The effective use of a learning management system still promotes student engagement!

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***Abstract*—Learning management systems have the capabilities of creating, fostering, delivering, and facilitating learning at anytime and anywhere. Although these systems have allowed students to engage in online discussions and collaborative activities, many academics believe that this online space has essentially remained a content repository. However, the fact that many academics simply use a learning management system as a content dumping site cannot be generalized across the board for all academics. No, such a blanket statement would prove to be a grave injustice to those few academics that are trying to improve their teaching abilities and promote student engagement and learning, especially through using a variety of tools which have been seamlessly integrated into many of these systems today. The purpose of this paper is to highlight how an academic in electrical engineering is still effectively using an institutional learning management system to promote student engagement through the use of four major features that are currently available in this platform. An ex post facto study is employed along with descriptive statistics involving quantitative analysis of the collected data. Results indicate that both academics and students engaged with all four primary features of the learning management system. However, the predominant features were accessing content followed by completing online assessments. A significant correlation was established between these two features and the final grade marks awarded to students at the end of the course. These results tend to suggest that some academics are widening their horizons and creating interactive experiences for students to enhance their learning. It is hoped that their experience and enthusiasm in using a variety of educational technologies will rub off on fellow colleagues to the greater benefit of students in higher education.**

Keywords—electronic communication, announcements, assignments, grade center, content folders, assessments, Blackboard™, eThuto

I. INTRODUCTION

"Computers themselves, and software yet to be developed, will revolutionize the way we learn". By expressing this statement, Steve Jobs well predicted the extensive use and importance of computers and software applications in education, not only to enhance the teaching and learning process but also to revolutionize the very essence of our pedagogical approaches. The implementation of various learning management systems (LMS) within all forms of education may well be classified as such a revolutionary process which has contributed to the development of the blended learning approach.

Blended learning may be defined as an approach to the design of a course or program that integrates the best of face-to-face and online learning in order to provide high level learning experiences [1]. It may furthermore encompass the mix of a number of instructional approaches as it has been defined as learning that is facilitated by the effective combination of different modes of delivery, models of teaching and styles of learning, and founded on transparent communication [2]. LMS fit this description as they have the capabilities of creating, fostering, delivering, and facilitating learning at anytime and anywhere [3], provided that they have a computer that is configured in the correct way [4]. Chu et al. [5] alludes to this advantage in stating that a LMS allows students to "time shift" and "place shift". Further advantages include support for social learning and student engagement [6], the use of both asynchronous and synchronous learning network models [7], the promotion of an emergent educational paradigm in which each student is the active and central actor of his or her own learning process [8] and a reduction in printing material which enhances efficient delivery [9].

Although these systems possess so many advantages, many academics believe that this online space has essentially remained a content repository for syllabi [10], for handouts [11] and for traditional assignments [12]. Furthermore, student enthusiasm for the web has burst the banks of LMS, such as Blackboard™, and flooded onto myriads of different social networking platforms. Subsequently, despite its many advantages, the true potential of LMS have not yet been fully realized by academics or students [13]. This tends to suggest that many of the integrated features and functionalities of a LMS are underutilized. This leads to the following research question "Does the effective use of all the main features of a LMS still promote student engagement and academic success?"

The purpose of this paper is to highlight how an academic in electrical engineering has used an institutional LMS (Blackboard™) to promote student engagement through the use of four different features that are currently available in this platform. An ex post facto study is employed along with descriptive statistics involving quantitative analysis of the collected data focusing on a module in electronic communications at a university of technology (UoT). Literature pertinent to the various features available in a generic LMS is firstly presented. The context of this study is then clarified along with the research methodology. Quantitative results are depicted in figures and tables followed by succinct conclusions.

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II. LMS FEATURES AND THEIR PERCEIVED VALUE

Among the most adopted educational technologies in the current higher education landscape in South Africa (SA) are LMS. A recent study conducted by Ng'ambi et al. [14] on 22 higher educational institutions in SA suggest that LMS remain the mainstay technologies used by educators for delivering educational resources. Considering the widespread adoption of LMS within SA, it can be envisaged that numerous pedagogical approaches can be implemented to enhance effective teaching and learning via these different platforms. This may possibly lead to an improved throughput rate, which, according to The Council on Higher Education (2013) in SA, is approximately only 20% for UoT's. This means that only 20 out of every 100 students who enroll for a specific qualification graduate within the regulation or allotted time.

