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Artigo original

USING *MOODLE* TO SUPPORT MASTER'S MODULE ATE THE EDUARDO MONDLANE UNIVERSITY

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ABSTRACT: This article explores the pedagogical and practical issues to be addressed when teaching with a Learning Management System (LMS) at the Eduardo Mondlane University in Mozambique. The study was conducted in the form of a development research, and reports on the design, evaluation, and implementation of the module Management Information Systems in Education. The online module was built using *Moodle* and the study was undertaken at the Faculty of Education. An evaluation questionnaire with open-ended questions was developed to evaluate the online component of the course. The questionnaires were completed by a sample of seven adult students who were registered for the course and their lecturer. Observations on the *Moodle* were also conducted. Two established theoretical points of departure contributed to build the conceptual framework for this study; constructivism and objectivism. 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 Cronjé model. The findings indicated that the use of an online module designed and delivered through *Moodle* is recommended because of four main reasons. Firstly, it can be accessed at any time and at any place. Secondly, it provides the opportunity to collaborate with others virtually. Thirdly, it is a useful educational package that can be adopted by teachers to supplement the teaching and learning process in schools. Finally, it improves communication possibilities.

***Keywords*:** Learning Management System (LMS), *Moodle*, constructivism, objectivism.

UTILIZAÇÃO DO *MOODLE* PARA AUXILIAR MÓDULO DE MESTRADO NA UNIVERSIDADE EDUARDO MONDLANE

RESUMO: Este artigo explora questões pedagógicas e práticas a serem consideradas quando se ensina utilizando um Sistema de Gestão de Aprendizagem (SGA) na Universidade Eduardo Mondlane em Moçambique. O estudo foi conduzido na forma de uma pesquisa desenvolvimento e reporta sobre o desenvolvimento, avaliação e implementação do módulo Sistemas de Gestão de Informação em Educação. O módulo *online* foi construído utilizando *Moodle* e o estudo realizado na Faculdade de Educação. Um questionário de avaliação com perguntas abertas foi desenvolvido para avaliar a componente *online* do módulo. O questionário foi preenchido por sete estudantes adultos que foram inscritos para o módulo e seu professor. Observações sobre o *Moodle* também foram realizadas. Dois conceitos fundamentais, o construtivismo e objectivismo, serviram de pontos de partida para criar o quadro conceptual do estudo. O modelo de Cronjé (2006) dos quatro quadrantes do ensino e aprendizagem foi adaptado e utilizado para desenvolver o quadro conceptual. Através da análise interpretativa, as respostas as perguntas foram apresentadas e enquadradas no modelo de Cronjé. Os resultados indicaram que a utilização de um módulo *online* desenvolvido e transmitido através do *Moodle* é recomendado por causa de quatro razões principais. Primeiro, *Moodle* pode ser acedido a qualquer hora e em qualquer lugar. Segundo, *Moodle* oferece oportunidades para colaborar com os outros virtualmente. Terceiro, *Moodle* é um pacote educativo útil que pode ser adoptado por professores para complementar o processo de ensino e aprendizagem nas escolas. Por último, *Moodle* pode melhorar as possibilidades de comunicação.

Palavras-chave: Sistemas de Gestão de Aprendizagem (SGA), *Moodle*, construtivismo, objectivismo.

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INTRODUCTION

The most popular university teaching strategy that has been used for many years 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. In developing countries, *Moodle* is a lucrative option because it is available free of charge.

The purpose of this study was to explore the pedagogical and practical issues that have to be addressed when teaching with Learning Management Systems (LMSs) in higher education. Two reasons have been considered for developing an online master's module using the LMS *Moodle* for the Faculty of Education at UEM in Mozambique. The first one was to improve the quality of teacher training in the Faculty and the second was 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. In developing countries with few ICT resources lecturers often shy away from using technology fearing that students may not have access to it, or may not have sufficient computer literacy to use such tools.

