Pre-Implementation Study of Blended Learning in an Engineering Undergraduate Programme: Taylor’s University Lakeside Campus

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Abstract

This paper provides a framework on the implementation of blended learning (BL) for engineering undergraduate programmes. A survey comprising questionnaires, interviews and practical observations were administered targeting members of the faculty from three various engineering disciplines within the School of Engineering (SoE). Raw data was generated to establish the status quo of BL tools that are most preferred among faculty members using radar charts. A framework using the Plan, Do, Check and Action (PDCA) cycle used to monitor the progress of BL in engineering undergraduate programmes is developed.

1. Introduction

The rules are changing drastically and there is an increased pressure on institutions of higher learning to evolve, adapt or desist (Swail, 2002). In 2003, the American Society for Training and Development identified Blended Learning (BL) as one of the top trends to emerge in the knowledge delivery industry (Rooney, 2003).

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Transformation of learning environments in higher education settings for an increasingly electronic world is critical (Williams, 2002). In agreement with Hicks, Reid and George (2001), there are demands for Universities to provide for a larger and more diverse cross section of the population, to cater for emerging patterns on educational involvement which facilitate lifelong learning and to include technology-based practices in the curriculum. The above literature all seem to focus on a need for a transformation in the learning environment. Before dwelling further into the measures needed for transformation, learning as a whole should first be understood. Learning may be defined as the acquisition of new mental schemata, knowledge, abilities, skills, etc, which can be used to solve problems potentially more successfully, furthering decision making on the basis of experience which elevates “doing” as a basis for achieving an effective understanding of knowledge (Pazos, Azpiazu, Silva & Rodriguez-Paton, 2002). The definition of BL on the other hand still remains a point of ambiguity. The main differences between BL and other terms such as distributed learning, e-learning, open and flexible learning and hybrid courses still remains unresolved. Some definitions of BL are so broad that it would be difficult to find any learning system that was not “blended” (Massie, Ross & Gage, 2004). While there exists a wide variety of definitions available for BL, if examined closely, these definitions are just variations of a few common themes. The three most common found definitions as described by Graham, Allen and Ure (2003) are:

- BL = Combining instructional modalities / delivery media (Bersin et al., 2003; Orey, 2002a, 2002b; Singh & Reed, 2001; Thomson, 2002).
- BL = Combining instructional methods (Driscoll, 2002; House, 2002; Rossett, 2002)
- BL = Combining online and face to face (F2F) instruction (Reay, 2001; Rooney, 2003; Sands, 2002; Ward & LaBranche, 2003; Young, 2002).

The first two definitions suffer from the problem that BL is so broadly defined that it may be seen as encompassing almost all learning systems. The third definition however, is a more accurate reflection of the author’s view on BL and shall be regarded as the foundation of this paper. The third definition reflects upon the combination of two separate models i.e F2F traditional learning systems and distributed learning systems with an emphasis on the central role of computer based technologies. Six reasons have been identified by Osguthorpe and Graham (2003) as to why an academic institution of higher learning should chose to design and eventually adopt a BL system, which are as follows: (1) Pedagogical Richness, (2) Access to Knowledge, (3) Social Interactions, (4) Personal Agency, (5) Cost Effectiveness and (6) Ease of Revision. However a more recent study by Graham, Allen and Ure (2003) showed that from the six reasons stated previously, academic institutions of higher learning that operate in a more laissez-faire environment tend to overwhelmingly chose BL systems mainly for three reasons which are (1) Improved Pedagogy, (2) Increased Access or Flexibility and (3) Increased Cost Effectiveness.

2. Rationale

Improved pedagogy with regards to an increase in the level of active learning strategies, peer to peer learning strategies and learner centered strategies have been cited by Hartman, Dziuban and Moskal (1999), Morgan (2002), and Smelser (2002). These authors have also provided an insight into how computer-mediated environments improve the level of authenticity when compared to the traditional classroom experience. For example, Collis (2003) shared a model for how BL can be used to integrate formal classroom learning with the much more anticipated informal workplace learning. Morgan (2002) and Smelser (2002) also suggested how by mixing live F2F elements with virtual reality, a more comprehensive collaborative learning and problem solving environment may be obtained.

