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Student usage of a learning management system at an open distance learning institute: A case study in electrical engineering

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Abstract

Growth in student numbers and heavy teaching workloads may negatively influence the quality of teaching and learning in higher education. Various strategies have been introduced to try and address these concerns. One specific strategy involves the use of learning management systems to enhance the interaction between students and academics. The purpose of this article is to highlight student usage of a learning management system in electrical engineering at an open distance learning institute in South Africa, correlating it to the student's academic achievement. The lack of 100% student engagement suggests that not all students have access to the Internet. A relationship was established between the pass rates of the modules and the student usage of the learning management system and student support given via the learning management system. Final grade results suggest that students who fully engaged with the learning management system are more likely to succeed in an open distance learning environment.

Keywords

Learning management systems, Sakai, Moodle, Blackboard, student access, student support

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Introduction

Institutions of higher education in South Africa (SA) are currently experiencing low throughput rates (around 15% in recent years[1]) in many of their educational programmes, including electronic engineering. This has a negative impact on government subsidies received from the Department of Higher Education and Training (DoHET) in SA and subsequently on the approved budget for new equipment within the various departments in the faculties or colleges. Many factors contribute to this low throughput rate, including lack of student motivation, not aligning theory and practice within the curriculum and not exposing students to real world situations.[2] Other factors relate to the attitude of academics in resisting change to the effective use of educational technology[3] and in the little knowledge and skills that freshman engineering students possess.[4]

Educational technology provides rich possibilities for teaching and learning and for extending and connecting the spaces and places of students.[5] Equal amounts of learning are often accomplished in less time using educational technology and are preferred by students when compared with traditional instruction.[6] Educational technology encompasses a wide umbrella, including learning management systems (LMSs).

The University of South Africa (UNISA) is the largest open distance learning (ODL) institute on the African continent providing distance education to almost 400,000 non-residential students.[7] UNISA has mandated the delivery of online educational material to distance learning students in an effort to improve student access and student feedback.[8] One of the main platforms employed by UNISA to accomplish this delivery is through the use of an LMS. UNISA expects all its academic staff members to engage more fully with their LMS in an effort to provide more student support to their registered students. Engstrom and Tinto[9] state 'that access without support is not opportunity'! Therefore, students need to regularly access the LMS, and academic staff need to provide continuous support via the LMS if students are to benefit fully from this academic opportunity to improve their qualifications.

Student usage within an LMS is not simply defined as the number of times a student accesses the system. It is characterised by a number of activities, including logging onto the system, posting a comment in a discussion group, downloading an additional resource, uploading an assignment and participating in a self-assessment. This is also true of student support given by academics via the LMS, which also includes the logon, the uploading of an additional resource, the placing of an announcement, the participation in group discussions and the setting of self-assessments (all these activities may also be considered as academic usage of the LMS).

The purpose of this article is to highlight student usage of an LMS in electrical engineering at an ODL institute in SA, correlating it to the student's academic achievement. The article first reviews pertinent definitions of LMS and then focuses on prominent platforms being used in SA today, such as Sakai™, Moodle™ (Modular Object-Oriented Dynamic Learning Environment) and Blackboard™.

Benefits and challenges of using an LMS at an ODL institute are then presented, along with the case study that was used in this research. The research methodology and results follow.

LMSs defined

Watson and Watson[10] define an LMS as an infrastructure that delivers and manages instructional content, identifies and assesses individual and organisational learning goals, traces the progress towards meeting those goals, and collects and presents data for supervising the learning process as a whole. Important concepts of this definition to ODL institutions are that it delivers instructional content and presents data for supervising the learning process as a whole. ODL institutions in Africa cannot always rely on their postal services to deliver instructional content to their widely dispersed student body on time. Furthermore, ODL institutions need to efficiently ascertain the level of support that academics give to their registered students. These concepts of the LMS therefore impact on the universities' reputation as one of timely content delivery and regular student support. Both these concepts impact greatly on student academic achievement.[11]

