An e-Assessment method based on the Constructive Progressive Alignment Pedagogy

Richard Lai and Nurazlina Sanusi
Department of Computer Science and Computer Engineering
La Trobe University, Victoria 3086, Australia
Corresponding Author Email: r.lai@latrobe.edu.au

BACKGROUND

Web-based or "online" learning commonly known as e-Learning which makes use of internet technologies has been widely used by many education institutions around the globe. Higher education institutions have been offering Learning Management Systems (LMS) as a part of campus-based and distance teaching and learning. However, many past researches in e-Learning mainly focussed on developing tools, reporting classroom experiences, scientific evaluation of techniques and technologies applied in the classroom rather than carrying out learning activities for enhancing student learning. With a LMS such as Moodle, using learning activities like e-Assessment, e-Forums and e-Discussions can potentially increase student learning; however, this is not very well understood and researched into.

PURPOSE OR GOAL

The aim is to find out if and how e-Assessment tasks can enhance student learning.

DESIGN/METHOD

We have devised a pedagogy called Constructive Progressive Alignment (CPA) which is an extension to Bigg's Constructive Alignment. Our e-Assessment method is based on the CPA principle and includes: a variety of smaller and regular e-Assessment tasks (Multiple choice quizzes, problem solving questions with some related to industrial/commercial issues, essay type, peer review, laboratory questions, tutorial questions on the materials taught), the deadline associated with each task, deadline reminders when students log onto Moodle, prompt feedbacks on the e-Assessment tasks, clear marking guidelines for the tasks, and Moodle displaying their e-Assessment marks progressively once an e-Assessment task has been marked.

RESULTS

We have used this strategy for teaching a few software engineering subjects each year since 2011. With an approval from the University, we are allowed to conduct a questionnaire and an interview with the students about their learning experiences. The results showed that the e-Assessments tasks and the ways they were implemented on Moodle based on the CPA pedagogy have positive contributions to student learning.

CONCLUSIONS

We can enhance student learning by having a good strategy in using the features of a Learning Management System like Moodle and organising e-Assessment tasks according to the CPA principle.

KEYWORDS

e-Assessment, student learning, Moodle, Constructive progressive alignment

INTRODUCTION

E-Learning system also known as Learning Management System (LMS) which makes use of internet technologies has been widely used by many education institutions around the globe. BlackBoard, WebCT, Moodle etc. are not only LMS tools that support e-teaching and learning but also support collaborative learning (Paechter et al 2010). Higher education institutions have responded by offering LMS as a part of everyday experience in campus-based and distance learning of teaching and learning. LMS supports blended learning that offers student the flexibility and accessibility in their learning. Blended learning is a combination of face-to-face and e-Learning practices (Derntl, et al, 2005;.Garrison, et al, 2004). Blended learning involves instruction and learning activities occurring both online and in classrooms. The effective uses of educational technologies remain as some of the central issues for both educators and researchers.

Research into the use of LMS mainly investigates students' perceptions of their learning regarding e-learning system's effectiveness. Several new technologies such as mobile computing, ubiquitous computing, ontology engineering, semantic web, grid computing, XML services have offered a kind of flexible educational platform for LMS. However, the uses of teaching technologies may not lead to a significant effect on student learning but they do support learning since they enhance students' learning experiences.

Computer-assisted assessment or e-Assessment has become an important part of LMS. Struyven et al. (2005) conducted a review on student's perceptions of online assessment in higher education and reported that there is a relationship between student's perceptions and their actions regarding the varieties of assessment modes. Based on an extensive review of literature, Buzzetto-More and Alade (2006) reported that assessment of student learning in an online environment required technology and e-learning strategies to determine the success. A study on student's perceptions with online delivery using a constructivist approach to learning was conducted by Hughes et al (2002). In their study, 220 students participated in an evaluation of online delivery; and they found that learning with web-based environment can improve their interests in learning.

E-Assessment has thus been identified as a good practice but little research has been conducted on how and to what extent e-Assessments contribute to student learning. With LMS such as Moodle, using learning activities like e-Assessment, e-Forums and e-Discussions can potentially increase student learning; however, this is not very well understood and researched into. The paper presents a method of using e-Assessment tasks for enhancing student learning. We have applied the method to teaching a few software engineering subjects; and their results are very positive but in this paper we are only able to include the results of a subject taught in 2011.

