Technology Integration in Project Oriented Design Based Learning for Distance Education

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ABSTRACT

Technology plays critical role in delivering modern education to the next generation. Proper and effective use of technology is extremely important especially for distance education. Students who enroll in distance mode have a number of limitations as most of them work full time along with the commitments to the family. This paper discusses technology integration for the distance students based on the Project Oriented Design Based Learning.

INTRODUCTION

The School of Engineering in Deakin University has committed to adopt a new learning model project oriented design based learning (PODBL) and dedicated to use this model in delivering a more effective distance education. This new learning model encompasses design based learning as the key driving force along with the principle of project based learning. This change was followed with another change bought by Deakin University bringing about a change in the delivery of education across all disciplines affecting every aspect of the student learning experience described as Cloud and Located Learning.

TECHNOLOGY INTEGRATION

1.1. Lecture Videos

The school of engineering at Deakin University uses a set of technology enabled learning practices (TELP) which included video recording of the lectures using video cameras and screen capture of the lecture slides using a software package

Camtasia to deliver content to the on and off campus students. The staff in the school were encouraged to use either the screen capture software or video recording to record their lectures which provided the off campus student with an experience similar to the on campus students and in some cases blend the screen capture recordings with the video lectures. These lecture resources provide the student with an opportunity to revisit the lectures and go through the concepts discussed during the session.

A research survey was conducted to gauge the response of the students towards these offerings. The responses from the students indicated, they have found the use of audio recordings, the Camtasia recordings and video recordings helpful but when asked about which technology enabled learning practice they would recommend for the future engineering students, 40% indicated the use of a blend of screen capture and video recordings as shown in figure 1 (Joordens M, Chandran J and Stojcevski A, 2012).

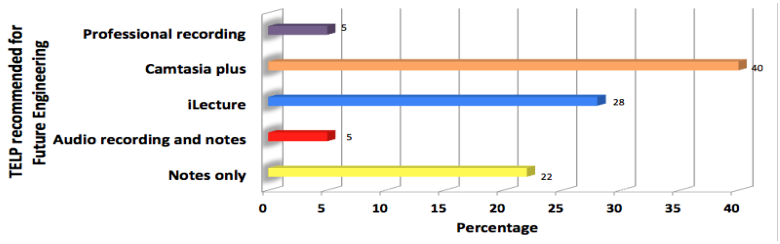

Figure 1: Technology enabled learning practices (TELP's) recommended in engineering

In their recommendation for the lectures they 28 % stated it allowed them to catch up on a missed lecture and mentioned the experience being similar as attending the lecture as shown in figure 2.The download statistics for the video recording support this view; the video downloads range from 25% to 60 %. When asked to mention about the advantages of the system they indicated that there is more interaction through a technology enabled learning practice rather than the physical on site lecture, as illustrated in figure 3. This clearly shows that if technology was used to its fullest potential, interaction is certainly achievable. Another 40% indicated that the advantage of TELPs is that the lecture or learning activity can be viewed more than once and can be successfully used as a catch up exercise also shown in figure 3 (Joordens Matthew, Chandran Jaideep and Stojcevski Alex, 2012).