This article synthesizes the findings from data that were collected by means of two methods. The first method was an evaluation questionnaire composed of open-ended questions. The second comprised observations of an instructor and students using the *Moodle* LMS. The major focus of the study is on answers to the central research question: **What are the pedagogical and practical issues that have to be addressed when teaching with a Learning Management System (LMS) in the course "Management Information Systems in Education"?** A summary of the findings and discussion of what can be learnt from the study are also presented. The article concludes with recommendations.

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

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

The study is limited by a very small sample size (n=7), but it is presented here in the hope that it will resonate with other studies about online learning in developing countries. Conceptually the article builds further on a model of constructivist and objectivist learning with media published in an earlier issue of this journal (CRONJÉ and BURGER, 2006).

LITERATURE SURVEY

This section presents a discussion based in the literature survey and is organized in two major subsections. It begins by exploring the themes that led to the research sub-questions, and then goes

further by placing the questions within a conceptual framework that integrates both the constructivist and competency-based, objectivist elements of the research.

Design Features of Learning Management Systems

The literature about features of learning management systems (LMS) says that all "LMS systems manage the log-in of registered users, manage courses catalogs, track learner activities and results, and provide reports to management" (MEGÍAS and ITMAZI, 2004, p. 1). An LMS includes tools such as: authoring of content, management of classroom training, and learner collaboration tools (MEGÍAS and ITMAZI, 2004). Communication tools are those which promote any kind of interpersonal communication using Internet-based technologies to transmit, present, explain and store information (e.g. e-mail, chat rooms, group discussions, conferencing, etc.).

Communication may be *synchronous* or *asynchronous*. 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. Jaffee (2003) states that face-to-face instruction makes use of *synchronous* communication, which can be supplemented by *asynchronous* communication and interaction can take place in a web-based learning environment by using LMSs. 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, p. 36) says 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". 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, namely *Blackboard* and *WebCT*, because they are seen to be the best. As a result, not many other systems are being used yet.

As regard costs, the majority studies contend that there are dozens of LMSs with diverse features. Therefore, selecting the most suitable LMS platform is a difficult process. Most of the LMSs mentioned in this study are commercial. A notable exception is *Moodle*, which presents at least three advantages. First, it can be downloaded free of charge. Second, it runs under many operating systems (e.g. Windows, Linux, and MS-SQL Server). Finally, developers can make appropriate changes in the source code to adapt it to their needs (YORDANOVA *et al*., 2003; JENSEN, 2004). Jensen (2004), for instance, provides evidence that he could use *Moodle* for a variety of different types of online training. Additionally, *Moodle* might be an interesting and suitable educational software that can be adapted for the context of developing countries like Mozambique. Thus, it is interesting to know to what extent design features of *Moodle* are appropriate for the process of learning in the course "Management Information Systems in Education".

Characteristics of Constructivist Learning

The literature about characteristics of constructivist learning says that in a constructivist perspective, students are viewed as actively engaged in making meaning. On the other hand, teaching is performed by using constructivist approach that 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 both a learner and a researcher, in order to strive for greater

awareness of the environment and the participants in a given teaching situation. This, in turn, allows to continually adjust their actions to engage students in learning, using constructivism as a referent (DOUGIAMAS, 1998 quoted by BERGGREN, 2006, p. 9). Papert (1993) coined the term "constructionism" for his method of teaching within a constructivist epistemology, where learning becomes the product of learning task in which learners construct real or virtual artefacts. Martin Dougiamas explored this method in a 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).

Another study that claims *Moodle* as constructivist is one by Dougiamas and Taylor (2002). They conducted a study about an Internet-based postgraduate course on the subject of "Constructivism". Their study was built for various groups of teachers who were engaged in professional development in distance learning (DOUGIAMAS and TAYLOR, 2002). Dougiamas and Taylor's (2002, p. 1) study 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". In their theoretical perspective, Dougiamas and Taylor (2002, pp. 2-3) advocate that "the most prevalent theoretical perspectives in research on online learning are those related to constructivism, particularly social constructivism and social constructionism".

Results of another research study that supports *Moodle* as a constructionist system carried out by Dougiamas (2000) show that a class of high school teachers learnt about the Internet through an Internet-based course called 'Internet Overview', delivered through *Moodle*. Accordingly, the development of such tools used a constructionist approach (DOUGIAMAS, 2000).