Rapuano[12] focused on the functionality of an LMS and noted that it may be used to manage and allocate learning resources such as registration, instructor availability, instructional material fulfilment and online learning delivery. It can be used to manage learning by keeping track of students' progress and performance across all types of training activities.[13] LMSs are very much centred on the management and distribution of learning materials, synchronous and asynchronous communication, and progress tracking and reporting.[12] They are specialised learning technology systems based on the state-of-the-art Internet and web technologies in order to provide education and training following the open and distance learning paradigm.[14] However, they are not only used for open and distance learning, but are frequently used as course websites that accompany lecture-based courses given in higher education institutions.[15,16] Subsequently, LMSs play a major role in supporting or complementing traditional teaching pedagogies used in classroom or laboratory environments.[17,18]

However, the mere fact that content is always available for students to download does not improve learning in any way.[15] It must be emphasised that the provision of effective support and technological infrastructure is as vital as the quality of teaching for online learners as a lack of technical and student support decreases learning motivation.[19] Therefore, along with access to content, there must be regular student support via the LMS if students are to improve their chances of achieving academic success!

LMSs used in SA – Sakai, Moodle and Blackboard

In 2005, EDIA became the first European Sakai Commercial Affiliate that delivered Sakai development and support services.[20] Sakai is really a community

supported by a foundation, developing a suite of software. Moodle was first registered as a word in 1999 by Martin Dougiamas, its founder and lead developer.[21] Peter Taylor then initiated the first Moodle website for a university (Curtin University) in 2001, which has subsequently grown to include 68,631 sites worldwide. Blackboard was founded in 1997 by Michael Chasen and Matthew Pittinsky.[22] Blackboard works with thousands of higher education, K-12, professional, corporate and government organisations, providing them with tomorrow's education experience today.

Figure 1 presents a breakdown of all the universities currently in SA as listed on the Higher Education Management Information System along with their respective ages and preferred LMS, while Figure 2 highlights the number of student enrolments during 2012. Noteworthy, from Figure 1, is the observance that younger universities tend to prefer Blackboard with some of the older universities preferring Sakai. Moreover, a statistically significant relationship (p value = 0.018) was established between the ages of the universities and their preferred LMS. Figure 2 emphasises the number of students that have been exposed to the various LMSs in SA (Blackboard = 341,000 students, Moodle = 119,800 students and Sakai = 492,071 students), highlighting that it can indeed be a force for improving academic student support in SA, which is one of the benefits of an LMS.

Benefits of using an LMS

The implementation of e-learning by means of an LMS makes educational content available to students at any time from any location through web access.[24] This is

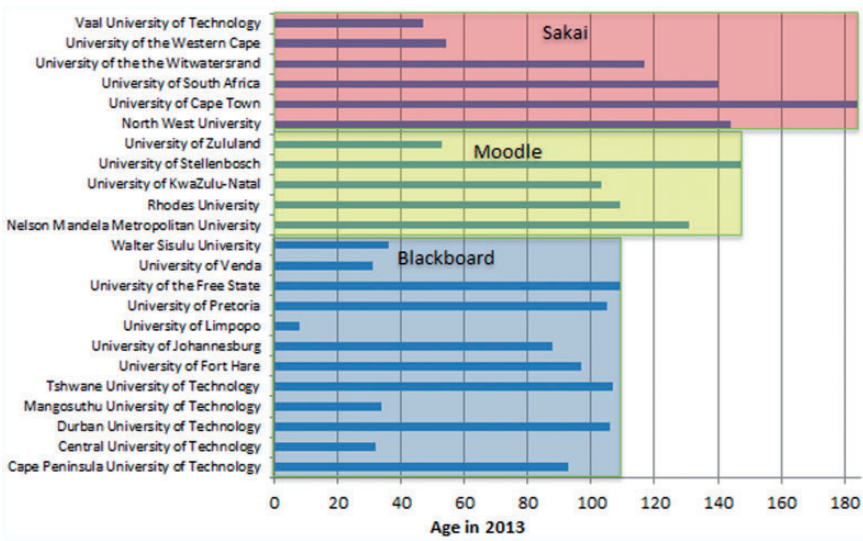


Figure 1. Universities in South Africa with their respective ages and learning management system (LMS).

maybe the singular most important benefit of an LMS, as it provides 24 h student access to the course content. The use of an LMS will make a one-stop access environment possible, where all the different educational technologies can be integrated into one platform.[24] The benefits of using an LMS include the following:

