Research Article

Structuring Online Self-assessments in a Learning Management System to Promote Reflective Practice!

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Abstract

Learning management systems help students to engage more fully with course content at any given time and location where Internet access is available. One of the four main key features of such systems is the assessment feature, which includes a very useful subsidiary tool called self-assessments. The purpose of this paper is to highlight how an academic in electrical engineering structures self-assessments in a learning management system to promote reflective practice among undergraduate students. A time-lag study is employed where both qualitative and quantitative data is analysed and presented using descriptive statistics. A moderate positive statistical relationship ($r = 0.504$ and $r = 0.527$) exists between the number of correct responses to the self-assessments and the final grades awarded to the students at the end of the semester. These results tend to suggest that some academics and students are benefitting from using self-assessments. Academics become more proficient and confident in presenting the course content, as they consistently set online self-assessments. Students become more proficient and familiar with the course content, as they consistently complete the online self-assessments.

Keywords: electronic communication; Blackboard™; self-assessments; eThuto; reflection

1. Introduction

"Learning without reflection is a waste. Reflection without learning is dangerous". These words, uttered by Confucius, clearly indicate that students in higher education (HE) MUST engage in reflective practice if their learning is to be beneficial. Reflective practice is defined as "a cognitive process and an open perspective that involves deliberate pause to examine beliefs, goals and practices in order to gain deeper understanding that leads action to improve the lives of students" [1]. This pause to examine practices or principles enables students to gain a deeper understanding of difficult abstract concepts which are often found in HE. One key way to implement reflective practice is through the use of online self-assessments in a learning management system (LMS).

Chu et al. [2] alludes to a key advantage of a LMS in that it allows students to "time shift" and "place shift". In other words, students are able to engage with online assessments in a LMS at any time or place where Internet access is available. Pre-scheduled online self-assessments in a LMS provide self-reflection and motivation for students to engage in and manage their learning [3]. Online self-assessments further provide students with

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immediate feedback, helping them to improve their self-knowledge and self-regulation skills [4]. However, to enable authentic improvements in learning progression, self-assessments need to be consistently implemented for student learning [5]. The research questions therefore arises "How can academics structure and consistently implement self-assessments in a LMS to promote reflective-practice"?

The purpose of this paper is to highlight how an academic in electrical engineering structures self-assessments in a LMS (BlackboardTM platform used [6]) to promote reflective practice among undergraduate students. A time-lag study is employed where both qualitative and quantitative data is analysed and presented using descriptive statistics. Literature pertinent to reflective practice is firstly presented, along with a method of structuring self-assessments. The context of this study is then clarified along with the research methodology. Results are depicted in a table followed by succinct conclusions.

2. Reflective Practice and Assessment

The theory of reflective practice was initially introduced in the field of city planning, or design, by Donald Schön [7]. The seminal work of Schön [8] identified three types of reflective practices, namely reflection-in-action, reflection-on-action and reflection-for-action. Schön attempted to explain how practitioners actually engage with their practice and discovered that designing appears to include a reflective conversation with oneself [9]. In other words, when academics design and develop assessments, they actual engage in a conversation with themselves as they contemplate what students have learned in a class and how they could assess it. They therefore reflect on the learning outcomes of a course or module, and ensure that those learning outcomes are assessed. Learning outcomes need to be clear, concise, measurable, manageable, reasonable and sustainable [10]. The aspect of measurable is clearly linked to assessments which must be designed in such a way that students may be able to demonstrate achievement of the learning outcomes. This brings to mind constructive alignment that refers to establishing a teaching environment where the teaching activities support and lead to the achievement of the desired learning outcomes as evidenced by students' engagement with the assessment tasks [11]. Academics must therefore reflect on the learning outcomes and various assessments task, or tools, achieving a balance between them in constructing effective self-assessments to promote reflective practice among students in HE.

3. Structuring Online Self-Assessments

Reflective assessments may involve creative thinking [12]. Creative thinking involves seeing situations in different ways and has two main components, namely "generation of novelty" (via divergent thinking) and "evaluation of novelty" (via convergent thinking) [13]. Students need to engage in divergent thinking by generating many new ideas or ways of explaining abstract concepts, where more than one idea is correct. However, convergent thinking is usually considered when only one possible solution to a particular problem is presented.