UoT's in SA are primarily residential contact universities that make use of a combination of face-to-face and online instruction. This leads to the thought of hybrid courses where a LMS may only be used to turn in assignments, while fully online courses will make use of all the LMS tools, including the discussion boards, course calendars, rubrics, and a digital syllabus [15]. Other tools include blogs and wikis to engage in learning outside of the classroom. Tools enabling the posting of documents, assignments and announcements, as well as features such as e-mail, chat rooms, transferability of documents and bulletin boards are also integrated into most LMS [9].

There has been literature published regarding LMS feature utilization from the students' perspective [16]. Noteworthy is the study done by Caruso and Kvavik [17] who reported that students used the syllabus more than any other LMS feature, followed by access to readings or lecture material and finally keeping track of their grades. Dabbagh and Bannan-Ritland [18] identified the most common features of a LMS by categorizing them as pedagogical tools. Figure 1 highlights the four major features of a LMS, along with its relevant subsidiary tools in the form of a hierarchy. The four major features include:

1. Content – The ability to upload and download relevant electronic documents, spreadsheets, presentations, images, animations and audio visual material
2. Assessment – The ability to implement a variety of assessments, including diagnostic, formative, summative and self-assessments, in order to test, survey and track student achievement in a course
3. Communication – The ability to foster student-academic and student-student interaction by means of asynchronous and synchronous tools
4. Administration – The ability to monitor and manage students, academics, courses and grades

III. CONTEXT OF THIS STUDY

Electronic Communications Systems 4 (EKS4) is an optional offering or module for the Baccalaureus Technologiae (BTech: Engineering: Electrical) qualification in SA [19]. Table I outlines the module structure, syllabus and assessments which are usually completed within a 12 week period. Students have to obtain a minimum of 120 credits for this qualification to be awarded. The majority of modules in this BTech programme have a credit value of 12 (this means that students should dedicate at least 120 notional hours to this module), with the exception of a capstone module (termed Industrial Projects 4) which has 36 credits attached to it.

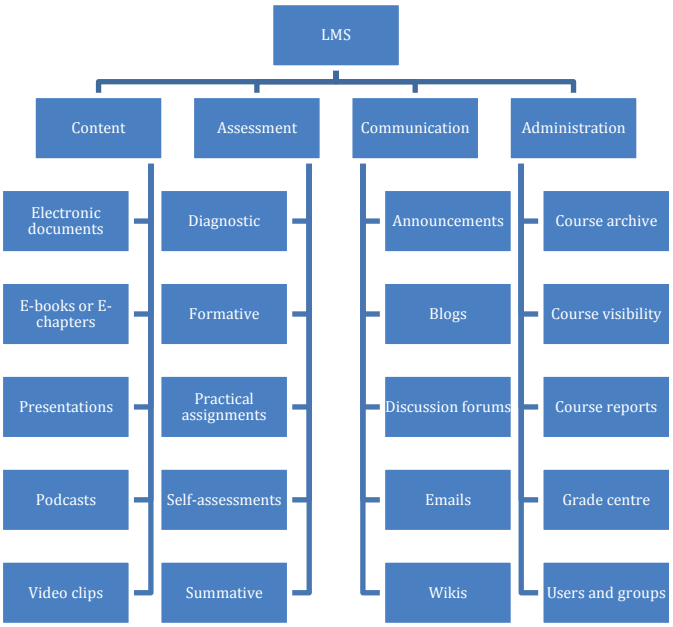

Fig. 1. Hierarchy of a LMS with its four major features and subsidiary tools

TABLE I. MODULE STRUCTURE AND ASSESSMENTS [20]

Qualification	BTech: Electrical: Engineering	Course Structure
Syllabus (Theoretical work)	1. Digital transmission of analogue signals 2. Communication systems 3. Spread Spectrum Systems 4. Error Control Coding	1. 16 learning outcomes 2. 20 learning outcomes 3. 9 learning outcomes 4. 11 learning outcomes
Formative assessments	2 x written classroom tests where Test 1 contributes 25% and Test 2 contributes 40% to the total course mark	Test 1: 25 marks from section 1 and 2 Test 2: 25 marks from section 3 and 4
Practical work	4 x practical assignments which are submitted online which contribute 35% to the total course mark	Each practical is linked to a theory section
Summative assessment	1 x closed book examination where the student's final mark comprises 40% of the total course mark and 60% of the examination mark	25 marks per theory section covered in the examination

The Central University of Technology (CUT) operates on a semester basis of roughly four months during which time BTech students attend one night class per week (5 periods, each

of 45 minutes in duration) over a 12 week period for the EKS4 module. Electrical engineering students need to be in possession of a National Diploma (minimum of 3 years to complete) before they can register for the BTech programme which can be completed within a year if they are enrolled full-time.