Increased Access / Flexibility seem to be an important factor in many programs where learning experience is gained at a distance from instructors and / or students (Reynolds & Greiner, 2002). This according to the authors was due to the fact that many learners want the convenience offered by a distributed learning environment. Dziuban (1999) stated that almost 80% of Universities in the U.S.A. have seen an expansion of reduced seat time
courses allowing for increased flexibility while retaining small amounts of traditional F2F contact. This proves to show that increased learning flexibility within a more distributed learning environment, a key feature of BL systems seem to be gaining popularity among a more computer mediated environment dependent students.

Cost Effectiveness which is an important consideration for the more laissez-faire Universities is also realized within a properly crafted BL system. This is because BL systems are capable of providing a large opportunity for reaching a large, globally dispersed audience in a short period of time with consistent, semi-personal content delivery as suggested by Kozma (1991). Dziuban (1999) also cited that some Universities have predicted cost savings due to cost reduction in physical infrastructure and improved scheduling efficiencies.

3. Methodology

3.1 Learning Content Management System (LCMS)

Taking into consideration the financial limits, as well as legislative rules imposed by other governing bodies of accreditation such as Engineering Accreditation Council (EAC) and Malaysian Qualification Agency (MQA) a baseline target was set as a tool to introduce and subsequently increase the awareness on the need for change, in order to adopt a BL system throughout the University. The target set was that 30% of the 50% of all modules for an engineering undergraduate programme conducted by the school should incorporate a BL approach. This means that a minimum total of 30% of the student’s learning time should be spent in a BL environment in at least 50% of the total modules offered by SoE.

In SoE of Taylor’s University Lakeside Campus (TULS), BL was embraced with a pragmatic approach. Taylors Integrated Moodle e-Learning System (TIMES) which is the LCMS system used in TULS is a Moodle based platform. It is a dedicated computer system used to organize and manage e-learning. This system offers a wide variety of tools that support and facilitate the publication of the service content, either in a text or graphic form or as ready-made documents or usable applications. TIMES also make it possible to manage groups of users as well as resources that were created for them. One of the most distinct features of TIMES is that the system offers tools which enable monitoring of the learning process. It is also worth noting that one of the world’s largest and oldest online Universities, Open University in Great Britain, has also chosen Moodle as its LCMS platform. Research by Dobrzanski, Honysz and Brytan, (2006) and Dobrzanski & Broz, (2008a; 2008b), shows that a Moodle based platform is also preferred in Poland.

3.2 Integrated Teaching and Life-Long Learning Center (InTelleCT)

BL design within TULS is seen as a problem solving exercise from the perspective of the learning experience rather than the perspective of the tools. Shuell (1986) observed that the teacher’s fundamental task is to get students to engage in learning activities that are likely to result in them achieving certain learning outcomes. Thus, to fully realize the potential of BL, the adoption of BL is motivated by a recognized need for more effective learning experiences that will lead to achievement of desirable learning outcomes. In order to facilitate the adaptation process among staff of the University, InTelleCT was developed with the aim of ensuring the provision of relevant, innovative and excellent teaching and learning experiences within the University. InTelleCT fuses the three-fold functions of three departments dedicated to cultivating a total learning experience through excellent teaching, academic student support and an innovative and technology-driven learning environment. Within InTelleCT, three divisions were established which are Teaching and Educational Development (TED), Learning and Academic Skills (LASC) and e-Learning Academy (eLA). Among the three divisions established, the eLA division was formed with the specific mandate to drive and support the implementation of BL at TULS.
The Associate Dean of Learning and Quality (ADLQ) is appointed within SoE to coordinate BL activities between eLA and SoE as shown in Fig. 1. ADLQ also ensures that a smooth transaction of learning environment from the traditional F2F learning environment to a BL environment is achieved. A screen shot of the survey conducted to gage the BL hours incorporated in each module within SoE is as shown in Fig. 2.