- increasing student motivation to learn and supporting active learning and problem solving;[25]
- offering students updated information to help them solve real-life problems;[25]
- enabling students and academics to seamlessly integrate real-world authentic activities within the class schedule;[25]
- providing students with interactive environments;[25,26]
- allowing students to organise information, contribute content and engage in learning activities;[27]
- facilitating various kinds of student–academic and student–student interactions;[24]
- supplying a number of synchronous and asynchronous communication tools;[28]
- furnishing tools that scaffold and support reflection on the learning process, e.g. journal keeping;[28]
- delivering intelligent agents to provide feedback on student work and help the academic monitor student progress;[14]
- expediting student feedback on submitted assignments or self-assessments;[8,26] and
- incorporating self-assessments so that students may prepare for examinations.[17]

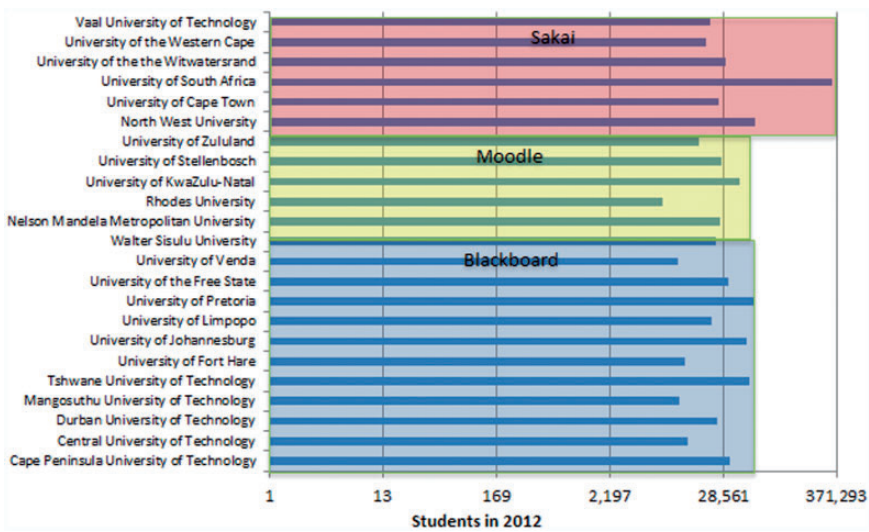


Figure 2. Universities in South Africa with their respective numbers and learning management system (LMS).[23]

Challenges of using an LMS

As with any software package, LMSs also have their fair share of challenges, including start-up costs (hardware and software) and staffing and training, which can be very expensive.[25] Software upgrades and product licenses are furthermore an ongoing financial expense to any university. New staff members are furthermore continually joining institutions of higher learning, which requires that continuous training programmes be offered to suitably equip these new members with the knowledge to effectively access and use the institution's LMS.

A major criticism of an LMS is that it is often used in very ineffective ways. Academics often use LMS to 'put content online' without applying any sound pedagogical principles.[15] For example, academics may post important documents or software on the LMS for students to access, but provide no guidelines on what to do with the document or how to use the software. So a major challenge faced by academics is to use the existing tools in pedagogically sound ways so that they take advantage of the online medium's affordances.[27]

According to Vrasidas,[27] another limitation of LMS is that it does not necessarily support constructivist learning, as it does not always provide academics and students with the tools needed to engage in constructivist learning. It also lacks tools to support authentic assessment. Usually, online assessment is based on written essays, short answers and multiple choice quizzes. Therefore, faculties often use the tools to create content-based assessment, even though they do not match the instructional objectives of the course.[27] Higher order questions (such as evaluate, analyse and design) may therefore be replaced with lower order questions (such as define, select and identify), which do not always promote critical thinking and deep learning.[29]

Other challenges to using an LMS in SA include the high costs of Internet access, students with limited financial resources, slow Internet penetration, low levels of ICT access, poor e-skill by students and quality assurance of assessments.

The cost of Internet access in SA is still relatively expensive when compared to Europe and the United States.[30,31] The total cost for residential uncapped Internet access in SA is currently around 26 per month.[32] In 2011, one out of every two black African households spent less than 60 per month on each of its members.[33] This means that roughly 43% of their expenditure would have to go to Internet access, something which is just not possible in SA's economic environment.