MOODLE

Our University has been using Moodle as the LMS for teaching and learning since 2011. Moodle (Modular Object-Oriented Dynamic Learning Environment) (http://moodle.org) is an Open Source Course Management System (CMS), also known as a Learning Management System (LMS). It has become very popular among educators around the world as a tool for creating online dynamic web sites for their students. Moodle aims to give educators good tools to manage and promote learning, but there are many ways to use it. For instance, it has features that allow it to scale to very large deployments and hundreds of thousands of students, yet it can also be used for a primary school or an education hobbyist. Many institutions use it as their platform to conduct fully online courses, while some use it simply to augment face-to-face courses (known as blended learning). Many users love to use the activity modules (such as forums, databases and wikis) to build richly collaborative communities of learning around their subject matter (in the social constructionist tradition),

while others prefer to use Moodle as a way to deliver content to students and assess learning using assignments or quizzes.

THE PEDAGOGICAL PRINCIPLE

Constructive Alignment (CA) (Biggs 1996) is a popular pedagogy adopted in many universities in the world. "Constructive" refers to the principle of constructivism in learning which states that meaning is personal, it depends on motives, intentions, prior knowledge, etc., and learning is a way of interacting with the world; and "Alignment" refers to what a lecturer does to support students' learning activities in order to help them achieve the Intended Learning Outcomes (ILOs)

CA is largely a technique for teaching planning and design for learning. It makes the assumption that students will naturally carry out the learning activities and construct knowledge as long as the lecturer provides the teaching and learning activities to facilitate them to achieve the ILOs; however, in reality, there is no guarantee that it happens as students are human beings who do not behave like a robot which automatically obey what a lecture asks it to do. CA does not provide clear guidelines as to how we should develop or create teaching and learning activities to help students achieve the ILOs; it does not pay much attention to how students learn progressively; in other words, CA pays more attention to the curriculum design but lesser to the human aspects of students as learners. In addition, students' ILOs are often measured towards the end of the teaching period, typically by examination and a big assignment. Assignments and examinations might not be well conceived; and students might view them as urgent and resort to outside help.

We are thus motivated to devise a pedagogy called Constructive Progressive Alignment (CPA), an extension to the CA principle. CPA (Lai and Sanusi 2013a and 2013b) takes into consideration students' progressive learning behaviours. The meaning of "Constructive" and "Alignment" remain the same as in the CA context. "Progressive Alignment" means that a lecturer designs teaching activities that support students' progressive learning behaviours as well as their abilities to achieve the ILOs. With CPA, the ILOs are specified using the SOLO taxonomy (Biggs and Collis 1982) and the principle of gauging students' progression in learning is based on Shulman's table of learning (Shulman 2002).

Shulman's table of learning (2002) defines a six-stage learning process which consists of: (1) Engagement and Motivation; (2) Knowledge and Understanding; (3) Performance and Action; (4) Reflection and Critique; (5) Judgment and Design; and (6) Commitment and Identity. However, stages 5 and 6 refer to students' longer and life-long learning. We are of the opinion that we could improve higher education student learning if we just focus on the first four stages of Shulman's table of learning, given the fact that there are only a limited number of weeks in one semester for teaching a subject at an Australian university. We use the CPA method in conjunction with Moodle.

THE e-ASSESSMENT METHOD

The e-Assessment method for enhancing student learning consists of two parts: (1) designing the contents of the e-Assessment tasks to help students achieve the ILOs and to measure their performance in the ILOs; and (2) organizing the e-Assessment tasks in manners that help them achieve the ILOs progressively. The former is based on the CA principle; and the latter is centred around the CPA pedagogy which encompasses Shulman's first four stages of learning. In this paper, we focus on the latter part.

Engagement and motivation

Learning begins with student engagement, without which subsequent stages of learning will not succeed well. Given the fact that CA is based on the principle of constructivism which focuses on what students do for the purpose of learning, lecturers should design more assessment tasks for students for better student learning outcomes. At our University, examination usually constitutes between 70% and 80% of the full marks and assessable course work between 20% and 30%. In 2011, we applied to the University to have 60% for examination and 40% for the assessable course work for the subjects to which we have applied the CPA method; and they were approved. A bigger weighting given to assessable course work enables us to have more freedom to practise the CPA principle; and it also encourages students to be more engaged in their learning by doing more learning activities themselves (Lai et al 2013b).

All assessment tasks are conducted 100% on Moodle; that is there is absolutely no pen and paper submission. In this way, students are more engaged in their learning. The e-Assessment tasks are of different types and aim to enhance their engagement in learning as in general human beings like varieties and tend to get bored with just one thing quickly. We require students to do smaller e-Assessment tasks instead of one big assignment as students tend to be able to manage smaller tasks better; and they will not be so easily discouraged and be more encouraged in their learning. Students have to do the e-Assessment tasks regularly; for instance, tutorial work is to be submitted online weekly.