Mayers (2001) in his research entitled "Learning Technology and Learning Relationships" states that before adopting any new learning technology, educators must first make clear in which pedagogical basis desires to proceed. He further argues that "the emerging pedagogical consensus is around constructivism - collaborative learning, authentic tasks, reflection and dialogue" (MAYERS, 2001, p. 16). Fahy (2004) contends that in constructivist learning environments the use of technology may differ "from being holistic, more collaborative in method, and more encouraging and accepting of learner initiatives, including greater freedom and variety in assignments and assessments" (HENRIQUES, 1997 quoted in FAHY, 2004, p. 149). Jonassen (1998) quoted in Fahy (2004) supports this claim stating that constructivists tend to use technologies because of three main reasons. Firstly, technologies can be used to acquaint and to engage learners with real-world problems and situations. Secondly, technologies can be used to model the analytic and thinking skills of the instructor and other experts, which learners subsequently apply with suitable feedback to their own problems and constructs. Finally, technologies can be used to work within an authentic problem context that reflects as much as possible the problem's real context and characteristics.

Furthermore, the social constructionist philosophy underpinning the design of *Moodle* builds on asserts that such constructivism learning takes place mainly in a collaborative environment in which everybody builds collectively (MOODLE-WIKIPEDIA, 2006). 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. It is also related to facilitating discussions and tasks in such a way that the students collectively achieve their learning goals.

Thus, one would say that the studies discussed above reveal the reality of using *Moodle* as a constructivist tool in various learning experiences. But for this study the question remains whether *Moodle* is really as constructivist as it claims to be, in supporting a course on "Management Information Systems in Education", in a developing country. In the next section the contrasting views of constructivism and objectivism, are discussed.

Constructivism *versus* Objectivism

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". Fosnot (1996, p. *ix*) defines constructivism as "a theory about knowledge and learning which describes what knowing is and how one comes to know".

Jonassen (1991) states that objectivism is viewed as the most common scientific conception of reality which holds that individuals, as learners assimilate an objective reality. That "the role of education is to help students learn about the real world, students are not encouraged to make their own interpretations of what they perceive and the teacher interprets events for them. Learners are told about the world and are expected to replicate its content and structure in their thinking" (JONASSEN, 1991, p. 59). He further contends that objectivism puts its emphasis on the object of our knowing. Whilst, in a constructivism environment the learners construct their knowledge based upon their prior experiences of mental structures, and of beliefs that they uses to interpret objects and events. Thus, "constructivism does not exclude the existence of an external reality; it merely claims that each learner constructs his or her own reality through interpreting perceptual experiences of the external world" (JONASSEN, 1991, p. 59).

Alessi and Trollip (2001) claim that objectivism is generally used by constructivists to describe what they consider the opposite end of the continuum from themselves. For Jonassen (1991, p. 61) "constructivists believe that learning is internally controlled and mediated by the learner. Whilst objectivists argue that learning is externally mediated by instructional strategies that predetermine the required mental activities that give rise to acquiring the elements of an external reality". Thus, one would say that "the two theories are generally described as polar extremes on a continuum from externally mediated reality (objectivism) to internally mediated reality (constructivism)" (JONASSEN, 1991, p. 51).

For Jonassen (1991) objectivism holds that the world is real, structured, and its structure can be built for the learner. He also affirms that the epistemology of objectivism maintains that the function of the mind is to mirror reality and its structure. The reality and its structure are mirrored by thought processes that manipulate abstract symbols which illustrate that reality. Accordingly, those thought processes can be analyzed and disaggregated. For that reason, the meaning which the thought processes produce is external to the person who perceives the intended meaning and it is decided by the structure of the real world. Therefore, learning consists of apprehending the kinds of concepts which the words mean in reality (RAND, 1966 quoted by JONASSEN, 1991). This builds upon Jonassen (1991, p. 59) view that "objectivism assumes that learning is the process of mapping those concepts onto

learners". Accordingly, Jonassen (1991, p. 58) synthesizes some of the contrasting views that objectivism and constructivism formulate "about reality, the mind, thought, meaning, and symbols". The following table (Table 1) show such "assumptions inherent in objectivism and constructivism".

