Distance Education and On-campus Students' Perceptions of Collaborative Learning in Engineering

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ABSTRACT

The aim of this paper is to analyse and present distance education as well as on-campus students' perceptions of collaborative learning in Project-oriented design based learning (PODBL). PODBL is a learning and teaching approach, where students learn through design activities while being driven by project(s). PODBL enhances on/off campus students' ability to acquire career essential skills that fulfill future industry needs. A paper-based survey is used to recognise a cohort of students' experience of collaborative learning in PODBL. The paper-based survey was given to 30 students from an engineering discipline.

The quantitative analysis of the survey results shows that more than 50% of the students view collaborative learning to have a large benefit in design-based learning.

KEYWORDS

Project oriented design based learning, collaborative learning, engineering education, students' perceptions.

1 INTRODUCTION

Collaborative learning is learning and teaching approach that encourages students to work together, share ideas, experiences and evaluate each other's results [1, 2]. In collaborative learning, each member of the team needs to understand what other team members have agreed to research and what them as individuals must contribute to the team. The students locate resources that are directly relevant to the learning issues.

In project oriented design based learning approach, on/off campus students' work in teams of four to six members with a facilitator. The same group meets regularly throughout the trimester to work on a series of design activities. The learning and teaching delivery is a combination of cloud and located learning activities. Cloud learning enables students to evidence their achievement through collaborative learning in distance education.

Engineering at Deakin has used design-based learning (DBL) as one of its engineering learning principles for further development in teaching and learning. Deakin University has about a third of its students studying off-campus [3]. It is required to improve the learning and teaching process as a holistic approach from the perspective of students' and staff over the entire degree program. The qualitative and quantitative paper based survey method is used to obtain on/off campus students' perspectives. This research paper shows a cohort of students' perceptions of collaborative learning in engineering education through PODBL.

2 PROJECT ORIENTED DESIGN BASED LEARNING (PODBL)

When students are involved in solving a problem through a creative project, they will experience meaningful ideas that allow them to analyse the suitable solution for it. It is a basic quality for a professional to deal with problems and find solutions for these problems. Educational institutions need to teach and train students not only to be a problem solver, but also think about achieving innovative and creative skills.

There are different kinds of problems exist in engineering. One of these is that design problems are most important to attract young and imaginative students' and projects are considered to be the best way for students to interact with teachers [4]. In addition to providing students with better practice in design and technology, project oriented design based learning will involve several advantages such as when good design meets social, economic and industrial needs[5]. This active learning process makes students practice and recognise different learning styles that support learning and sharing through cooperative methods [6].

The newly proposed approach, Project Oriented Design Based Learning method is able to motivate the students and teach engineering design in classrooms to achieve more practical experience that fulfill the academics and industry needs. Project Oriented Design Based Learning is set to have a positive effect on students' knowledge of the content and development of skills, such as innovation and creativity that increases their motivation and engagement [7-9].

In PODBL, learning is initiated by design based learning through projects, which incorporates aspects of design by active learning, learning by doing, creative problem solving and innovative designing[10]. Engineering programs are required to demonstrate that their graduates are capable of acquiring and achieving career focused learning outcomes. It creates a boundary for a student learning capability, when programs are content driven that is focused on engineering science and technology courses. PODBL is a structured framework, which will overcome insufficiency of design practice related to industry requirement.

2.1 Cloud and Located Learning

The PODBL 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, Deakin University. 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 (figure 1) involves nine main steps. The steps are illustrated in figure 1 below. Steps 1-6 & step 9 are a combination of both cloud and located learning, and steps 7-8 are performed through located learning.

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.

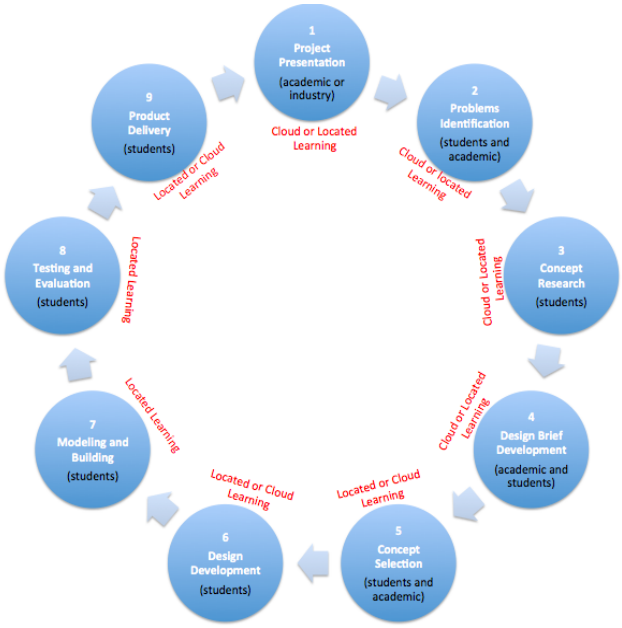

Figure 1: The PODBL cycle

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 [11]. 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.

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 (for distance education) 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 (distance education) 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.

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.

3 COLLABORATIVE LEARNING

When students work in groups of two or more where the centre of attention is project report or a design is known as collaborative learning. Participants have their individual accountability along with several conditions. Collaborative

learning requires working together towards a common goal where students are responsible for one another's learning [12]. It is an educational approach to learning and teaching that involves a group of learners working together to solve a problem, complete a task or create a product [13].

