The night before the test: Electrical engineering students' use of online resources to prepare for assessment

Faculty of Engineering | Department of Electrical and Electronic Engineering

Module: Systems and Signals 214
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BLENDED LEARNING CASE STUDIES 2016

Context

Background overview

Stellenbosch University has increasingly expanded its use of various technologies to support student learning. At the same time, the Faculty of Engineering has experienced a rapid growth in student numbers representative of the socio-economic and cultural diversities of the country. The use of ICT has offered the possibility to address this challenge and still maintain a competitive level of teaching and learning. One of the ways in which ICT has been used is by making resources available online for students.

The module Systems and Signals 214 is compulsory for all second-year Electrical and Electronic Engineering students, introducing various key concepts in this field. The use of technologies to assist learning forms an integral part of the teaching of and learning in the module. Much of the literature on the use of technology to support learning appears to assume that the accessibility of materials and the nature of the net generation means that students are engaging in learning in their own time and at their own choice of venue. This has led to increased interest in researching how students are learning under these new conditions. In other words, what are the affective manifestations of the new systemic mechanisms?

A study done by Howell, Jahrig and Powell (2004) suggests a significant relationship between academic performance and sleep quality for students carrying a greater workload, as is the case with electrical engineering students. In 2016, the lecturer wanted to determine if this suggestion holds true for situations where resources designed to support understanding and assessment are available on a 24/7 basis (systemic). The aim was to use students' SUNLearn activity logs to ascertain their sleep patterns (affective) and how this correlates with students' academic performance (cognitive).

Subject area

Systems and Signals 214 covers an introduction to the field, which includes circuit analysis techniques and power calculations for both direct current and alternating current circuits and the analysis of basic cases of transient behaviour in passive circuit networks. Some concepts and analysis techniques for balanced three-phased circuits are also introduced.

Intended learning outcomes

Using the SUNLearn activity logs, the lecturer wanted to explore students' use of the electronic study resources available on SUNLearn. Analysing the activity reports available on the learning management system could provide insights into the access of the online resources in relation to the students' sleep patterns and academic performance. Through this analysis of student study habits, the lecturer hoped to contribute to the growing body of knowledge on technology-supported student learning that takes us beyond the typical endorsement of a technology resource (Laurillard, 2007) and enables a more refined understanding of the educational problem being addressed.

Established practice

The presentation format of the module consists of three lectures and a tutorial or practical session each week. The lectures are formal "chalk & talk" sessions where theory and some examples are discussed. The tutorials follow a problem-based learning approach where students are expected to apply what they have learned and assistance from lecturers and student assistants is available. From a cognitive support perspective, the course material made available to the students in this study include a module framework, a textbook, lecture notes, tutorials, tutorial tests, practical assignments and memoranda for the tutorials and tutorial tests.

The challenge

Many of the studies on the relationship between the affordances of technology and engineering student learning focus on student perceptions and suggest a technological panacea for the woes in engineering education. There is little interrogation into how and when students use what kind of resources and what kind of learning this enables, however. The question of time is a crucial one and technology has offered a way for lecturers to avoid the 'too-little class time' issue and shift the responsibility of learning to students in their own time.

The first assessment for all engineering modules at Stellenbosch University is written in one week at approximately the halfway point of the semester while lectures are suspended. Students therefore write one test a day for five days under examination conditions. The possibility exists that students

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do not get enough physical rest, which may influence their academic performances. During 2016, the assessment took place towards the end of test week. The analyses of test performances became a matter of contention since the relationship between sleep patterns and fatigue became a point to investigate from an ethics-of-care perspective.

Advantages associated with the integration of technology

On SUNLearn, a time-stamped activity log was created for every item that users clicked on when signed onto the course website. This allowed the opportunity to correlate the use of online resources, the length of use and academic output. The integrated technology used was therefore online resources and SUNLearn logs.

Student overview

The two cohorts (i.e. year 1 and year 2 of the project) whose activity logs were investigated both consisted roughly of 160 second-year students each. Stringent entry requirements are applied to all students who study Electrical and Electronic Engineering and their basic maths and science skills can therefore be considered to be above average. The module in question is compulsory for all students who wish to obtain a BEng (Electrical and Electronic) degree and it is a co-requisite for a further three second-semester modules, namely Energy Systems 244, Electronica 245 and Systems and Signals 244. The motivation for students to pass this course can therefore be considered to be high.

Learning and assessment activities

Educational approach

The workload for engineering students has steadily increased. In an engineering thermodynamics course study (Taraban, Hayes, Anderson & Sharma, 2004), the authors researched the impact of lecturers' use of technology to expand the possibilities for instruction. Students were asked to keep an activity log of their engagement with module resources and activities. These logs were then analysed in relation to course performance. Key findings indicate a strong correlation between online homework problems and course grades.

Taking inspiration from this study, the lecturer thought that it would be valuable to explore her own students' interaction with online resources to understand better the challenges of time management that students face and to reflect on future interventions when curriculum reform is envisaged.