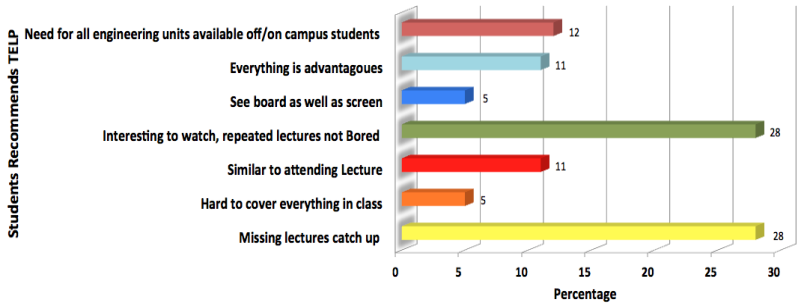

Figure 2: Student recommendations about TELP

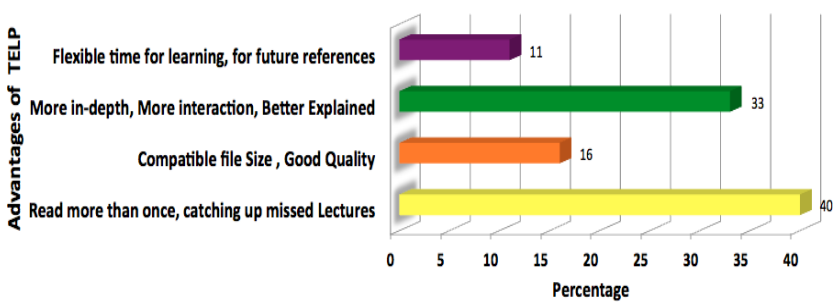

Figure 3: Advantages of TELP

2.2 Cloud Deakin

Cloud Deakin is the learning content management system for Deakin University and it is the portal which provide the students with the opportunity to interact with the staff and their peers. It is Deakin's cloud learning environment and hosts the content like the lecture notes, assignment details and the lecture videos. The cloud environment is setup to allow students and staff to interact on various topics and also students to interact within themselves. Staff members are able to provide feedback to the students and are also able to set various assessment tasks which allows for greater flexibility to the students to attempt these tasks and also allows them to maintain a record of their progress. Cloud Deakin provides the platform for students to discuss their design projects, interact with staff and peers, collect and maintain evidence on the projects.

2.3 eLive Tutorials

ElluminateLive! (eLive) is a technology resource which facilitates communication and collaboration between staff and students. It allows the staff and students to talk over the internet and also via an online chat room. It allows for students and staff to have online meetings and facilitates learning and training. Tutorials in the classroom setting allow for students to interact with the staff revisit the concepts discussed during the lectures; this scenario is replicated using eLive in a virtual setting. It presents off campus students to interact and collaborate with the staff and their peers in a safe and secure environment. Staff members can share audio and visual materials with the participants and can also invite guest speakers like experts from the industry. The flexibility of the online environment allows for the meeting to set up without the boundaries of time and space. The initiative from the school has been well received by the off campus students and also by the on campus students who use this as an extra opportunity to collaborate with the staff and their peers.

Project oriented design based learning approach focusses on this interactivity between the staff and students and among themselves and this resource provides them opportunity to interact in various setting in which members from the industry can also be invited to share their ideas and views. This resource also allows the school to provide the enhanced interaction between student and staff as mentioned in the cloud learning policy.

Project oriented design based learning (PODBL)

Design is one of the fundamental processes in engineering and is involved in all the engineering activities. The study of engineering is not just learning the scientific knowledge and technological skills but it also the learning of established practices, beliefs and professional values of engineering culture. Engineering design has been identified as a systematic and intelligent process in which designers generate, evaluate, and specify concepts for devices, systems or processes which meet the requirements of the end user (Felder, 1988). Design problems which are a classified as open ended problems with multiple correct solutions allow students to use a systematic problem solving methodology with multiple iterations giving them a better understanding of the problem and the processes involved in solving a problem.

Learning an active process of investigation and creation based on the learner's interest experience and curiosity in most cases results in expanded knowledge and skills. Students when taught to solve a problem in general recollect 90% of what they do which is much higher than the recollection of the material they read, hear or see (Hung 2008).

Project based learning a student centred approach to learning uses project as task to direct the learning for the students. The projects are set by the facilitators and the students need to produce a solution to solve the project and are required to

produce an outcome in the form of a report. The teachers act as facilitators and guide the students in this process and teaching is considered as an input directing the learning process.

Project based learning provides students with the opportunity to apply their knowledge to solve problems rather than problem solving activities which provide no evaluable real outcomes. Engineering pedagogy often uses a theory based science model which doesn't prepare the students for the practice of engineering and this is one of its biggest criticisms, project based learning addresses this issue; as self-directed study is a big part of the student's responsibility in a project based learning module (deVere, I. 2009, Hung 2008).

Design based learning is also a self-directed approach; students here initiate learning by designing creative and innovative practical solutions fulfilling academic and industry expectations. The design problem solving process which is the centre of the design based learning approach has been adopted from a combination of problem and project based learning models (Wijnen 2000, Doppelt 2009, Doppelt 2008). Students with different learning styles are able to express their skills and talents working through design project which allows them to practice skills like problem solving, collaborative teamwork, and active learning while engaging in real world problems.

The school of engineering organized an industry forum and one of the key topics was the investigation of the industry and academic requirements for students and the feedback from industry representatives reflected that they are looking to recruit graduates who have acquired design skills and have acquired knowledge through projects. The industry views suggested for a sustainable design teaching and learning through a design based learning model using industry or community based design projects will enrich the student's problem solving skills, integrate design with manufacturing and give them a global perspective through real world projects (Littlefair 2012, Chandrasekaran 2012, Joordens 2012).