Creative thinking is involved when engineering students are requested to explain engineering abstract concepts to non-engineering individuals. Firstly, engineering students need to define the specific abstract concept, calling on their prior knowledge to help them. They then need to reflect on the profession of the non-engineering individual, finding some or other link between the duties or responsibilities of the individual and the definition of the abstract concept. Creative thinking then comes to the fore in that the engineering student needs to tell a short story or illustration in which the abstract

concept is explained in terms of the non-engineering individual‟s duties or responsibilities. This same process was followed by the academic in structuring the online self-assessments. The academic reflected on the learning outcomes, and identified important abstract concepts which students may find difficult to understand or recall. The academic then identified a well-known duty or responsibility of a specific non-engineering individual that corresponds to the definition of the abstract concept. Consider two examples.

Filters are widely used in electronic communication to allow certain frequencies to pass, while attenuating all other frequencies. One of the questions posed to students in the online self-assessments is: How would you explain the operation of a filter to a bus driver? Now, the student must first recall (lowest level of Bloom‟s taxonomy [14]) the definition of a filter. The student must then identify one of the responsibilities of a bus driver and link it to the definition (creative thinking). One responsibility relates to checking if boarding passengers have the right ticket or monetary value. If not, then they are refused entry onto the bus and cannot proceed to the following stage of the journey. Similarly, if a frequency does not have the right value dictated by the filter, then it will not be allowed to enter or pass to the following stage of the circuit (this is the short story or illustration which the student must provide).

Another abstract concept relates to line of sight propagation for communication systems, which is defined as propagation in which the direct ray from the transmitter to the receiver is unobstructed. One of the questions posed in the online self-assessments is: How would you explain line of sight of a Microwave system to a hunter who hunts springbok with a rifle? Again, the student must first recall the theory or definition of line of sight (quantitative stage of learning according to Biggs [15]). Then the student must identify one of the responsibilities of a hunter, which is to kill the springbok in order to provide food for his family or community. However, there must be no obstruction between the rifle and the springbok, just as there may be no obstruction between a transmitter and receiver for a Microwave system (again, the short story or illustration).

These short stories, or illustrations, help students in two ways [16]; firstly it helps them to gain a better understanding of the abstract concept; second it helps them better retain the information for future use. Four to five of such short stories, or illustrations, were requested from students for each of the four main sections of the syllabus, resulting in a total of 17 questions in the online self-assessments. Each of the four online self-assessments was set prior to the classroom discussions of a main section of the syllabus wherefrom specific abstract concepts were selected that may prove challenging for students to understand or recall. These were then made available within two weeks of completing the main section of the syllabus. This procedure corresponds to other studies where online self-assessments have been validated as a formative assessment strategy [17]. This results in consistent delivery over the course period, which is a key requirement of online self-assessments if progression of student learning is to be achieved. The responses of the students were then reviewed and the results were presented to the students in order to train them in how to answer future online self-assessments. The discussion of the various responses also helped them to reflect on which response was correct or incorrect, further helping them to synthesize the abstract concept (higher level of Blooms taxonomy [14].

4. Context of This Study

Electronic Communications Systems 4 (EKS4) is an optional course or module for the Baccalaureus Technologiae (BTech: Engineering: Electrical)

qualification in South Africa [18]. This module requires students to dedicate at least 120 notional hours to it, thereby enabling students to obtain 12 out of the required 360 credits for the BTech qualification. The Central University of Technology (CUT) operates on a semester basis of roughly four months during which time BTech students attend one 4 hour class per week over a 12 week period. 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 one year of full-time study.

The EKS4 syllabus covers four main theory sections with a total of 56 specific learning outcomes [10]. Formative assessments include two written classroom tests, four practical assignments and four online self-assessments. All these formative assessments contribute to the student‟s final grade. A final written summative assessment is completed at the end of the semester.

5. Research Methodology

A time-lag study is used where both qualitative and quantitative data is analysed and presented using descriptive statistics. Descriptive research occurs where a specific situation is studied to see if it gives rise to any general theories, and a time-lag study determines the impact of a particular event on a group of students over a specific period of time [19]. The particular event is the introduction of online self-assessments for promoting reflective practice among undergraduate students enrolled for EKS4 (being the group of students). The time period is limited to 2014 and 2015, when EKS4 was offered during the second semester of the year (August to November).