Table 1: Objectivism *versus* constructivism (JONASSEN, 1991, p. 58)

	Objectivism	Constructivism
Reality (real world)	External to the knower Structure determined by entities, properties, and relations Structure can be modeled and shared with others	Determined by the knower Dependent upon human mental activity Product of mind Symbolic procedures contrast reality Structure relies on experiences and interpretations
The mind	Processes abstract symbols and approach them, therefore they mirror nature. Is an abstract machine for manipulating symbols	perceives and interprets the world by creating symbols is the conceptual system for constructing reality
Thought	Disembodied: independent of human experience Governed by external reality Reflects external reality Manipulates abstract symbols Represents (mirror) reality Atomistic: decomposable into "building blocks" Algorithmic Classification	Embodied: grows out of bodily reality Grounded in perception and construction Grows out of physical and social experience Imaginative: enables abstract thought More than representation (mirrors) of reality Gestalt properties Relies on ecological structure of conceptual system Building cognitive models
Meaning	Corresponds to entities and categories in the world Independent of the human mind External to the knower	Does not rely on correspondence to world Dependent upon understanding Determined by understanding of the knower
Symbols	Represent reality Internal representations of external reality	Tools for constructing reality Representations of internal reality

Thus, one would say that the discussion above clearly illustrate the different views of constructivism and objectivism. This makes one ask about the extent to which *Moodle* would support objectivism and competency-based teaching.

Competency-based education

The literature about the requirements of competency-based education contend that in general, competencies are related to highly professional performance and both concepts are directly linked to each other. Adendorff (2004, p. 13) says that "competencies allow people to focus on clear specified behaviour. Thus, 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". Westera (2001) stresses that competency is considered as a cognitive structure that enable specified behaviours. He argues further that competences can be seen as a higher-order skills and behaviours which include knowledge, skills, attitudes, and critical thinking, and assumes decision making. Taking into account the above viewpoints,

one would say that competency-based education is 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 qualified to answer the needs and demands of Mozambican society (FACED/UEM, 2001).

McDonald and Van der Horst (2005, p. 9) say that competency-based education is based on the focus of "achievement in specific competencies (often only skills in isolation)". They also imply that competency-based education supports the idea that the entire learning process is individual, and 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 skills-based isolated nature of competencies places competency-based education towards an objectivist, rather than a constructivist epistemology. Thus, if *Moodle* claims to be constructivist, this makes one ask about the extent to which it would support objectivist, competency-based teaching. In the next section complexities, dynamics of current society and characteristics of flexible practitioners are discussed.

Complexities and dynamics of current society, and characteristics of flexible practitioners

The literature about complexities and dynamics existing in current society, and characteristics of flexible practitioners says that in today's world technology is becoming a more and more important tool used by employees or corporations because of its rapid penetration and the changes which are taking place in society (WOODS and DEKKER, 2000). Lowendahl and Revang (1998), quoted by Navarro and Gallardo (2003, p. 199), state that "as knowledge and technology become dominant social forces, practitioners of every occupation, despite a significant knowledge base, must keep learning". Thus, one can view practitioners as being people on the forefront, who determine how technology and organizational change transform work processes in a society (WOODS and DEKKER, 2000).

Snooks (1996) contends that 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). Navarro and Gallardo (2003, p. 199) argue that "in recent decades the developed world has undergone major social, political, economic, technological, and demographic changes". These observed factors are influencing 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, p. 200) 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". Lawler (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). Additionally, 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. In this respect, the Internet has been shown to be a useful tool in meeting the information needs in developing countries (MBAMBO and CRONJÉ, 2007).

What remains to be seen, though, is how *Moodle* can contribute to the development of flexible practitioners in a dynamic, complex, society in a developing country, in an online environment.

Criteria for Effective Online Learning

The literature about online learning says that 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 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, and they need to be provided with some form of support. Duggleby (2000, p. 4) 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". Duggleby also states four main aspects that characterize online learning. Firstly, learning material needed for a course can be uploaded onto a web site. Secondly, interactions between the instructor and students and among students can take place through e-mail. Thirdly, collaboration among the students is enabled. Finally, learning environment may be built to encourage cooperative work and socialization.