With different learning styles students are able to express their skills and talents through working on projects or by simply designing experiments in authentic learning environments [14, 15]. Integrating design and technology tools into science education provides students with dynamic learning opportunities to actively investigate and construct innovative design solutions.
A design based learning environment assists curriculum to move into the twenty first century with students being hands-on in their work, in addition to using problem solving skills, engaging in collaborative teamwork, creating innovative designs, learning actively, and engaging with real-world assignments. By engaging students in collaborative learning, PODBL provides an opportunity to experience individual, inventive and creative projects that initiate the learning process in relation to their preferences, learning styles and various skills.

4 METHODOLOGY

Engineering at Deakin has used design-based learning (DBL) as one of its engineering learning principles for further development in teaching and learning. It is required to improve the learning and teaching process as a holistic approach from the perspective of students' and staff over the entire degree program. The qualitative and quantitative paper based survey method is used to obtain on/off campus students' perspectives. Qualitative methods are useful for evaluating, developing program goals and for involving participants in the evaluation process to gain their insight and perspective [16].

From the quantitative and qualitative analysis performed, the results are analysed and presented from a students' perspective about collaborative learning in project oriented design based learning within the engineering curriculum. The survey is paper based which was conducted by a third person not involved in the research project.

The survey was given to on/off campus students in the third year of engineering and was anonymous and non-identifiable. These results are from students' own experiences and the results present various views, which include students' knowledge and expectations of collaborative learning.

5 RESULTS

Students' Perceptions of Collaborative Learning

The on/off campus students' views on collaborative learning through project oriented design based learning in this research come from a cohort of senior year undergraduate engineering students'. This study goal is to determine the students' perspective of DBL on collaborative learning and how the perspective changes over the years studying engineering.

Figure 2 shows students' perceptions of advantages of teamwork (collaborative learning) in design-based learning, which includes real world experience, teamwork and interaction. This indicates that the present curriculum needs a change in teaching by implementing the DBL units from 1st year engineering programs. About 34% students says through teamwork DBL, they acquired interactive knowledge, 15% of students mentioned that it develops collaborative skill, management skill and social science. It's interesting to see 11% senior year says that they get the opportunity of managing large projects through real world problems with industrial experiences.

Figure 3 illustrates students' perceptions on disadvantages of (teamwork) collaborative learning through design-based learning. Most of the on/off campus students mentioned the problems exist in teamwork such as lack of consistence, communication, decision-making, co-operation and time management

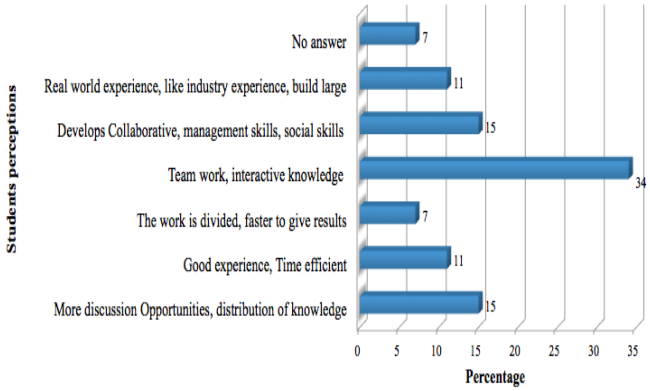

Figure 2: Advantages of collaborative learning

When students are questioned about their preference of learning design based education through collaborative learning. Figure 4 clearly shows 62% of students preferred half teams and half individuals mode of design based learning through collaborative learning.

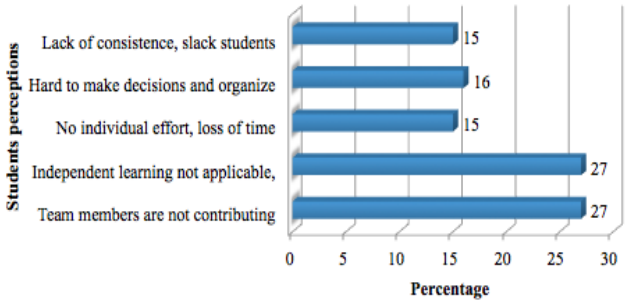

Figure 3: Disadvantages of collaborative learning

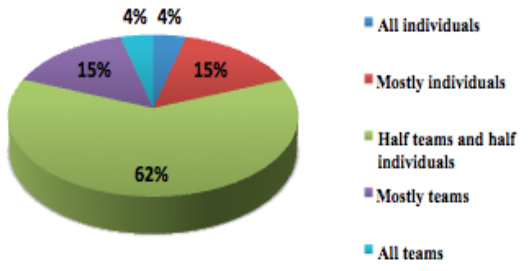

Figure 4: Modes of Design based learning preferred

The quantitative analysis of the survey results shows about more than 50% of the students' view some aspect of the advantage of teamwork (collaborative learning) in design-based learning includes real world experience and interaction, develops collaborative, management and social skills. Overall students views resembles that most of the essential graduate abilities are attained through collaborative learning (teamwork) in DBL mode. The students' perspectives are required to verify the learning and teaching methods and to identify the best practices in these methods to ensure the best possible learning experiences for the student.

6 CONCLUSION

This research paper focused on identifying students' perceptions and experiences on collaborative learning in project oriented design-based learning. The quantitative analysis of the survey results shows that more than 50% of the students view collaborative learning to have a large benefit in design-based learning. Project oriented design based learning approach created an enhancing environment for students and staff members through collaborative learning in distance education. The students' perceptions always have an important value in an engineering curriculum to foster their learning outcomes.

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