We consider the opinions of the students on the breakdown of the marks of all the e-Assessment tasks; this would engage them more learning the subject as they would feel more belonged to the class. We make weekly online announcements about assessment, tutorial/laboratory, marking criteria, seminar and talk, assessment results, etc. By doing so, it is aimed at helping students to be more organised and engaged in their studies.

Knowledge and Understanding

In conjunction with Moodle, we organise the e-Assessment tasks in manners that promote student knowledge and understanding. Students are given smaller and regular e-Assessment tasks which are of different types. The e-Assessment tasks include Multiple choice quizzes, problem solving questions with some related to industrial/commercial issues, essay type, peer review, laboratory questions, tutorial questions on the material taught, etc. In addition, the following associated techniques also contribute to student knowledge and understanding: (1) the deadline of each task, (2) the deadline reminders when students log onto Moodle; (3) the prompt feedbacks on the e-Assessment tasks; (4) the clear marking guidelines for the tasks, and (5) the feature of Moodle displaying their e-Assessment marks progressively once an e-Assessment task has been marked.

Students are given an online quiz on the subject materials shortly after they have been taught in a lecture. The quizzes would contribute to students' knowledge as they get to see the gap in their understanding of the materials taught by receiving the feedbacks and the results of the quizzes quickly. Some e-Assessment tasks are designed to be related to real-life industrial/commercial issues; and they would contribute to the higher-order learning and understanding as they were able to see how the theories were put into practices.

Practitioners from the industry are invited to give guest lectures. The aim is to bring the real world into the class room. To increase students' knowledge and understanding, it is essential that they see how things are put into perspective with the industry and they are able to see the relationship between their career, the industry and currently what they are learning. We also design an e-Assessment task which is related to the guest lectures.

Performance and Action

Typically, students are given one or two weeks to complete a task; for instance, quiz is due at 9am of each Monday; tutorial at 9am of each Tuesday; laboratory at 9am of a Wednesday, and problem solving question at 9am on a Thursday. The regular deadlines get them into the habit of reviewing the teaching materials and putting their knowledge into action by doing their e-Assessment tasks. In addition, we use the following Moodle feature for helping students with respect to their performance and action: immediately after a student logged into the LMS, Moodle displayed the deadline of each of the e-Assessment tasks, serving as a reminder for them to take action to meet the deadlines and to take action in doing the tasks.

The marking guidelines are made explicitly to students; they are marked according to two main criteria: (a) evidence of effort; and (b) correctness; students will get full marks for a question which demonstrates these two criteria.

We send out weekly Moodle announcements reminding students about e-Assessment deadline, marking criteria, the availability of assessment results, general feedback on the assessment tasks, seminars and talks on topics that are relevant to them, what would be taught in the next lecture, and what would be done in the next laboratory/tutorial class. This would help students organize their studies better.

Moodle displays a summary of the marks for all the e-Assessment tasks submitted by a student. This feature of Moodle is very useful for helping students take action of their learning. As time goes by, students see their cumulative marks and know how well they have been performing. Should it be the case that they are not doing too well, the poor cumulative marks remind them to work harder in the remaining part of the semester. This is one of the distinct advantage of having smaller and regular e-Assessment tasks instead of a big one. In the latter case, students only get to know their performance in their subject and receive feedbacks on their work towards the end of the semester. By that time, perhaps there is not much that they can do about their learning.

Reflection and Critique

An e-Quiz submission is marked by Moodle and the results could be returned to the students very quickly after its deadline was closed. As for other types of e-Assessment, we aim to finish marking them and releasing the results as quickly as possible, usually within two weeks after they have been submitted; and we provide feedback on their work through Moodle. In addition, we also discuss with the students the answers to each of the e-Assessment tasks during tutorial/laboratory classes. By doing so, students reflect on their work by knowing where they have done wrong and how they can improve.

We choose a suitable e-Assessment task which can be used for peer review by the students themselves. We display each of the students' answers (with the name of the student removed) on Moodle; each student is asked to review other students' answers by using a five-point *Likert*-type scale (with 5 being excellent, 4 very good, 3 good, 2 average and 1 poor). In this way, each student gets to reflect on his/her own work by comparing it with others'. In addition, each student is required to give a five minute presentation on an e-Assessment topic and his/her performance in the presentation is judged by his/her fellow classmates and the lecturer. In preparing for the presentation, each student would reflect on his/her learning and receive critique on his/her work from others during his/her presentation. Each student receives a peer review score as a part of his/her assessable work.