Taking this further, 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. 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, p. 4) notes that "online learning allows for flexibility of access from anywhere and usually at any time". In addition, online learning encourages participation instead of passive interest, and promotes communication, thus reducing the isolation of learners.

There seems to be agreement in the literature on the advantages of online

teaching and learning (ALLY, 2004; DUGGLEBY, 2000; ZHAO, 2003).

Ally (2004, p. 5) stresses some of the benefits of online learning as follows:

> 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 their field work. Situated learning is facilitated. 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 (ALLY, 2004, p. 5).

Duggleby (2000, p. 9) claims that "there is a big demand for distance education and that it provides a high quality of teaching and learning to many people". However, Duggleby states that distance education has serious shortcomings both for tutor and the learners; but online learning can mitigate the disadvantages of distance education because of the following advantages: quick communication; communication is of higher quality; student interaction can take place; development and maintenance of learning is easy; and online courses are widely accessible.

Zhao (2003) points out the following online teaching and learning advantages:

- 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 *et al*. (2001), the evaluation of online learning should centre on three issues: the learning that has taken place, the learning materials and the learning environment. A well-established fact of teaching online is that it takes a lot more time and effort than face-to-face instruction (KEARSLEY and BLOMEYER, 2004).

Once again one needs to ask about the suitability of *Moodle* for higher education in a developing country.

The following section will discuss a conceptual framework in which the learning environment is evaluated in terms of the types of learning materials and the learning that has taken place.

CONCEPTUAL FRAMEWORK

Two established theoretical points of departure have contributed to building the conceptual framework for this study;

constructivism and objectivism. It is necessary to consider the relationship between these two conflicting theories. Whilst constructivism is based on the construction of own knowledge, the competency-based approach is usually objectivist in nature. McKenna and Laycock (2004, p. 167) explain that "constructivism, in contrast to objectivism, regards knowledge as a personal interpretation, individually and actively constructed on the basis of experience rather than transferred from a third party".

Cronjé (2006) describes a model, whereby objectivist and constructivist theories are seen in a two dimension matrix (see Figure 1). Figure 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. For the purposes of this article the label 'objectivism' shown on Cronje's **X** axis, corresponds to the investigation regarding 'competency-based' learning.

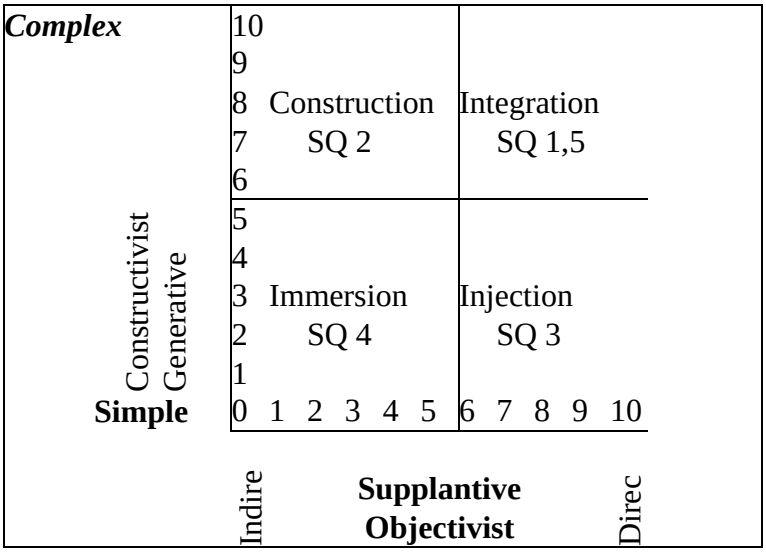

Figure 1: Four quadrants of teaching and learning (adapted from CRONJÉ, 2006, p. 396).

In the next paragraphs Injection, Construction, Immersion and Integration are explained. The research presented here investigates how the *Moodle* learning management system functions in each of the four quadrants respectively. Figure 1 also indicates which sub-questions (SQ 1 to SQ 5) are dealt with in which quadrant.