Large numbers of previously disadvantaged people live in many rural areas of SA with few employment opportunities[34] and subsequently limited household income. Students from these rural areas do not have the financial means to afford Internet access or the latest computer technology. They are therefore disadvantaged anew, in that access to an LMS is just not possible.

Internet penetration in SA is approaching 20%, with the Internet user base having grown from 6.8 million in 2010 to 8.5 million at the end of 2011.[35] Despite this growth, nearly 8 million people in SA still access the Internet on their mobile phones. In fact, personal Internet access is as low as 3% in some

provinces.[36] Internet access is therefore limited in many of the rural communities in SA, with access often gained through cell phone usage, which has a limited bandwidth. In fact Ko[37] declared that with the current low levels of ICT access, SA would find it difficult to provide most citizens with access to public services, such as e-government, e-entrepreneurship and e-learning services.

SA has citizens who are lacking in e-skills.[38] Students falling into this category would have difficulty in accessing and effectively using an LMS. This could well be true of freshman or first-year students who have not yet been exposed to ICT programmes. However, senior university students having been required to complete one or another ICT course during their studies and would therefore possess a set of specific e-skills.

Quality assurance of assessments is another challenge, as UNISA's assessment policy dictates that all assessments should be authentic.[39] In other words, the assessment must be completed by the registered students, and not by someone else. This is not readily achievable with an LMS when students are scattered over a wide region and therefore proves problematic in having the final grade marks of the students encompass these assessment marks.

Research methodology

This research encompasses a post-facto study involving a quantitative analysis showing descriptive data. It focuses on students enrolled for a BTech qualification in electrical engineering during 2013, with specific emphasis on electronic communication. Students have to obtain a minimum of 120 credits at National Qualifications Framework (NQF) level 7 to be awarded the B.Tech. degree in electrical engineering, which usually can be completed within 2 years. The majority of the modules in the B.Tech. programme have a credit value of 12 (representing 120 notional hours of study), with the exception of a capstone module (termed Industrial Projects 4), which has 36 credits attached to it. This means that students need to complete 7×12 credit modules, along with the compulsory capstone module to achieve the 120 credits. Six of the elective modules in this programme with a 12-credit weighting is Electronics 4 (ECT4), Microwave Engineering 4 (MWE4), Opto Electronics 4 (OPE4), Radio Engineering 4 (RAE4), Satellite Communication 4 (SCM4) and Electronic Communication 4 (ECM4). These six modules were selected for this study as they all form part of the electronic communication field. Quantitative analysis is done using the student usage statistics obtained from the LMS and student's final grade marks obtained from the information technology department.

Student usage of the LMS at UNISA is determined using two predefined reports available within the Sakai platform, namely 'Report (Less active users)' and 'Report (Users with no activity)'. These two reports indicate the number of times both academic staff and students access the LMS system along with their associated activity (e.g. posting of comments, setting of self-assessments or downloading of resources). The number of times students access the LMS during 2013 is then correlated to their final grade mark for the associated module, which they obtained

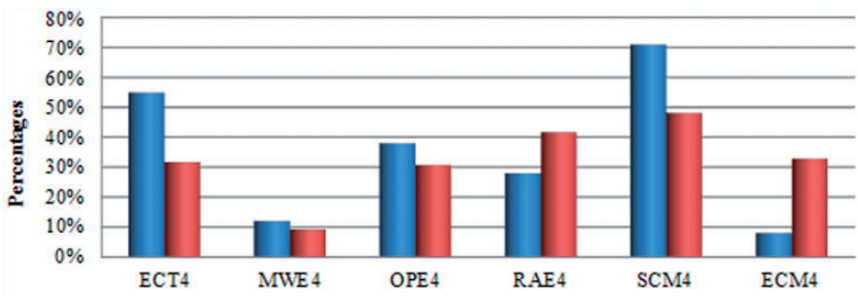
in the final examination during October/November of 2013. This is shown in table format. A correlation is also done between the final student grade marks and the number of times the academic accessed the LMS (in this research it is considered student support in terms of how the academic interacted with the students via the LMS).

Results and discussions

Figure 3 highlights the six modules offered within the electronic communication field showing their respective pass rates (students who obtained more than 50% for their final examination) and student accesses (these are students who wrote the examination and accessed the LMS more than 10 times). This figure only indicates the number of students who physically wrote the examination and does not include all the registered students. Many students register for the module but do not attend the exam due to various reasons (see Figure 4 for the number of students who registered at the beginning of the year for the modules and those that actually wrote the examination at the end of the year).