We also have e-Assessment essay tasks which are aimed at helping students reflect on their learning as they have to crystalize their thoughts by reviewing most of the previous teaching material in order to be able to do the task.

STUDENT QUESTIONNAIRES

We have received an approval from the Ethics committee of the University to conduct a survey amongst the XXX students about their learning experiences, where XXX is the name of the subject to which we have applied the CPA method. The approval number is FHEC11/R49. A questionnaire form was designed to find out the learning experiences of the students. The form was handed out to the students during the laboratory/tutorial class of the last week of the semester. The form consisted of 21 statements. Students were asked to assess how true each of these statements was to them by selecting one of the following against it: (i) SA- Strongly Agree (represented by a score of 5); (ii) A - Agree (represented by a score of 4); (iii) N - Neutral (represented by a score of 3); (iv) D - Disagree (represented by a score of 2); and (v) SD - Strongly Disagree (represented by a score of 1).

In order to preserve the integrity of the data and the data collection process, the forms were collected by another academic staff (suppose David was his name) rather than the lecturer. David collected all the forms and put them in an envelope in his office. He then stamped on each of the survey forms a departmental chop with his signature and the date of the signature. When we were ready to do the analysis, we worked on the signed and stamped survey forms. We have used this strategy for teaching a few software engineering subjects each year since 2011 and have conducted the questionnaires amongst the students of these subjects. In this paper, we include the results of the subject CSE3MQR taught in 2011. There were 27 students who enrolled in CSE3MQR in 2011; and there were 20 who filled in the questionnaire form. After the end of the 2011 semester, ten students participated in an individual interview, informing us about their learning experiences.

DISCUSSION OF THE RESULTS

Though all the data are not able to be shown, we include in Tables 1,2,3 and 4 the results for 2 of the statements related to e-Assessment with respect to: (a) Engagement and Motivation; (b) Knowledge and Understanding; (c) Performance and Action; and (d) Refection and Critique. The results for each of the questionnaires were analyzed and the Average Score (AS) for each of the statements was computed. The AS ranged from 4.1 to 4.6.

For (a), it is found: (i) that getting students involved in deciding the breakdown of marks for the e-assessment tasks helps student engage in the subject because they feel that their opinions are valued, that their interest in the subject grow and that they think more about how to score more marks; (ii) that smaller and regular e-assessment tasks motivate students to learn better as compared to one big assignment because they do not easily forget what they have learned from the weekly lectures when whereas they would for doing one big assignment and that the tasks can be easily understood by the students as it is easier and takes lesser amount of time for them to revise the materials taught.

For (b), it is discovered: (i) that an online quiz given immediately after a weekly lecture helps students increase their knowledge and understanding because they get to test their understanding immediately, learn from their wrong answers, review the lecturing materials better, seek clarifications from the lecturer/tutor quickly about any parts that they are not clear about; and (ii) that tasks on industrial/commercial issues helps them understand the materials taught better because they can reason about why certain things happen in the real world, and apply the knowledge to real-world problem in future.

For (c), the findings are: (i) that the regular deadline associated with each task helps students perform and take actions in their learning because they would study more consistently and review the lecture notes, and develop a more systematic way of organizing their studies; (ii) that clear marking guidelines for each of the e-Assessment tasks motivate

them to do their best because they guide students to produce better answers, give them the idea of how to score good marks, and enable them to do the specific tasks more clearly.

Table 1: Students' e-Assessment experiences with respect to Engagement and Motivation

Statement	AS	Main points of students' responses to the statement
1. I think doing a variety of smaller e-Assessment tasks has motivated me to learn the subject materials better, as compared to doing one big assignment.	4.4	• It is easy to do assignments that were relevant to weekly lecture notes. • It is easier to grasp the concepts. • It makes me revise what I gave learned in the classroom • It is easier to understand and to remember the important points. • It is quicker to learn and needs lesser amount of revision. • It helps me stay on track of the subject and I forget what I have learned for doing a big assignment.
2. The fact that the lecturer considered our opinions on the breakdown of the marks of the e-Assessment tasks has motivated me to learn and engage more in this subject.	4.3	• I can plan the strategy to get better mark. • I could plan my study better. • I could plan how to score well for particular assignments • My opinion was considered in determining the breakdown of the assessment marks. • The discussion makes me more interested in learning the subject.