The lecturer framed her investigation by three complementary perspectives as proposed for open distance learning, i.e. cognitive, systemic and affective aspects (Tait, 2000). These different characterisations are based on the centuries-old philosophy of the education of the whole person (Brühlmeier, 2010), the so-called head, heart and hand dimensions.

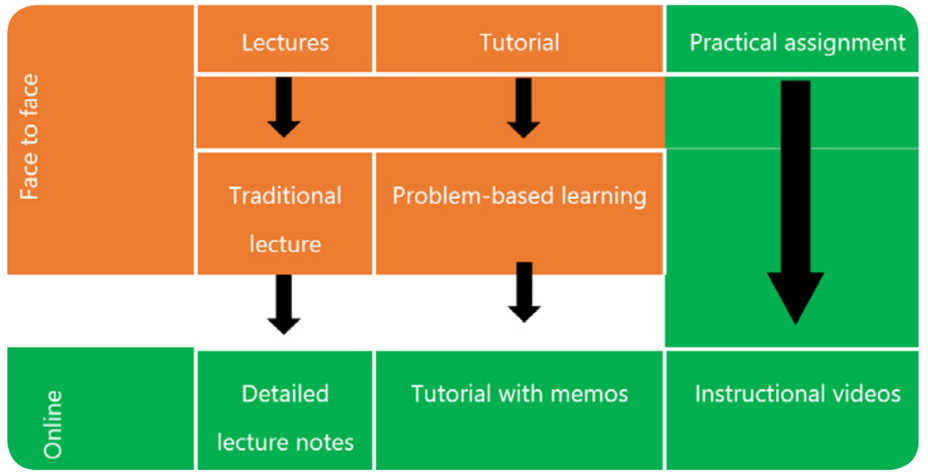

Figure 1: Presentation format of the module

The module consists mainly of traditional lectures, tutorial sessions and practical assignments. Figure 1 above shows that the lectures and tutorial sessions take place face to face. In addition to these sessions, detailed lecture notes, tutorials with memos and practical assignments (with instructional videos) are made available on SUNLearn. The instructional videos are available before and during the practicals. As a whole, the module provides an enabling system for student learning. The time-stamped activity log allowed the opportunity to correlate the use of online material, the length of use and academic output.

Student self-regulation

Access to the learning material occurred at the students' own pace and time and in their own space. The lecturer posted all the instructional and learning materials before the teaching sessions, which remained available

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to the students throughout the semester. The lecturer did not monitor the students' use of these support materials; it was the students' own responsibility to manage their learning.

Time	User full name	Affected user	Event context	Component	Event name	Description	Origin
22 May, 23:52			File: Tut 5 Memo	File	Course module viewed	The user with id '100429' viewed the 'resource' activity with course module id '412437'.	web
22 May, 23:51			File: Lecture 17 February - English (Natural response of parallel RLC - Crit Damped)	File	Course module viewed	The user with id '77603' viewed the 'resource' activity with course module id '400293'.	web
22 May, 23:51			Course: 2017-46779-214 Stelsels en seine - Systems and signals - 214	System	Course viewed	The user with id '77603' viewed the course with id '29344'.	web
22 May, 23:45			File: Tutorial 5	File	Course module viewed	The user with id '100429' viewed the 'resource' activity with course module id '411547'.	web
22 May, 23:42			Course: 2017-46779-214 Stelsels en seine - Systems and signals - 214	System	Course viewed	The user with id '86251' viewed the course with id '29344'.	web
22 May, 23:42			Course: 2017-46779-214 Stelsels en seine - Systems and signals - 214	User report	Grade user report viewed	The user with id '86251' viewed the user report in the gradebook.	web
22 May, 23:42			Course: 2017-46779-214 Stelsels en seine - Systems and signals - 214	System	Course viewed	The user with id '86251' viewed the course with id '29344'.	web
22 May, 23:40			File: Tutorial 4	File	Course module viewed	The user with id '97552' viewed the 'resource' activity with course module id '405946'.	web
22 May, 23:39			Course: 2017-46779-214 Stelsels en seine - Systems and signals - 214	System	Course viewed	The user with id '97552' viewed the course with id '29344'.	web
22 May, 23:38			File: Tutorial 4	File	Course module viewed	The user with id '97552' viewed the 'resource' activity with course module id '405946'.	web

Figure 2: Example of SUNLearn activity logs

Learning environment

Technology resources

The learning technologies used to create the instruction videos included video cameras and Camtasia software over and above the laboratory technologies used for the demonstrations. SUNLearn was used for all the online resources and activities. The learning management system was reliable, accessible and widely used by both the lecturer and the students. The practical assignments were accompanied by instructional videos made available online for use by the students.

The SUNLearn logs were used to explore the student's interactions with the online resources and subsequently the relationship between the students' interactions and their sleeping patterns and academic performance.