The EKS4 syllabus covers four main sections as shown in Table I. A total of 56 specific learning outcomes are specified for this module [20] which incorporates verbs such as defining, describing, sketching, analyzing, calculating, designing, determining and evaluating. The last five verbs are used extensively in the assessments as it places particular emphasis on the higher levels of learning listed in Blooms Taxonomy which contribute to deep learning and critical-thinking [21]. Two written formative assessments are completed in a classroom environment while four practical assignments are submitted online via the institutional LMS. A final written summative assessment is completed at the end of the semester.

Student engagement was promoted by making use of all four main features of the LMS depicted in Figure 1. Students were asked to download updated versions of the study guide, test solutions, exam preparation documents and specific e-files relating to each of the four main units. This primarily helps to relieve additional costs associated with buying a prescribed textbook and it also ensures a rich mixture of a variety of authors who are experts in their own respective fields. Self-reflective assessments and practical assignments were posted on the LMS. The purpose of the self-reflective assessments was to encourage students to engage in reflective practice regarding the theory which was covered in the classroom. The purpose of the practical assignments was to encourage students to complete the practical work scheduled in a laboratory on their personal computer, thereby reducing further costs associated with printing. Communication focused mainly on the use of announcements regarding updated course contents and new assessments that were posted by the academic. Finally, the grade centre tool under the administration feature was used by the academic to manage the student's course mark which contributes 40% to the final mark of the module. These course marks were also visible to the students who could thereby measure their academic progress, identifying areas of deficiency which needed attention.

IV. METHOD

An ex post facto study is employed along with descriptive statistics involving quantitative analysis of the collected data. An ex post facto study is a type of non-experimental research in which the exploration of causal relationships is performed 'after the fact', meaning after variations of the independent variables of interest have already occurred [22]. The independent variable of interest is the LMS of CUT, as it is not dependent on any student engagement as it is a standalone system. The dependent variable of interest is student engagement, as its promotion is dependent on or influenced by the effective use of a LMS.

Descriptive statistics, rather than inferential statistics, are used as the results are interpreted with regard to specific engineering students enrolled at a UoT. These descriptive statistics include the student profile, overall usage of the LMS and the final grades awarded to the students in this study.

Qualitative analysis is important as it brings a methodical approach to the decision-making process, given that qualitative factors such as "gut feel" may make decisions biased and less than rational [23]. The qualitative analysis focuses primarily on the number of specific students in the study, as well as on the number of times that they actual accessed the four primary features of the LMS. Grades are presented as percentages.

The target population was restricted to all engineering students enrolled for the module EKS4 during the second semester of 2014 (n = 16). Academic and student usage of the LMS is presented in order to determine which features were primarily used in this module. Spearman Rho correlations are then made between student usage of the LMS and their final grades awarded at the end of the semester in order to ascertain which features had the greatest impact on the achievement of the students.

V. RESULTS

The profile of students registered for EKS4 during the second semester of 2014 is shown in Figure 2, which highlights that the majority of students were male (81%); substantiating the fact that Engineering tends to be dominated by males [24]. The majority of students (81%) were 25 years and older; this may reflect a worldwide trend in which more people are upgrading their qualifications in the wake of the global economic downturn [25]. It further indicates that student perceptions would be based on various years of industrial experience, adding richness to the data.

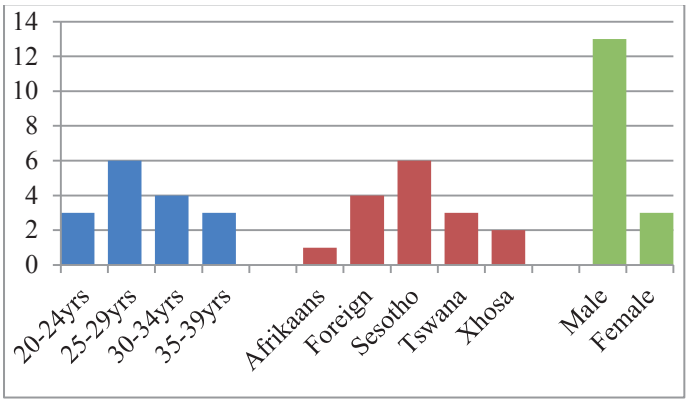

Fig. 2. Student profile (n = 16)

Figure 3 presents the overall usage of the LMS by students enrolled for EKS4 at CUT. Both the academic and the students predominantly use the content feature within the LMS, with the assessment feature in second place. The administration feature follows in third place, with some 414 accesses during the 14 week semester period.

