75.

Jaffee, D. (2003). Virtual Transformation: Web-Based Technology and Pedagogical Change. *Teaching Sociology*, Vol.31, No.2, pp. 227-236.

Jensen, J. (2004). White Paper: Is This the Best Way to Develop, Deliver and Manage Online Training? *A discussion of lessons learned while integrating DVD video and PowerPoint lessons into a free open-source web-based management system*. Retrieved: April 14, 2006, from http://www.americatrainingpartners.com/projects/ATP/addtl_files/best_way_html/

Jolliffe, A., Ritter, J., & Stevens, D. (2001). The Online Learning Handbook: Developing and Using Web – Based Learning. London: Kogan Page.

Kearsley, G. & Blomeyer, R. (2004). Preparing K–12 Teachers to Teach Online. *Educational Technology: the magazine for managers of change in education*, Vol. 44 ISSUE 1, pp.49-55.

- Kelly, H. (2004). Enhancing Interpersonal Interaction in Online Courses. *Educational Technology: the magazine for managers of change in education*, vol. 44 ISSUE 1, pp.53-56.
- Kirschner, P. A., Vilsteren, P. van, Hummel, H., & Wigman, M. (1997). A study environment for acquiring academic and professional competence. *Studies of Higher Education*, 22(2), pp.151-171.
- Kirschner, P., Carr, C., Merriënboer, J. v., & Sloep, P. (2002). How Expert Designers Design. *Performance Improvement Quarterly*, 15(4) pp. 86-104.
- Klebl, M. (2006). Usability of a Runtime Environment for the Use of IMS Learning Design in Mixed Mode Higher Education. *Educational Technology & Society*, 9 (1), 146-157.
- Lawler III, E. E. (1994). From job-based to competency-based organizations. *Journal of Organizational Behaviour*, Vol.15, pp.3-15.
- Macdonald, J. (2001). Exploiting Online Interativity to Enhance Assignment and Feedback in Distance Education. Open University Press. Vol.16, No.2.
- Mario, M., Fry, P., Levy, L. & Chilundo, A. (2003). Information and Communication Technologies Policies and Use (Chapter 6). In *Higher Education in Mozambique: A case Study*. James Currey Publishers.
- Martinez, M. (2001). Mass Customization: Designing for Successful Learning. *International Journal of Educational Technology*, 2(2), 1-23.
- Mayer, R. E. (2001). *Multimedia Learning*. United Kingdom: Cambridge University Press.
- McDonald, R. & Horst, H. (2005). *Outcomes-based education: Theory and Practice*. Republic of South Africa: H van der Horst & R McDonald.
- McKenna, P., & Laycock, B. (2004). Constructivist or Instructivist: Pedagogical Concepts Practically Applied to a Computer Learning Environment (pp. 166-170). Annual Joint Conference Integrating Technology into Computer Science Education.
- McMillan, J. H & Schumacher, S. (2006). *Research in Education: Evidence-Based Inquiry*. (6th Ed.). Boston: Pearson Education, Inc.
- Megías, M. G. & Itmazi, J. A. (2004). *Survey: Comparison and Evaluation Studies of Learning Content Management Systems*. PhD Dissertation. University of Granada.
- Moodle (2006). Retrieved: February, 18, 2006 from (<http://Moodle.org>)
- Moodle-Wikipedia (2006). Background; Moodle Features. Retrieved: April 12, 2006, from <http://en.wikipedia.org/wiki/Moodle>

Muianga, X. J. (2003). The Implementation of a Course Management System (CMS) in the Faculty of Education, Eduardo Mondlane University. Master's Thesis. University of Twente, Netherlands.

Mutula, S., Kalusopa, T., Moahi, K., & Wamukoya, J. (2006). Design and implementation of an online information literacy module: Experience of the Department of Library and Information Studies, University of Botswana. *Online Information Review*; 30(2), 168-187.

Nag, A. (2005). Moodle: An open source learning management system, NEWS FORGE: The Online Newspaper for Linux and Open Source (February 14, 2006). Retrieved February 14, 2006, from: <http://www.newsforge.com/>

Navarro, J. R. & Gallardo, F. O. (2003). A model of strategic change: Universities and Dynamic Capabilities. *Higher Education Policy*, Vol. 16, pp. 199 – 212.

Papert, S. (1993). The children's machine: Rethinking school in the age of the computer. New York: Basic Books.

Punch, K. F. (2005). Introduction to Social Research: Quantitative and Qualitative Approaches. (2nd Ed.). Thousand Oaks: Sage Publications.