Assessment impact

When combining the overall assessment performance with the time of last access to the course-website data versus test-performance graph shown in Figure 3, it can be seen that the students who went to bed after 02:00 all fall in the category of students who failed the assessment. Figure 2 therefore suggests that there is a relationship between the number of hours that the students slept the night before the assessment and their academic performance. This suggested relationship is not, however, reciprocal: the students for whom online activity after 02:00 was logged all failed the assessment but not all the students whose activity stopped before 02:00 passed the assessment either. This unidirectional relationship means that a variety of factors influences academic performance.

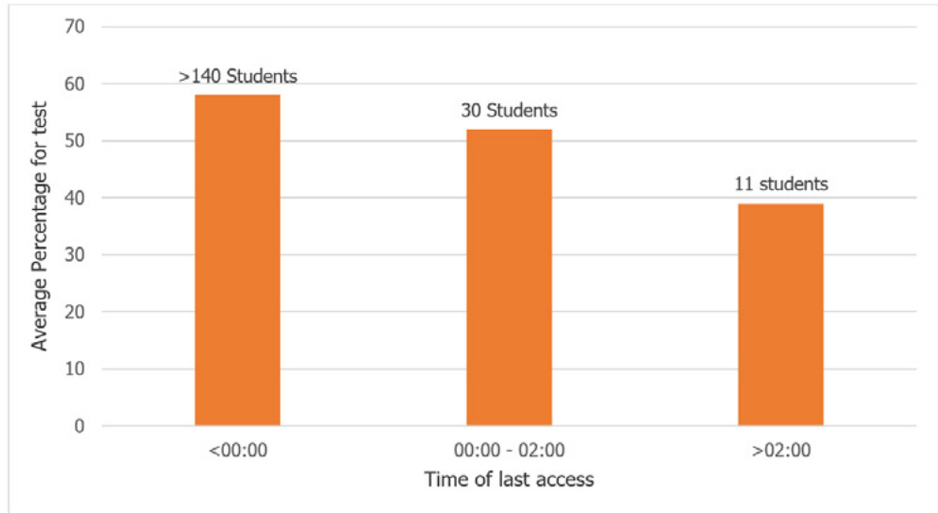

Figure 3: Average assessment performance per sleep category

The data confirm that blindly emulating seemingly successful content access behaviour is not enough to ensure academic success; i.e. having only access to content intended to support successful academic outcomes is not a guarantee for academic success. What other factors together with readily available online resources that support and enhance successful academic outcomes in the Systems and Signals 214 module are therefore open for further investigation?

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The lecturer was able to draw the following conclusions:

1. The negative impact of student behaviour from an *affective* perspective manifested *cognitively* in a 100% failure rate for all the students who demonstrated poor sleep hygiene (those whose online activity ceased only after 02:00).

2. Struggling students - for whom the learning management system (LMS, i.e. Moodle), from a *systemic* perspective is seemingly ideal given the 24/7 provision of a range of materials to support deep learning - it gives the impression that gaining proper understanding of the concepts is not a priority.

3. Top performing students study habits suggest an ideal *cognitive-affective-systemic* synergy. Their personal systemic is evident through a multimodal approach to the learning support materials (both offline and online), which appeared to enable or, indeed, result from the positive *affective* behaviour evident in their sleep hygiene.

**Figure 4: Student studying

General

Opportunities

The time-stamped activity log data provided by SUNLearn are a very effective way in which entirely objective data regarding student study behaviour can be collected. The data collection method is, in the lecturer's opinion, more reliable than self-reported data, since the students do not know that their behaviour is being analysed and can therefore not adjust their behaviour or exaggerate certain aspects of it during reporting.

Further investigation into students' time management skills in a highly complex and dense knowledge environment (engineering) is recommended.

Further research on students' perceptions of their quality and quantity of learning using SUNLearn is necessary. Comparison between modes of learning and learning outcomes in an engineering context is envisaged.

Challenges

The log data are available for only one year, which means that all the data must be collected and stored before the one-year window expires.

Advice

The lecturer is sure that many more insights into student study habits can be obtained by analysing the log data available on SUNLearn. This study suggests that academic success is significantly linked to evidence of 'responsible' (or self-regulated) learning but that this is not the reality for the majority of the students in the study. The question of the appropriated of materials and platforms in relation to learning outcomes or objectives is a significant one given the proliferation of technology-supported learning initiatives.

Other concluding thoughts

One clear advantage of SUNLearn, which enables student behaviour tracking, is that it facilitates a richer view of the complex relationship among the cognitive, the affective and the systemic domains of student learning support. This understanding, however, needs to be accompanied by a deeper interrogation of how the actual learning materials facilitate deep, strategic, surface learning and a more focused study of how the 24/7 availability of learning materials actually influences study behaviour. The

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current study suggests that students are lured into a false sense of security by believing that they can access materials at the last minute and that this might be sufficient to pass. This clearly is not the case and the study in question hopes to make a contribution to a more refined understanding of the affordances and constraints evident in the use of technology-based learning support.

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