![Fig. 1. The Role of the Associate Dean of Learning and Quality (ADLQ)](image)

![Fig 2. Screen shot of Survey to Gage BL hours in each module for staff in SoE.](image)

4. Results and Discussion

4.1 Radar Chart for BL Tools and Hours.

As most if not all tutors had no experience in teaching within a BL framework, discussion sessions between the ADLQ and practitioners of e-learning and specialists in e-methodology, together with staff from eLA were held. This coupled with practical observations, student feedback and also valuable inputs from experienced staff members led to the creation of five BL tools that may be used as a preliminary tool in advocating BL environments in classrooms. Similar investigations conducted in University of Pretoria, University of Technology, Sydney and University of West Florida employed the use of a radar chart for results illustration.
In addition, The American Society of Quality states that “Radar charts, which are extensively used in the field of institutional development, are commonly used to measure quality.” Therefore, it is the belief of the author that the innovative use of a radar chart for educational assessment fits the purpose as well. The results are explained in Fig. 3, which is useful in interpreting the most favourable tool among staff of SoE.

Small magnitudes, (1) represent tools which are less favourable while large magnitudes, (5) represent more favourable tools. This chart suggests an image of a tiny island within an ocean, which amplifies the cautious steps that need to be taken by the ADLQ and eLA staff in educating the academicians within SoE on the usages of the various tools in order to achieve a BL environment that is a hybrid between F2F and online learning so instruction occurs both in the classroom and the online component becomes a natural extension of traditional classroom learning.

The findings from the above chart can be explained as follows:

![Radar Chart for BL Tools in SoE](image)

Lecture capture system is seen by most staff as a tool for improvement. Such a system will also enable the enhancement in the learning quality of the students since students may review the captured lecture anytime, anywhere thus moving away from the traditional mortar-brick system opening the doors to a more flexible learning environment. However some staff believes that the lecture capture system has their disadvantage which is disclarity among students since their doubts cannot be addressed spontaneously. Others expressed concern due to the uncomfortable feeling that is felt being brought about by the thought that the lecture is monitored throughout the session and freedom to deliver in one’s own pace is compromised. However it should be noted here that in the studies reviewed by Heterick and Twigg (2003), the authors suggested that in large student number classes, recorded (captured) lectures is a useful tool to replace the traditional one or two lectures each week allowing the module coordinators with more time to give to individual students and to enhance the quality of the course through sustained development and innovation as well as teaching development. Mixed responses on the effectiveness of this BL tool created an average of 3 out of 5 within SoE. Due to this, it was concluded that 1 lecture hour which is captured shall be equal to 20 minutes of BL time.

Live Conference tool involves the presentation of a video or any other audio formatted lecture through the use of Internet. The staffs have identified this tool as one which is capable of promoting higher levels of interaction in a teacher-student environment. However students stressed that due to the bandwidth limitations, the video or audio quality may be compromised or even totally disrupted thus disabling the students to participate in a high level interaction environment that was perceived. This is the rationale behind the average score of 1 that was assigned to this tool. The total time contributed by activities using this tool was computed on a 1 to 1 ratio, which implies that the total activity time equals to the BL time.
Online Discussion consists of the use of Facebook, MSN Messenger, Blackberry Messenger, WhatsApp, Moodle forums and others alike. Such a method has gained support from the staff and students as it has been recognized to be highly interactive, yielding an average score of 3. It also encourages participation from all students and at times student with a rather quiet nature may also be motivated to write. However more than often, due to the highly interactive environment that most of the time is minimally guided by the module coordinators, students tend to repeat the same point by “liking” comments thus not having to go through a deep thinking process since the answers are already visible through the forum. With regards to the number of hours contributed to BL, if postings are to be within the lecture period then the activity would be accounted for on a 1 to 1 ratio. However, if delayed postings are allowed, the module coordinator needs to estimate the duration of the activity and assign that duration on a 1 to 1 ratio with regards to the contribution towards BL hours.