Reeves, T. C. (2000). Enhancing the worth of instructional technology research through "design experiments" and other development research strategies. Symposium on: International perspectives on instructional technology research for the 21st century, (session 41.29: New Orleans, LA, USA). Retrieve: March 23, 2006, from <http://it.coe.uga.edu/~treeves/AERA2000Reeves.pdf>

Snooks, G. D. (1996). The dynamic society: Exploring the sources of global change. London and New York: Graeme Donald Snooks.

Soles, C. & Moller, L. (2001). Myers Briggs Type Preferences in Distance Learning Education. *International Journal of Educational Technology*. Penn State University. Vol.2, No. 2

Stager, G. S. (2003). The feeling of wonderful ideas – Implications for the future of Teaching and learning. *Paper presented at the IFIP Working Groups 3.1 and 3.3 Working Conference: ICT and the Teacher of the Future, held at St. Hilda's College, The University of Melbourne*. Australia: Australian Computer Society, Inc.

Stephanidis, C. (2000). Challenges towards universal access in the information age *Research and Development, ERCIM News No. 40*. Retrieved: December 5, 2006, from <http://www.ercim.org/publication/prosp/UI/>

Stephenson, J. (2001). Teaching and Learning Online: Pedagogies for new Technologies. Jonh Stephenson (Ed.). London: Kogan Page.

Stigler, J. & Hiebert, J. (1999). The teaching gap: Best ideas from the world's teachers for improving education in the classroom. New York: Free press.

Teichler, U. (1999). Higher Education Policy and the World of Work: Changing Conditions and Challenges. In: *Higher Education Policy*, Vol. 12, pp. 285-312.

Tiarnaigh, M. (2005). An integration of Moodle (Modular Object-Oriented Dynamic Learning Environment) with an AHS (Adaptive Hypermedia System). Final project (not published).

Van den Berg, K. (2005). Finding open options: An open source software evaluation model with a case study on Course Management Systems. Master's Thesis. Tilburg University.

Van Merriënboer, J.J.G. (1999). Cognition and Multimedia Design. Open Universiteit Nederland.

Veal, D., Maj, S. P., & Duley, R. (2001). Assessing “hands on” skills on CS1 computer & network technology units. *Technical Symposium on Computer Science Education*, pp.381–385, ISSN: 0097-8418.

Von Glasersfeld, E. (1995). Radical constructivism: A way of knowing and learning. Washington, DC: Falmer.

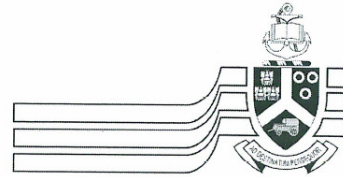
Westera W. (2001). Competences in Education: a confusion of tongues *Journal of Curriculum Studies*, 2001, Vol.33, N° 1, 75-88.

Woods, D. & Dekker, S. (2000). Anticipating the effects of technological change: A new era of dynamics for human factors. *Theoretical Issues in Ergonomics Science*, Vol. 1, No 3, pp. 272-282.

Yordanova, L., Boychev, G., Tsvetanova, Y., Hrisuleva, V., & Kiryakova, G. (2003). Development of a Web-based Course on Informatics via Open-source Software Package MOODLE. *International Conference on Computer Systems and Technology - CompSysTech'2003*. Retrieved February 14, 2006, from: <http://ecet.ecs.ru.acad.bg/cst/Docs/proceedings/S4/IV-15.pdf>

Zhao, F (2003). Enhancing the quality of online higher education through measurement, *Quality Assurance in Education*, Vol. 11, N° 4, pp. 214-221.

APPENDIX 1- ETHIC COMMITTEE CONSENT LETTER



University of Pretoria

Pretoria 0002 Republic of South Africa
Tel (012) 420 2966; Fax (012) 420 3003
<http://www.up.ac.za>

Department of Curriculum Studies

19 June 2005

To Whom It May Concern:

This is to confirm that Ms Feliciano Eduardo (Student no 25103076) is a student of the University of Pretoria, Faculty of Education, Groenkloof Campus. The aim of the study is to develop, implement and evaluate an Online Master's Module using MOODLE for the Faculty of Education (FacED) of University Eduardo Mondlane (UEM) in Mozambique. This letter is to confirm permission to conduct this study and collect data at the Faculty of Education, University of Eduardo Mondlane.

A handwritten signature in black ink, appearing to be 'WJ Fraser', written over a dotted line.