Descriptive statistics, rather than inferential statistics, are used as the results are interpreted with regard to specific engineering students enrolled at CUT. Descriptive statistics include the student profile, the number of students who could provide an appropriate short story, or illustration, and the final grades awarded to the students in the module EKS4.

The target population was restricted to all engineering students enrolled for EKS4 during 2014 and 2015 (n = 29). However, only 22 of these students engaged with more than 50% of the online self-assessments which were then analysed qualitatively. This involved reviewing the responses of the students and determining if their short story, or illustration, made sense (i.e. if it would help the non-professional to understand the abstract concept).

The quantitative data is related to the final student grades obtained in this module, which were then correlated to the total number of correct responses for the self-assessments. Pearson correlation values of between 0.5 and 0.8 are considered a moderate positive correlation.

6. Results

The profile of students registered for EKS4 during 2014 and 2015 highlights that the majority of students were male (80%); substantiating the fact that Engineering tends to be dominated by males [20]. The majority of students (75%) 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 [21]. The dominant home language is Sesotho (40% of students); this is indicative of the Free State Province in South Africa [22]. Table 1 presents the descriptive statistics; the first column shows the number of questions attempted by the students; the second column the number of correct short stories, or illustrations; the third column the final grades. A moderate positive statistical relationship ($r = 0.504$ and $r = 0.527$) exists between the number of correct responses and the final grades awarded to the students at the end of the semester.

7. Discussion and Conclusions

The purpose of this paper is to highlight how an academic in electrical engineering structures self-assessments in a LMS to promote reflective practice among undergraduate electronic engineering students. This involved the following steps:

1. Reviewing the learning outcomes of each section of the module and determining which abstract concepts would be difficult for students to understand

2. Identifying a non-professional that has a duty or responsibility that may be linked to this abstract concept

3. Setting the online assessment before the classroom discussions and making it available within two weeks of completing that specific section of the module

4. Reviewing the responses with the undergraduate students and training them in how to answer future online self-assessments.

Table 1. Correlation between the correct responses in the online self-assessments to the final grades of the students

2014 - EKS42AI		
Number Questions	Correct Responses	Final Grades
17	17	100
17	6	54
14	4	67
17	6	55
13	2	53
17	5	55
14	3	54
17	8	71
17	8	64
17	5	50
14	3	58
Samples (n =)		10
Correlation (r =)		0.504
Less than 50% engage		6
Throughput rate		88%

2015 - EKS42AI		
Number Questions	Correct Responses	Final Grades
17	17	100
17	10	58
14	6	40
17	6	50
17	10	68
17	8	70
14	10	81
9	3	67
13	0	34
13	1	41
12	5	60
10	1	54
17	3	77
Samples (n =)		12
Correlation (r =)		0.527
Less than 50% engage		1
Throughput rate		75%

Training students with regard to answering the online self-assessments was done in the following way:

1. Students were firstly encouraged to recall the definition of the abstract concept

2. They were then instructed to review the duties or responsibilities of the non-engineering individual, attempting to find a link or similarity to the definition

3. Students were then encouraged to write a short story, or illustration, that would help the non-engineering individual to better understand the engineering related abstract concept.

A study by Nolan and Swart [23] revealed that an institutional LMS did not really help students to better understand abstract concepts in a statistical course. However, it was recommended to increase its usage among undergraduate students. In this study, undergraduate students were requested to complete four online self-assessments over a 12 week period were 17 difficult abstract concepts were presented. This resulted in a consistent delivery of the self-assessments (every 3 weeks) and increased usage of the LMS. A moderate positive statistical relationship was found to exist between the total number of correct responses and the final grades of the students.

Although this study was limited to only two academic years, it does suggest that the academic and the engineering students are consistently engaging with reflective practice. The academic is reflecting on selecting difficult abstract concepts from the learning outcomes and an appropriate non-engineering individual to whom students need to relate. Students need to reflect on the duties and responsibilities of these non-engineering individuals formulating an appropriate short story, or illustration, which will help the individual to better understand the abstract concept. Learning with reflection is therefore not a waste, but truly beneficial to all involved!

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