MODELLING AND ANALYSING A COMPUTER-MEDIATED LEARNING INFRASTRUCTURE

By:

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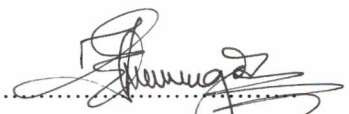
Declaration

This thesis is my original work and has not been presented for a degree in any other university



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This thesis has been submitted for examination with our approval as university supervisors

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Abstract

Keywords: ICT, E-learning, Internet, Pedagogy, Content Calibrator, Content Representation Model, Scenarios, Instructional Design, Modelling.

The convergence of technologies of telecommunications, computing, microelectronics and the Internet into what is commonly referred to as information and communication technologies (ICTs) has had profound impact on the way we teach and learn. This has created an information revolution within an optimistic global society that has embraced virtual learning environments in the provision of courseware. This notion presents opportunities and challenges to universities and colleges of higher learning worldwide. In response, most of such institutions have embarked on both on-campus and off-campus online education in one form or another to extend their services to greater number of students within what could be described as the Socrates' Athens great school of modern times.

In this research, one such instructional infrastructure has been developed and it has been used to design and develop an e-learning system that aims to enhance flexible learning opportunities within the context of a university setting. The system comprises two main modules: a back-end module, which supports server functionalities and houses the *representation model* and the front-end module for learner interaction with the system and upon which the *score calibrator model* is a substratum. These two models – the representation model and the score calibrator model – rely on input from a self-learning subsystem within the e-learning system that in turn captures its input from cookies and

dynamic learner variables such as pace of learning, durations of continuous use, post-test scores; together with static variables such as learner-entry behaviour and learner goals and background. Whereas the score calibrator is a computer-based model that maps a score to a specific content representation hence being able to associate learning objectives with the level of mastery of content using the post-test scores, the representation model, at any given time t, supports a finite but dynamic number of content representation and presentation *scenarios* which characterize the persona of a specific homogenous learner group g.

Unified Modelling Language together with the Object Orientation approach was applied in designing the system while the web application was designed using hierarchical hypertext organization model for the overall site with 'linear with options and side trips' for the various modules. A variety of programming tools were used for the implementation.

The system has been subjected to a three-stage pilot implementation process in which learners were asked to evaluate the various aspects of the e-learning system. Two cohorts of students comprising Introductory students doing a diploma in a humanities program and another comprising Bachelors students doing a Computer Science course, were used for the experiment. Purposeful sampling technique was used to select participants from the introductory group of students while random sampling method was used to select the advanced students who participated in the e-learning experiments. Each of the two cohorts were divided into two groups. Paired groups – comprising a group from either cohort – went though the e-learning course while the other pair took the face-to-face option. Quantitative as well as qualitative data were collected and analysed.

Results indicate a high acceptance rate of the e-learning methodology with learners particularly keen to choose the kind of instructional design option to pursue. In addition, the infrastructure provides an instrument that ensures self-regulating quality courseware development practices since each portion of content can be intuitively subjected to validity and relevance requirements, which are indicated by results of summative evaluation at the end of each unit.

Other major findings of the e-learning experiment showed that both advanced and introductory students were enthusiastic in using the instructional methodology. However, there were indications that introductory students were more highly motivated than the advanced students.

Results from the comparative analysis showed that the e-learning infrastructure created, provided a pedagogically sound mode of instruction whose implementation within a computing-resource-constrained environment is logistically feasible. Instructors for the courses used during the experiment also evaluated the system and were satisfied that pedagogical aspects were well taken care of.

With careful creation of content, it was pedagogically possible to use the infrastructure as an alternative instructional methodology to offer selected modules for certain courses.

An e-learning validation model that provides a mechanism for checking for completeness of the e-learning content as well as the e-learning system itself using pre-determined variables was developed. The model makes it

reasonably mechanistic for content developers to establish suitable combinations of *content ingredients* that will characterize desired types of e-learning contents.

A second model was postulated in an attempt to show that the extent of attainment of learning objectives was proportional to instructor availability and courseware material (content) organization and presentation. The study proposed that, in this model, there are two additional variables that are assumed to remain relatively stable after determination: learner entry behaviour, which is determined using *pre-course test scores* and learner learning ability which can be influenced by results of advice from the content calibrator.

Finally a third model called "Formative phases of e-learning implementation" was developed. This model comprises a series of practical steps that can be followed during the transition process into embracing e-learning as an instructional methodology. This model is currently being applied in a university-wide e-learning implementation project and positive preliminary feedback has been received.