PROF WJ FRASER
HEAD OF DEPARTMENT:
CURRICULUM STUDIES
Tel: (012) 420-2207
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E-mail: wfraser@hakuna.up.ac.za

DEPT HOOF HEAD OF DEPT
DEPARTEMENT KURRIKULUMSTUDIES
DEPARTMENT OF CURRICULUM STUDIES

APPENDIX 2 – CONSENT LETTER FOR ACCESS TO THE STUDY



UNIVERSIDADE EDUARDO MONDLANE

Faculty of Education

10 July 2006

To Whom It May Concern:

Ms. Feliciano Eduardo, lecturer in the UEM Faculty of Education Department of Curriculum Development and Teacher Education, has undertaken data collection within the framework of her research project for the Master's degree at the University of Pretoria, South Africa.

This letter is to confirm that data collection took place during two weeks from 10-21 July 2006, in Mozambique.

Prof. Dr. Inocente Vasco Mutimucuo
Dean of Faculty of Education



APPENDIX 3-PARTICIPANT'S CONSENT LETTER

Project Title: Design, Implementation and Evaluation of an Online Master's Module using *Moodle* for the Faculty of Education of the Eduardo Mondlane University

11, Jun 2006

Dear Participant

You are invited to participate in a research project aimed to develop, implement and evaluate an online master's module using *Moodle* in the masters program of the Faculty of Education (FacEd) of the University Eduardo Mondlane (UEM) in Mozambique.

Your participation in this research project is voluntary and confidential. You will not be asked to reveal any information that will allow your identity to be established, unless you are willing to be contacted for individual online learning environment and complete the evaluation questionnaire. Should you declare yourself willing to participate in an individual online learning environment and complete the evaluation questionnaire, confidentiality will be guaranteed and you may decide to withdraw at any stage should you wish not to continue with a questionnaire.

Accompanying this letter, is a document explaining [*participant's role in the research process*]

The results from this study will be used to write and complete the requirements of my Masters degree at University of Pretoria, Faculty of Education.

If you are willing to participate in this study, please sign this letter as a declaration of your consent, i.e. that you participate in this project willingly and that you understand that you may withdraw from the research project at any time. Participation in this phase of the project does not obligate you to participate in follow up individual questionnaires, however, should you decide to participate in follow-up questionnaires your participation is still voluntary and you may withdraw at any time. Under no circumstances will the identity of questionnaire participants be made known to any parties *that may be involved in the research process and/or which has some form of power over the participants.*

Participant's signature : Date:.....

Researcher's signature..... : Date:

Yours Sincerely

Feliciano Eduardo

Participant's role in the research process

The following are important aspects of my research project:

- The research will require collaboration from the lecturer of the module will be designed. The lecturer will contribute with ideas and some materials/resources to be added in each lesson.
- The lecturer of the module will also contribute in adding material in the *Moodle* software.
- The lecturer will administer and facilitate the online module in collaboration with the researcher.
- Data will be collected in a direct manner from participants-in other words, questionnaires need to be completed in an hour.
- Students are expected to upload assignments, presentations and chatting/discussing the topics related to the module through *Moodle*.
- Students are expected to log onto *Moodle* and participate in all the lessons virtually.

Thank you for your participation.

Feliciana Eduardo

Masters student

University of Pretoria
South Africa

APPENDIX 4 – LECTURER EVALUATION QUESTIONNAIRE

EDUARDO MONDLANE UNIVERSITY

Faculty of Education

Date: ____/____/2006

Final Moodle Lecturer Evaluation Questionnaire

This questionnaire is addressed to the Lecturer who administrated and facilitated the online masters module designed and delivered through *Moodle* for students enrolled in the second year (2005/06), on optional module (Management Information Systems in Education) from specialization phase in Administration and Management in Education at the Faculty of Education in Mozambique.

I appreciate your interest in *Moodle* and I would like to thank you for taking the time to complete it. Please take the time to answer the following questions about online module delivered through *Moodle*. Your time and responses are sincerely appreciated. Your responses are very important and will allow improving the online Module.

1. What difficulties/ barriers did you experience in teaching with *Moodle*?

2. What is your suggestion on how to improve this/these problems?

3. What are the benefits of using *Moodle* in this module?

4. Describe your motivation or incentive to teach with *Moodle*?

5. *Moodle* offers the following tools or functions. What features of *Moodle* are appropriate for teaching and learning?

TOOLS	PLEASE TICK ✓	OTHER-SPECIFY
Forum		
Assignment		
Chat		
Choice		
Dialogue		
Journal		
QUIZ		
Resource		
Survey		
Workshop		
Grade		
Help		

6. Explain why these tools are important to be used for teaching and learning?

7. Describe how did you encourage participation in the group discussion through *Moodle*?

8. In what way do you think that the online module developed and delivered using *Moodle* helped you to develop competencies that can allow you to be a professional in your work place? Please elaborate.