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 1, the injection quadrant is high in objectivist elements and low in constructivist 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 and BURGER, 2006). Sub-question 3 deals with aspects in this quadrant.

Construction

Construction is high in constructivist elements, as seen in Figure 1. 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). 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). Sub-question 2 deals with this quadrant.

Immersion

As Figure 1 shows, immersion has low elements of both constructivism and objectivist 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 and 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. Sub-question 4, dealing with the dynamics and complexities of society, resorts in this quadrant.

Integration

This quadrant consists of a synergistic combination of elements from objectivist and constructivism, both at high levels and in appropriate conditions, as Figure 1 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, objectivist education. The first and last sub-questions, related to the general suitability of *Moodle*, and to the adjustments that may have to be made to the specific course, fall in this quadrant.

RESEARCH METHOD

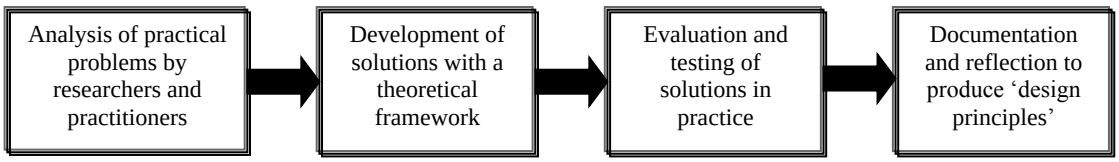

Figure 2: The development research approach of this study

The study took the form of a development research adapted from Reeves' (2000) model, because this study employed the design, implementation and evaluation of an online master's course called Management Information Systems in Education. The learning intervention was constructed 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 intervention 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. The instrument used for data collection was a questionnaire with open-ended questions and observations within *Moodle*. The data collection took approximately two weeks.

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 design comprised the following structure as follows:

- Blocks in three columns;
- Content column in the centre;
- Content organized by week.

The screen in Figure 3 illustrates the home page. It is a general welcome to the *Moodle*-based course.

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 course page provided an outline of the course with links to everything. The screen below illustrates how the lessons 1, 2, 3, and 4 were structured.

Figure 4 shows the weekly structure of the course. 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.

Figure 3: *Moodle* home page of the course

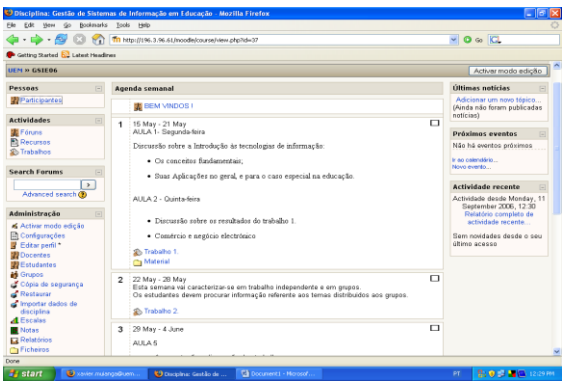

Figure 4: Weekly structure

The screen below shows assignments uploaded by the students. Observations show that the students only uploaded the final project. Figure 5 shows the students' uploaded final project and comments provided by the facilitator.