Industry views along with student perspectives on design based learning have been aligned together towards a new approach Project oriented design based learning. PODBL will have a positive effect on student content knowledge and help develop skills like collaboration, critical thinking, and problem solving skills and increase student motivation and engagement. Project-Oriented Design Based Learning (PODBL) is a teaching and learning approach (TLA) that is based on engineering design activities while driven by a project. Deakin Engineering has proposed the use of PODBL to encourage independent learning and a deep approach to learning. It is also an approach that supports the development of information literacy and design thinking in the field of tertiary education - two of the key learning outcomes in engineering these days. Students learn through real engineering design activities while driven by a project that has a defined deliverable, which is presented to them by industry partners or academic staff.
Project-Oriented Design Based Learning (PODBL) is a teaching and learning approach (TLA) that is based on engineering design activities while driven by a project. The PODBL approach at Deakin Engineering encourages independent

learning and a deep approach to learning. There are many versions of project based learning as well as design based learning. Deakin's engineering approach is a unique combination of the two. PODBL indicates that students learn through real engineering design activities while driven by a project that has a defined deliverable, which is presented to them by industry partners or academic staff.
The model is applied across all four years of engineering and across the four disciplines of civil, mechanical, electrical and mechatronics taught in the school of engineering. Students are introduced to projects from the first year of engineering; the projects in the first year are university projects and as the students' progress in year two through to year four projects from the industry are introduced.

In the PODBL model participants work in teams four to six members with a facilitator which is similar to the project based learning approach. The same group meets regularly throughout the trimester to work on a series of design activities. The PODBL cycle involves nine main steps. The steps are illustrated in figure 1 below. Steps 1-3 take place in the cloud, step 4-6 are a combination of both cloud and located learning, and steps 7-9 are performed through located learning.

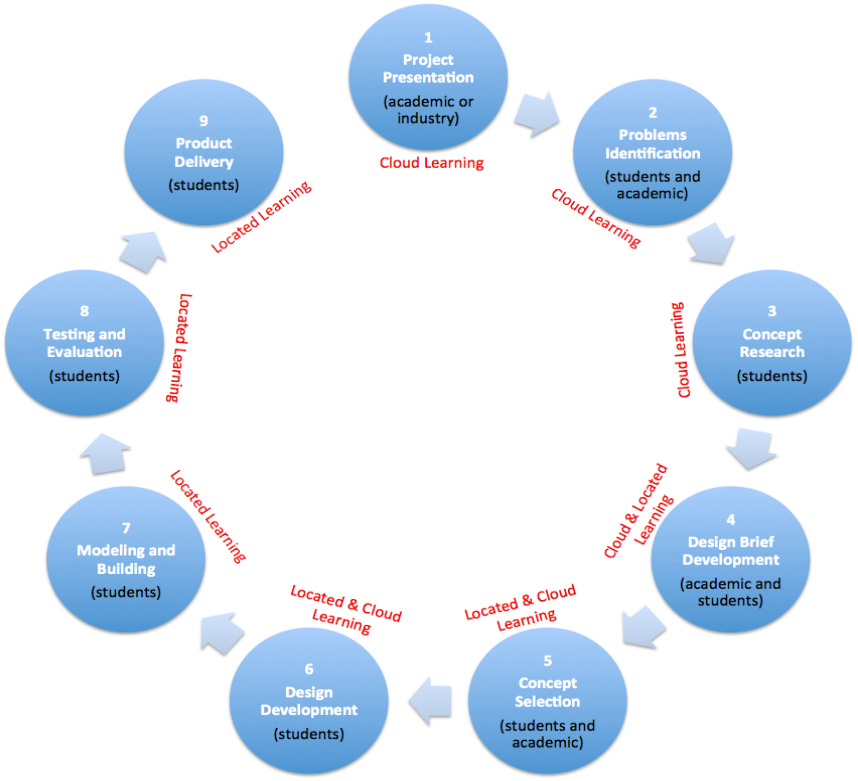

Figure 1: The PODBL learning process

Media content

Steps 1 to 3 of the PODBL cycle the project is presented to the students by the academic or industry based facilitator and the students are given the opportunity to brainstorm on the project to identify the problems and engage in concept research to understand the essential learning issues and the overlapping issues. These activities are conducted in the seamless digital environment for cloud based learning. The students are provided with integrated short, accessible, highly visual, media-rich, interactive learning experiences rebuilt for the mobile screen, and integrating learning resources created by Deakin and other worldly universities and premium providers.

The school of engineering has already started in this direction with the use of technology to enable learning practice and under this initiative encouraged staff to record the lectures and tutorials. The staff could record their lecture on video or use screen capture software to record the lecture slides along with audio and the recording are provided to the students via the cloud. These lecture resources provide the students with an opportunity to revisit lectures and go through the concepts discussed during the session. The lecture videos allow the students to catch up on missed lectures with an experience similar to attending a lecture. Students have indicated in a survey they use the lecture as a catch up exercise and it allows them greater interaction. The school is moving towards the recording of short topic based clips no longer than ten minutes which will allow the students to access material which are media rich and visually engaging (Joordens, 2012).