9. Describe how did you experience interaction with students?

10. Would you recommend the online course designed and delivered through *Moodle* to others? Why (or why not)?

11. General

11.1 Is there anything else you would like to say? Please feel free!

Thank you for your time and responses

**Feliciana Eduardo
Master student
University of Pretoria, SA**

APPENDIX 5 – STUDENT EVALUATION QUESTIONNAIRE

EDUARDO MONDLANE UNIVERSITY

Faculty of Education

Date: ____/____/2006

Final Moodle Student Evaluation Questionnaire

This questionnaire is addressed to master's students who are enrolled second year (2005/06), on optional module (Information Management Systems in Education) from specialization phase in Administration and Management in Education at the Faculty of Education in Mozambique.

I appreciate your interest in *Moodle* and I would like to thank you for taking the time to learn more about it. Please take the time to answer the following questions about your online module delivered through *Moodle*. Your time and responses are sincerely appreciated. Your responses are very important and will allow improving the online course.

1 To what extent are features of design in *Moodle* appropriate for the process of learning?

1.1 *Moodle* offers the following tools or functions. What features of *Moodle* are appropriate for your learning?

TOOLS	PLEASE TICK ✓	OTHER-SPECIFY
Forum		
Assignment		
Chat		
Choice		
Dialogue		
Journal		
QUIZ		
Resource		
Survey		
Workshop		
Grade		
Survey		
Help		

1.2 Explain why these tools are important to be used for your learning?

2 Is *Moodle* really as constructionist as it claims for the purpose of the online module?

2.1 In your opinion, were group interactions, i.e. discussions encouraged by using the online module? 'Please' explain briefly.

2.2 Did you contribute to group discussions posted in *Moodle*? 'Please' elaborate.

2.3 In your view, were the assignments well integrated into the online course?

2.4 Assess your opinion about workload, i.e. number of assignment, required readings, etc. Was the workload manageable in terms of hours allocated?

2.5 Were the instructions of the assignments clear to you? 'Please' elaborate.

2.6 Were there any instructions you did not understand? 'Please' elaborate.

3 How does *Moodle* support competency-based education?

3.1 What are the benefits of using *Moodle* in this module?

3.2 In what way do you think that the online module developed and delivered using *Moodle* helped you to develop competencies that can allow you to be a professional in your workplace? 'Please' elaborate.

3.3 Do you think the timetable set up for the online module was efficient to you? In terms of time set for completion of the individual and collaborative assignments, final project and content. 'Please' elaborate.

3.4 Do you think the online course provided you with materials/resources that motivated you to learn? ‘Please’ elaborate.

3.5 Describe how did you experience interaction with your classmates or colleagues?

3.6 Besides the discussion that took place in the collaborative group tasks, why did/did not you contribute to the discussion in general?

3.7 Which any other mode of communication did you use during the course with the facilitator or other colleagues?

MODES OF COMMUNICATION	‘PLEASE’ TICK ✓
E-mail	
Face-to-face	
Fax	
Cell phone	
Any other-specify	

3.8 Why did you use this/these alternative method of communication?

3.9 In what way do you think the communication forms (i.e. email, chat/discussion, forum, etc) used through *Moodle* were suitable to you? ‘Please’ elaborate.

3.10 If you experienced communication problems i.e. during the chatting/discussion, did the lecturer help to solve them? How?

3.11 Describe any other possible problems you experienced with online module that was delivered through *Moodle*?

3.12 What is your suggestion on how to improve this/these problems?

4. How does *Moodle* help us accommodate a more dynamic and complex society to develop more flexible professionals?

4.1 Describe your personal skills and knowledge that you achieved as a result of using the online module developed and delivered through *Moodle*?

4.2 How did your team group/group discussion help you to develop these skills and knowledge?

4.3 How will you apply the experiences achieved in this online course in your work place (i.e. working in teams, individual work, thinking critically, etc)?

4.4 Would you recommend the online course designed and delivered through *Moodle* to others? Why (or why not)?

5. What changes should we make on the online module using *Moodle* to realize an effective learning process?

5.1 Do you think the materials on *Moodle* were interesting, comprehensive and clear to you? ‘Please’ elaborate.

5.2 Do you think the materials/resources (i.e. PDF files, reading list) available in *Moodle* were suitable for your study? ‘Please’ make more comments.

5.3 Approximately how many hours did you spend on each activity per week?

ACTIVITY	TIME ESTIMATE (HOURS)
Independent work	
Chatting /discussion	
Working on computer	
Searching information in the internet	
Final Project	
Make PowerPoint presentation	
Other activities-specify	

6. General

6.1 Is there anything else you would like to say? Please feel free!

Thank you for your time and responses

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Please, place your contact here:

E-mail:

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