Figure 3 suggests that the pass rate of the module may be directly proportional to the student usage of the LMS when considering ECT4, MWE4, OPE4 and SCM4. However, the opposite is seen for RAE4 and ECM4, suggesting that the pass rate is inversely proportional to the student usage of the LMS. This may have been due to the change in the primary lecturer of the module or a change in the course syllabus. However, when considering the overall picture, a significant statistical relationship ($p = 0.096$) is established between the pass rate and student usage of the LMS (see Table 1).

Table 1 also reveals that a significant statistical relationship ($p = 0.068$) exists between the pass rate and the student support within the module (considered as the



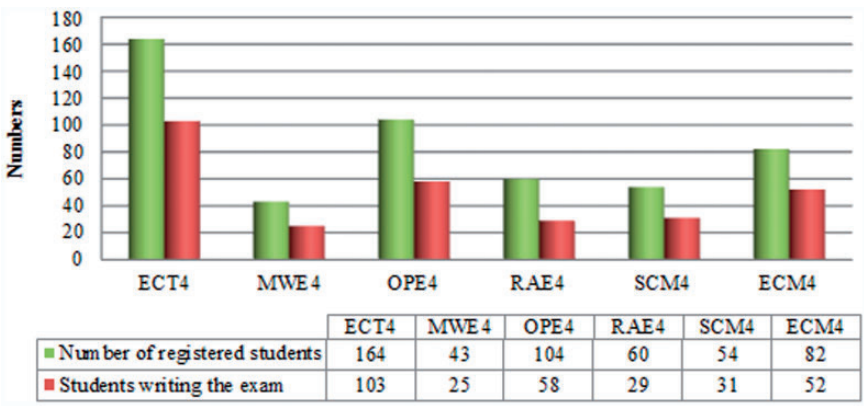
	ECT4	MWE4	OPE4	RAE4	SCM4	ECM4
Students passing the exam	55%	12%	38%	28%	71%	8%
More than 10 accesses	32%	9%	31%	42%	48%	33%

Figure 3. Students passing the exam and accessing the learning management system (LMS) more than 10 times.

academic usage of the LMS in order to interact with the students, be it via an announcement, a group discussion, the uploading of an additional resource, etc.). This suggests that both student usage of the LMS and student support via the LMS have a bearing on the pass rate of the module and subsequently on student achievement. Figure 3 furthermore reveals a serious concern when considering ECM4. Only 4 of the 52 students who wrote the examination successfully completed the module (Figure 4 shows the 52 students and Figure 3 indicates a pass rate of 8%). Moreover, only 17 accessed the LMS more than 10 times (33% from Figure 3).

Figure 4 suggests that many students desire to complete a higher qualification at an ODL institute but are not really committed to the examination process. This may be due to increased work commitments, unforeseen family responsibilities, unexpected tragic events, unrealistic module expectations and sudden economic downturns.

Figure 5 presents data showing the level of access by students for the six modules for the 2013 academic year. One out of five students (around 22%) did not access the LMS system at all for three modules (ECT4, MWE4 and OPE4). This may be due to a lack of financial resources, a lack of computer technology and a lack of



	ECT4	MWE4	OPE4	RAE4	SCM4	ECM4
Number of registered students	164	43	104	60	54	82
Students writing the exam	103	25	58	29	31	52

Figure 4. Registered students versus students writing the exam.

Table 1. Correlations between pass rates and student accesses or student support.

Correlation between pass rate and student accesses		Correlation between pass rate and student support	
Pearson	0.618	Pearson	0.681
Significance	1.571	Significance	1.861
p value[a]	0.096	p value[a]	0.068

[a]$p < 0.1$ level.