Figure 4 depicts academic and student usage of the content and assessment features. The black column illustrates that students accessed a number of announcements which were placed under the Introduction folder. However, the highest student access was recorded for downloading course notes which were made available under each unit of the module. Test solutions and examination preparation documents were also downloaded, but to a lesser degree. This tends to indicate that the academic placed more reading material for the students to

download, than worked-out theoretical examples. Self-reflective assessments and practical assignments were used under the assessment feature, and where accessed more often than any other of the subsidiary tools available under the content feature (612 accesses for the self-reflective assessments which could be completed multiple times). Rubrics were developed and implemented for each practical assignment and were used online to assess each student's submission (pdf file submitted by the students).

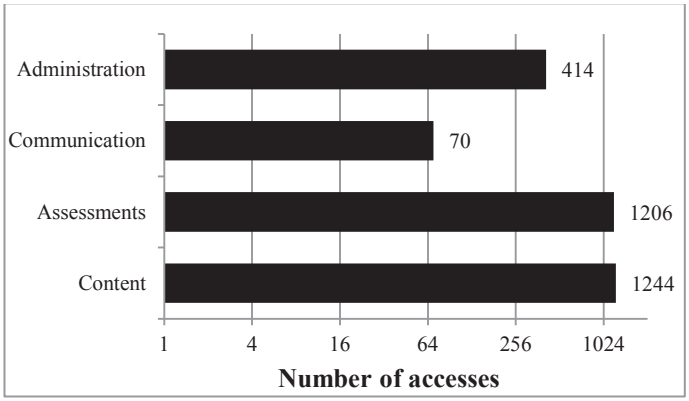

Fig. 3. Overall usage by an academic and students of the four main features in a LMS

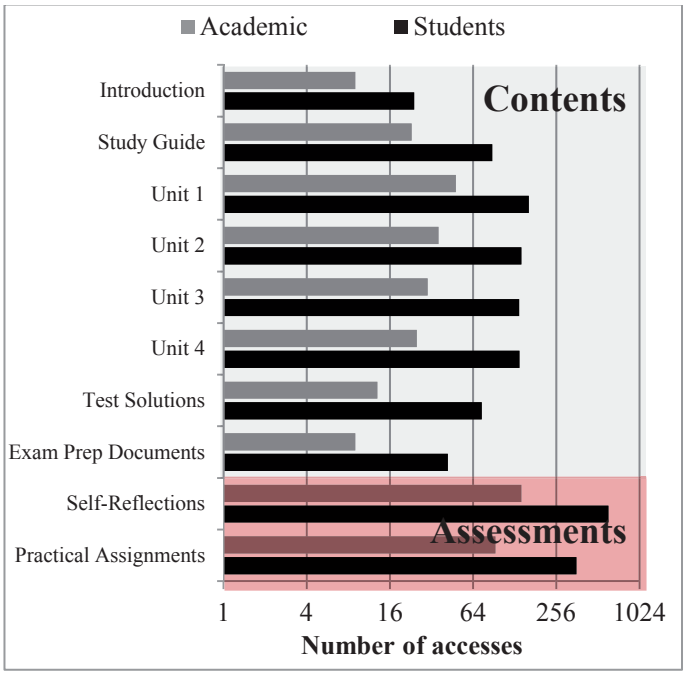

Fig. 4. Academic and student usage of a LMS in electronic engineering at a residential university regarding the content and assessment features

The grey bars in Figure 4 indicates that the academic used the LMS to upload a number of course notes for each unit (e-files with pdf extensions which replaced the printed textbook), PowerPoint presentations for each unit (classroom lectures) and worked-out examples for each unit (calculation questions). Seven self-reflective assessments were set by the academic using the Respondus software, while four practical assignment templates (featuring the practical assignment guidelines and methodology) and their associated rubrics were loaded. Table II indicates the results of a Spearman Rho correlation between student final grades and their accesses of the four main features.