Table 2: Students' e-Assessment experiences with respect to Knowledge and Understanding

Statement	AS	Main points of students' responses to the statement
1.The fact that the lecturer gave an online quiz on the subject materials immediately after they have been taught during a lecture has contributed to my better understanding of them.	4.6	• I can ask lecturer to explain the question which I have answered wrongly, based on the immediate results published on Moodle. • I can test my understanding of the concepts just taught in the lecture. • I can learn from my mistakes based on the immediate results and feedbacks. • This activity enables me to know the points that I missed out during the lecture. • I learn more about the concepts just taught. • I can test my understanding and it is a good idea to have such an activity in the class.
2. I think the e-Assessment task on real-life industrial or commercial issues have contributed to my higher-order learning and understanding.	4.3	• It prepared me to face the real world and real life problems. • I can apply the knowledge I gained from doing the assignments in future at work. • I learned about the real-world situation. • I could reason with myself why certain things happened in the real world. • I get to learn how to handle the real-life problem. • It makes me understand more of the world issues. • It gives me ideas of what is happening in the real world.

For (d), it is found: (i) that peer online and presentation reviews of other students' e-Assessment submissions help students reflect on their learning because there is an increase in interactions amongst fellow students and teaching staff, they get to know other's answers and make them review their own answers more; (ii) that essay type of e-assessment help them reflect on their knowledge because they need to construct the answers based on their understanding, to use whatever knowledge to do the assignments., and to apply all the knowledge they have learned about the subject.

CONCLUSIONS

In the past, researches in e-Learning mainly focused on developing tools, reporting classroom experiences, scientific evaluation of techniques and technologies applied in the classroom rather than carrying out learning activities for enhancing student learning. Bigg contends that students learn by what they do rather than what a lecturer does; so it makes more sense for a lecturer to pay more attention to his/her assessment activities. In this paper, we have presented a method for enhancing student learning using e-Assessment tasks. The method is based on: (1) the CPA pedagogical principle; (2) organizing the e-Assessment tasks according to Shulman's first four stages of learning; and (3) making better uses of the Moodle features.

Table 3: Students' e-Assessment experiences with respect to Performance and Action

Statement	AS	Main points of students' responses to the statement
1. I always like to meet the deadline of each of the e-Assessment tasks of this subject because they in general help me understand the materials better.	4.3	• I have to do research before doing the task. • I have to review my lecture notes. • It made me study the subject consistently. • I am then trained to have a systematic way of studying. • I can organize my studies better. • I have to force myself to study the subject because I do not want to lose mark for late submission.
2. I think the clear marking guidelines for each of the e-Assessment tasks have helped motivate me to do my best.	4.2	• They guided me to produce better answer. • I know how to score and get good marks. • They gave me the idea of how to score good marks. • They enable me to do the specific tasks easily and more clearly. • I know how to produce good answers.

Table 4: Students' e-Assessment experiences with respect to Reflections and Critiques

Statement	AS	Main points of students' responses to the statement
1. I think the online and presentation reviews of my e-Assessment submissions have increased my learning due to the interactions involved with the lecturer and other fellow students.	4.1	• I get to know others' thoughts and how they did the assignments. • They increased my confidence. • They made me investigate the topic more. • I believed mire interactions will make me learn more. • They made me prepare myself and review the lecture notes before I participated. • The interactions make me feel more belonged to the class.
2. I think the e-Assessment essay tasks have helped me reflect on the subject materials and hence increase my understanding of them.	4.3	• I need to construct the answers based on my understanding of the lecture notes and other reading materials. • I have to use whatever knowledge to do the assignments. • They made me prepare for the examination. • They made me apply all the knowledge I have learned about the subject.

We are of the opinion that student learning is guided by pedagogical principle rather than technology while the latter supports the former. In our work, the CPA principle plays an important role of promoting student learning. Having the appropriate uses of web-based system features, students are motivated to participate in learning and will increase their learning. Notably, our method does not involve creating new learning technology nor new LMS functionalities. Our work is in agreement with a recommendation made by Buzzetto-More et al (2006), which says "Lecturers are to design teaching and learning activities that help students construct their knowledge. It is critical for instructors to aid students' and build them for learning and teaching with knowledge acquisition in technology to support learning with different type of assessments."

We have applied our method to teaching a few software engineering subjects; and we have included in this paper a part of the results of students' learning experiences in studying one of these subjects. The results were very positive. We thus conclude that organising and designing the e-Assessment tasks using the CPA principle does enhance student learning

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