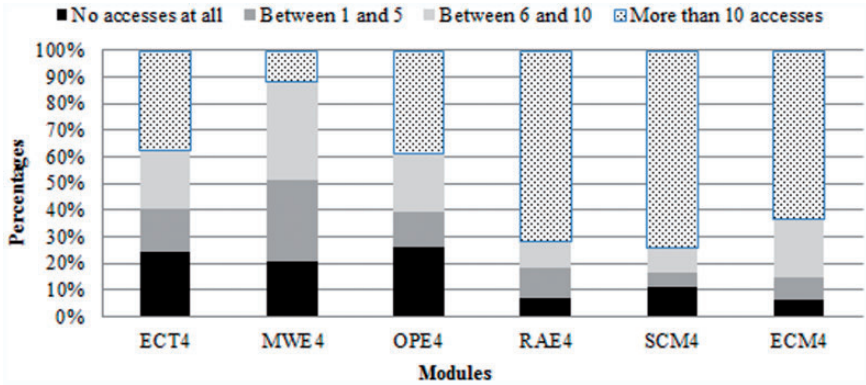


Figure 5. Student accesses to the learning management system (LMS) per module.

connectivity or a lack of e-skills. It may also be that these students were not encouraged by the academic to access the LMS (therefore, the little or no student support) or that they were not really committed to the examination process. This is also attested to by the fact that less than 40% of the registered students accessed the LMS more than 10 times. On the other hand, more than 60% of the registered students accessed the LMS more than 10 times for the modules RAE4, SCM4 and ECM4. This suggests that these students were maybe really committed to the examination process and that the academics accessed the LMS many times providing additional resources and announcements for the students to access. The average number of student accesses is also higher for the last three modules than for the first three modules, suggesting that more resources and information were made available by the academics for their students (see Figure 6).

Figure 6 shows the total accesses by the academic versus the average accesses per student in each module. This figure suggests that the academics in ECT4, MWE4 and OPE4 did not really interact with their students via the LMS. This could be due to the fact that the primary lecturers are temporary external contract lecturers with no real commitment to the LMS policy of UNISA. On the other hand, RAE4, SCM4 and ECM4 are all managed by full-time internal associate professors who are really committed to the improved use of the LMS. An increase in academic access furthermore exerts a positive influence on the access by students.

Engineering academics at UNISA accessed the LMS for a number of reasons. First, the academic in RAE4 and SCM4 posted additional reading material in response to questions received via email from the registered students. These were termed frequently asked questions (FAQs), which enabled all registered students to view the email questions sent to the academic along with the appropriate response. Examination preparation questions, announcements of encouragement and support, supplementary information regarding good study habits and feedback on assignment submissions were also posted. The academic in ECM4 posted many additional calculation examples for students to complete. Previous examination

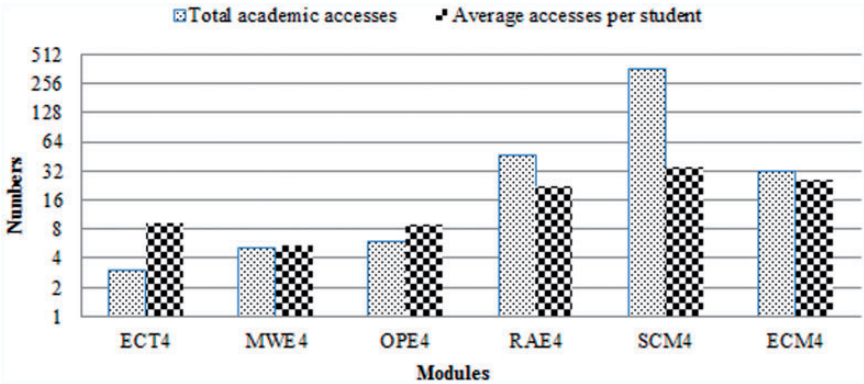


Figure 6. Total academic accesses versus the average access per student.

papers were posted by the departmental secretary for ECT4, MWE4 and OPE4, as they were handled by external contracted lecturers.

Conclusions

The purpose of this article was to highlight student usage of an LMS in electronic communications at an ODL institute in SA, correlating it to the student's academic achievement. Student and academic usage was defined in terms of logging onto the LMS, downloading or uploading resources, setting or taking self-assessments and participating in group discussions. A significant statistical relationship was established between the pass rate and the number of student accesses ($p = 0.096$) and between the pass rate and the student support within the module ($p = 0.068$). This suggests that both student access to the LMS and student support via the LMS have a bearing on the pass rate of the module and subsequently on student achievement. ODL institutions must therefore place more emphasis on the use of their LMS by both students and academics, which could see an improvement in throughput rates and an increase in subsequent government subsidies.

Conflict of interest

None declared.

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