Online Assessments emerge as the top most favourable tool with an average score of 4. The online assessments include quizzes, structured questions and essay based questions. This tool based on empirical observations from staff and students promotes instant feedback to the students so that immediate remedial action can be accounted for. Assessments can also be conducted on a more frequent manner through the use of Multiple Choice Questions (MCQ) thus allowing students to obtain more feedback with regards to their understanding about the subject matter. For activities using this tool, the time taken to complete the assignment would then be regarded as BL hours.

Online Document Update also promotes an interactive environment, however the major difference here is that group participation and the ability of the module coordinator to gain a better insight on the individual contribution to the total group work is made possible. However academic dishonesty which occurs when a different student writes on behalf of his group member cannot be detected thus bringing the score assigned to this tool to 1. The contribution towards BL hours for this activity is 50% of the total activity time.

4.2 Implementation Framework

While preparing and realizing the project, great attention was paid to ensure high quality of teaching and learning is sustained within the classroom. Following the concepts underlying Total Quality Management (TQM), a Plan-DO-Check-Action cycle was developed to continuously monitor the progress of the implementation of BL environments within the classroom. PDCA cycles were developed by W.E. Deming in Bell Laboratories, U.S.A in the 1930’s. The main concept behind the PDCA cycle is to divide the project into four steps. In TULC, each module was to be blended based on the number of credits that is offered by the module. For an example a module with 3 credit hours would require 120 notional hours, thus a total of 30% of these hours should be spent in a BL environment. Below, as seen in Fig. 4, a framework governing the initial implementation of BL within TULC is provided based on a PDCA cycle.

In the PLANNING section, the syllabus is written by the module coordinator and its compliance to the programme’s requirements are discussed among the module coordinator, programme director and senior staff of SoE to ensure its alignment with the proposed learning outcomes, assessment methods and other legislative requirements. Once the syllabus is finalized, the syllabus content is now divided into smaller sub topics that would address each learning outcome directly. Sub topics are then further segmented into teaching hours. Each teaching session is for a period of two hours. Within this two hours segmented portions of the sub topic is addressed. For each segment a certain percentage of BL is introduced based on the depth and the learning outcomes. The tool that is to be used to cater for this BL activity is to be decided by the module coordinator after discussing with the ADLQ and other senior members of SoE within the same discipline.

The DO section involves the preparation of electronic material that would seem most useful in enhancing the student’s learning experience as well as the teacher’s teaching experience. Module coordinators would then conduct the session which would be observed by senior staff of SoE which is assigned by the ADLQ. Upon completing the session students are assessed on the understanding of the subject matter. This assessment is best
done through a discussion forum which is created in TIMES. However module coordinators are not requested to adhere to the use of TIMES as a sole platform to obtain this feedback.

In the CHECK section, the module coordinator now obtains the student feedback together with the class observer feedback. An action plan is discussed with the ADLQ to address the gaps that were discovered. Based on the gap analysis corrective actions catering for improvement are planned. This action will then result in a more enhanced delivery method.

In the ACTION section, scope of activities involves the execution of the enhanced delivery method that was formulated earlier. Student feedback is obtained once again and thus the quality improvement cycle forms a closed loop where the principles of continual quality improvement can now be employed in the pursuit for an excellent BL environment.

Fig. 4 PDCA Cycle for the implementation of BL within a Module.
5. Conclusion

A framework based on a survey consisting of questionnaires has been administered in SoE. The results seem to show that the staffs of SoE are keen on adopting a BL environment into their classrooms. However the relatively small island depicted by the radar chart in Fig. 2 proves to show that not all staff seems to be well informed with the use of these tools to enhance the BL environment in the classroom. It is hoped that once an initial pilot run is administered in SoE, the feedback from the staff would enable higher levels of collaborative BL design between the eLA team and the T&L coordinators which would then churn out brand new ideas on the improvisation of BL within the classrooms of SoE. The guidance provided on the quantification of BL hours based on the BL activity which is still in the conceptual stage needs to be experimented first by module coordinators. The feedback obtained from these tests would craft a better quantification system thus forming a closed loop for continual improvement in quality.

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