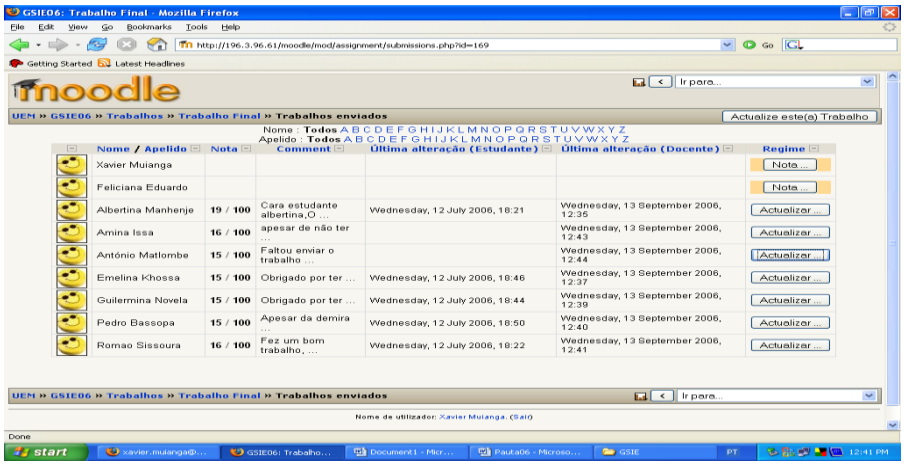

Figure 5: Final project upload

RESULTS AND DISCUSSION

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

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

This research sub-question was answered in the integration quadrant. The *Moodle* course included the following design features: forum, discussion, assignment, chat, choice, dialogue, journal, quiz, resource, survey, workshop, grade and help. 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 integration quadrant of the adapted Cronjé model (2006) shown in the Figure 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 and TAYLOR, 2002, p. 3). Of these features, only the assignment, resource, grades and help tools were used. 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. Additionally, 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.

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

This research sub-question was answered in the construction quadrant. 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. 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, in 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, if the discussion, chat or other integrative and creative tools of the platform had been used consistently by the students and the lecturer, *Moodle* could have been sufficiently constructionist for the purposes of this learning environment. 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. The construction quadrant is high in constructivist elements, as seen in the adapted Cronjé (2006) model (Figure 1). Following this line of thinking, it can be argued that the group discussions were composed of various elements of learning such as investigating, collaborating, sharing and building that are paramount in the contruction 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.

How does *Moodle* support competency-based education?

The answer for this research sub-question was obtained in the injection quadrant. 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. The use of *Moodle* in the course "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 course 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 course 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. 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). This agrees with the adapted Cronjé (2006) model (Figure 1) which shows that the injection quadrant is high in objectivist elements and low in constructivist aspects.

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. In this question it was 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*. 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 and GALLARDO, 2003). *Moodle* allowed students to learn to manage and integrate all the available information, to take control of their leaning 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 course can be applied in a different manner in the professional field (e.g. an informatics researcher). Therefore it can be concluded that in this case *Moodle* helped to develop high quality professionals with different abilities and skills in ICT that can be useful in a 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.

Furthermore, the adapted Cronjé (2006) model (Figure 1) indicates that the immersion quadrant has low elements of both constructivism and objectivism. Therefore, it can be concluded 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.

CONCLUSIONS

Moodle did not work as expected because of breakdowns and slow Internet connections. These were the biggest problems that contributed to the malfunctioning of *Moodle* and consequently, students did not experience *Moodle* as it was intended.

Although *Moodle* was not exactly as constructionist as it claims, for the purpose

of this study, it was concluded that if the most integrative and creative tools of the platform had been exploited, such as discussion or chat, during the online course "Management Information Systems in Education" by students and the lecturer, it could have been more constructionist.

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.

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 courses at the Faculty of Education, enhances innovation and will help other developers in future. 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.

Moodle showed that the students and the lecturer experienced discomfort and irritation with several problems they faced. Working with *Moodle* requires a lot of support (i.e. technical assistance, administrative assistance, instructional design assistance, counseling, and help for special needs). Whereas 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. Integration is a synergetic combination of elements of objectivism 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.

Recommendations

Two sets of recommendations flow from this study. The first set flows from the last sub-question, and involve the improvement of the online course. We present them here in the hope that they will be useful for other designers of similar courses. The second set of recommendations is for further research.

Recommendations for improvement of the course

The last question summarizes the changes that have to be considered in future designs of the online course using *Moodle* in order to achieve a more effective learning process: **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 following aspects should be taken into account:

- Materials (e.g. pdf files, reading list) that fully cover the content must be uploaded into *Moodle* by the lecturer so that they will have a wide enough knowledge base to complete the assignments.
- 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 course 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 course "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 into more masters' courses. 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.

Recommendations for further research

This research has shown the value of development research in guiding practice. It is recommended that online instructors teach courses at master's level in developing countries should be encourage 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.

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