Online Tutorials

Steps 4 to 6 in the PODBL cycle the teams are involved in developing the design brief to produce the key planning document with the specifications for the project and project plan, select the concept for the solution based on the ideas generated during the concept research step and move on to the design and development step to develop the final design. These activities are a combination of cloud and located learning activities. The students will interact with the staff during the design brief and concept selection stage; this interaction can be over the cloud or on campus for students who are able to come on campus.

The school of engineering has taken a step in this through the use of online tutorials. Tutorials conducted in the classroom provide the students to interact with the staff member and also revisit concepts covered in the lectures and collaborate with staff. This initiative of collaboration and interaction between the students and staff has been taken online through the use of Elluminate Live! eLive a technology resource which facilitates communication and collaboration between staff and students. It allows the staff and students to talk over the internet and also via an online chat room and to have online meetings and facilitates learning and training. It presents off campus students to interact and collaborate with the staff and their peers in a safe and secure environment. Staff members can share audio and visual materials with the participants and can also invite guest speakers like experts from the industry. The flexibility of the online environment allows for the meeting to set up without the boundaries of time and space. The initiative from the school has

been well received by the off campus students and also by the on campus students who use this as an extra opportunity to collaborate with the staff and their peers. Project oriented design based learning approach focusses on this interactivity between the staff and students and among themselves and this resource provides them opportunity to interact in various setting in which members from the industry can also be invited to share their ideas and views. This resource also allows the school to provide the enhanced interaction between student and staff as mentioned in the cloud learning policy

Online Assessments

The PODBL model allows for a variety of assessment techniques to be used during each step of the cycle. The teams are working in a group which makes it ideal to implement self and peer assessment strategies. The cloud and located learning interaction allows for the students to receive feedback at every step in the cycle. The feedback provided by the academic or industry facilitators allows for formative assessments techniques to be applied along with summative assessments. The project which drives the design activities in PODBL has a defined deliverable based on real world problems giving the students the opportunity to work on the tasks they will face when they graduate as engineers. The cycle also allows for the student to collaborate on real world projects and evidence their achievements in professional and personal digital portfolios.

The project in the PODBL model allows for the learning and teaching delivery to take place as a combination of cloud and located learning activities. Cloud learning enables students to evidence their achievement and requires students to be generators of content, collaborators in solving real world problems, and evidence their achievements in professional and personal digital portfolios. With premium cloud learning experiences in place, students who come to campus will have the opportunity to engage with teaching staff and peers in opportunities for rich interpersonal interaction through large and small team activities and also provided through the use of lecture videos, online tutorial for students who are able to make it on campus.

DISTANCE EDUCATION: CHALLENGES AND WAY FORWARD

Education at a distance through the use of correspondence courses and video media has been available for some time now; the advent of technologies and the World Wide Web and virtual realties has further enhanced the offerings allowing for them to go online. Distance education has also been adopted in the field of engineering education and the rise in networking capabilities has allowed the offering of an online engineering course. The acceptance and utilization of online engineering education has been determined the quality of the online course compared to the traditional course and availability and accessibility of courses and material to the students.

Providing an engineering course through a distance education program brings forward many challenges and the distinguishing challenges is the lab requirements for an engineering course; along with this the other challenges is to make sure the content is taught effectively to meet the learning outcomes, ensure the assessment is aligned with the learning strategy and importantly ensure the technology works and is resourced properly.

The PODBL model and cycle provides a blend of cloud and located learning to the distance students; the students are able to access all the content online. The content covers the learning material and the lecture videos which are supported with the use of online tutorial sessions through the use of eLive allowing them to interact with the staff and peers. The model allows for a blended learning mode with a combination of online and face to face interaction and the project in PODBL gets the students to work in teams where they share the ideas, investigate the solution build it and present it which drives their learning and construction of knowledge. The PODBL model also employs the use of a variety of assessment strategies based on both formative and summative methods; these strategies allow the students to receive quick feedback at every step. The feedback and summative assessments and the deliverables for the project collected as a digital portfolio allow the students to evidence their achievements. Technology is integrated in every step of the PODBL model and cycle providing students with content, the platform to interact with the peers and staff and also to generate evidence of their achievements.

CONCLUSION

Engineering education has been delivered in the distance mode for some time now; the advent of technology has allowed it to be taken online and provide access to content and material from anywhere. Distance education with engineering also poses challenges in ensuring learning outcomes are met through the content, delivery style and assessment. The project oriented design based learning model which drives the learning based on design through a project gives the distance students a blended environment of cloud and located learning. The students work in teams on projects where they collaborate, share, investigate, build and present the project. The PODBL cycle has technology integrated in each step and is used as the platform for students to interact with staff and peers, provide assessment for their deliverable, host the content and learning material and also hold evidence of their achievements.

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