These results indicate a positive statistical significant relationship ($p = 0.062$) between the assessment feature and the final grades of the students. A negative statistical significant relationship ($p = 0.050$) was established between the final grades of the students and the content feature. This indicates that a higher content access sum results in lower academic achievement. A possible reason for this is that some students repeatedly view the files under the content feature, but do not necessarily download them to their electronic devices, thereby raising their content access sum.

This is illustrated in Figure 5, where the grey shaded area represents the number of content accesses and the black solid lines the final grades of the students. Student 4, in Figure 5, accessed the same content some 95 times. However, only 30 electronic files were made available for download. This suggests that this student repeatedly accessed the same information, without downloading it to an electronic device for future use. On the other hand, student 14 only downloaded 9 of the 30 files. A possible reason for this may be that fellow students downloaded the material and then shared it with this student. Noteworthy is the final pass rate for EKS4, being 88% (14 out of the 16 students achieving academic success).

TABLE II. SPEARMAN RHO CORRELATIONS BETWEEN THE FINAL GRADES OF STUDENTS AND THEIR LMS ACTIVITIES

	Content	Assess-ment	Communica-tion	Administra-tion
Total samples	16	16	16	16
Correlation	-0.497	0.476	0.052	-0.351
Significance	2.142	-2.024	-0.196	1.400
p-value	0.050*	0.062*	0.848	0.183

*Correlation is significant at the 0.1 level

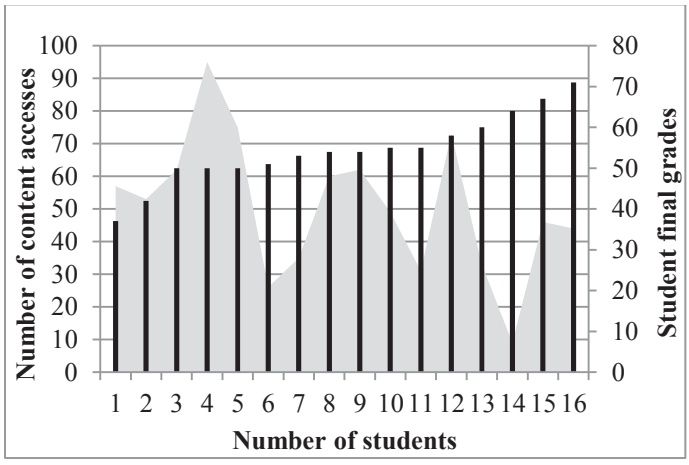

Fig. 5. Student final grades and their number of content accesses

VI. Discussions and Conclusions

The purpose of this paper was to highlight how an academic in electrical engineering used an institutional LMS to promote student engagement through the use of four primary features

that are currently available in this platform. Results indicate that both academics and students engaged with all four primary features of the LMS, with the predominant features being content followed by assessments.

A positive statistical significant relationship ($p = 0.062$) was established between the assessment feature and the final grades awarded at the end of the course. This suggests that the use of a number of self-reflective assessments in the assessment feature helped students to better reflect on specific aspects of the theory, contributing to their academic achievement at the end of the course. These self-reflective assessments have promoted student engagement which has been collaborated by research in the field of ethics that suggest that repeated self-reflective activities have significant potential in increasing the students' personal engagement in the learning process [26].

A negative statistical significant relationship ($p = 0.050$) was established between the final student grades and content feature. This may be due to the fact that some students are not downloading the course material to their electronic devices, but are repeatedly returning to the LMS to review it. This may suggest that these students are not really technologically literate, which relates to the ability to use and manage technology. Other students may not be accessing the content feature, as they obtain the material from fellow students who have downloaded it. No other statistical significant relationships were discerned between the final grades of the students and the communication and administration features. These results indicate that the number of completed self-reflective assessments, rather than the number of content accesses, may be a valid indicator of future academic success.

The results of this study suggest that the effective use of a LMS still promotes student engagement and academic achievement, as 88% of the student successfully completed the module. Furthermore, these results suggest that some academics are widening their horizons and creating interactive experiences for students to enhance their learning. It is hoped that their experience and enthusiasm in using a variety of educational technologies will rub off on their fellow colleagues, thereby enhancing not only the teaching and learning process, but also revolutionizing the very essence of their pedagogical approaches.

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