STUDENT ENGAGEMENT EXPERIENCES IN A BLENDED-COOPERATIVE LEARNING ENVIRONMENT FOR ENGINEERING PROGRAMMING CLASS

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HIGHLIGHT

The purpose of this innovation is to increase student engagement experiences in a blended-cooperative learning environment (BCLE) for engineering programming class. In this learning environment, students are encouraged to participate in routine engineering programming activities, which helps them for constructing their programming knowledge based on cooperative learning (CL) activities with the help of several LMS and engineering programming software. The application of Moodle for asynchronous CL activities delivery, OpenLearning for a micro-credential implementation of basic engineering programming as well as MathWorks Online courses for MATLAB introduction courses, combined together with synchronous online with breakout room classes has enriched student learning experiences. This can be observed by the higher value of active index in Moodle as well as higher course learning outcomes (CLOs) achievements. In addition, students learning behaviour also shows positive changes from independently individual practice into interdependently cooperative practices that confidently encouraged team-working principle. Therefore, it can be concluded that students' exposure to BCLE able to improve not only students' achievement in CLOs but also their learning experiences.

Keywords: Blended Learning, Cooperative Learning, Engineering Programming, Students Engagement

INTRODUCTION

Blended-Cooperative Learning Environment (BCLE) is the environment which included asynchronous online learning activities and synchronous online cooperative learning (CL) activities. Avgerinou (2008) defines BCLE as "learning environment in which students try to fulfill the assigned tasks in teams with the support of computer-aided or web-based applications."

El-Deghaidy & Nouby (2008), in their study, mentions three types of interaction in BCLE: Social, Content and Teacher. The first interaction type is the teacher that allows face-to-face interaction and active learning for a social environment. In addition, the teacher can plan and manage the learning parts and chooses appropriate communication tools before establishing communication with students. The second interaction type is content. Content is related to cognitive interaction regarding the skills and concepts presented in the course module. And the last type; social interaction refers to students' ability to perceive themselves as a community supporting positive interdependence. Such an interaction in the learning process occurs when students achieve cooperative tasks and share the sources.

The objective of this innovation is to increase student engagement experiences in a BCLE for engineering programming class (KC06603 Engineering Problem Solving & Programming). Engaging students during the online class is one of the challenging tasks especially for engineering programming class which requires students to do hands-on learning activities. Getting students engagement in a hands-on engineering class involves not only the exact and suitable pedagogical knowledge but also technological knowledge on top of the content knowledge. Thus, BCLE has been designed based on TPACK framework and successfully implemented in an engineering programming class.

BLENDED-COOPERATIVE LEARNING ENVIRONMENT USING TPACK FRAMEWORK

Figure 1 shows the designed BCLE using TPACK framework. TPACK (technological pedagogical content knowledge) framework is a framework of teacher knowledge for technology integration which is critical to effective teaching with technology (Koehler & Mishra, 2009).

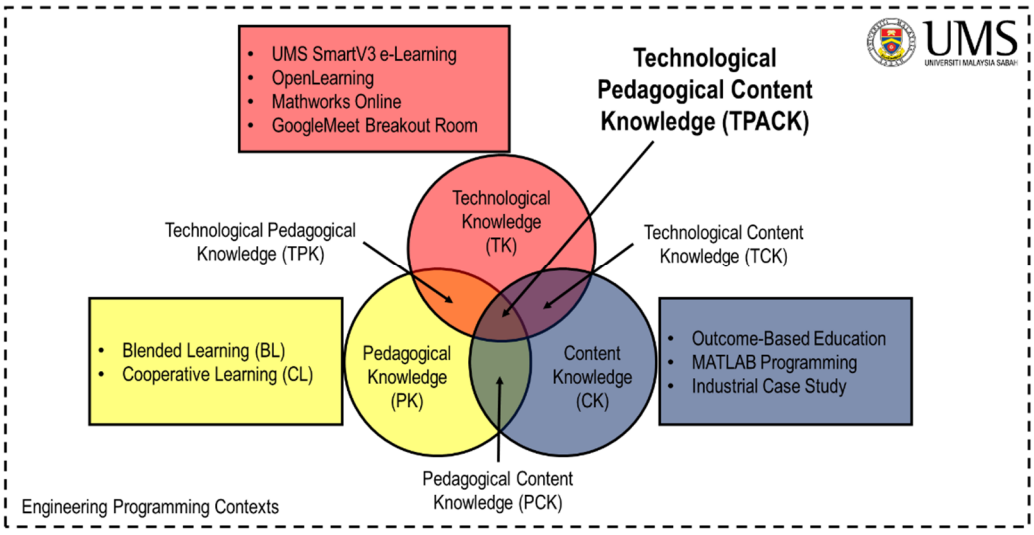

Figure 1: The BCLE for UMS engineering programming course using TPACK framework

In this learning environment, students are encouraged to participate in routine engineering programming activities, which helps them for constructing their programming knowledge based on CL activities with the help of several Learning Management Systems (LMS) and engineering programming software. The application of LMS such as Moodle for asynchronous CL activities delivery, OpenLearning for a micro-credential implementation of basic engineering programming as well as MathWorks Online Self-Paced Online courses for MATLAB introduction courses, combined together with synchronous online Google Meet with breakout room classes has enriched student learning experiences by opening wide range of resources to encourage engagement.

SIGNIFICANCE OF THE INNOVATION

In this learning environment, engagement is defined as the quality of efforts students themselves devote to educationally purposeful activities that is positively linked to student desired learning outcomes, including higher grades, student satisfaction and perseverance as well as team-working skills. This can be observed by the higher value of active index (AI) in Moodle as well as higher course learning outcomes (CLOs) achievements. Table 1 shows information of KC06603 implementation for two sessions during COVID-19 pandemic which were fully conducted online. Both sessions were successfully achieved blended-learning (BL) level (1,7,3,2 concept). Session 2020/2021 was conducted as BL whereas session 2021/2022 was conducted as blended-

cooperative learning (BCL). It can clearly be seen from Table 1 that BCL class received higher hits compared to BL class, although more students were in BL class.

Table 1: Active Index calculation for KC06603 in UMS SmartV3 (Moodle)

Session	Mode	Hits	Students	Active Index
1 – 2020/2021	BL	676	52	13
1 – 2021/2022	BCL	**5082**	42	**121**

In addition, the most important result is that BCL class obtains 121 value of AI compared to only 13 for BL class. AI is the average access for each student to e-learning platform. To be recognized as an active BL course, AI value must be greater than 28 during the semester, which is equal to at least two times per week for one student access to e-learning. Since the AI value for BCL class is the highest (and more than 28, refer to Table 1), it can be verified that BCL class is an active class which offered more opportunities for student engagement experiences.

Apparently, when students have better engagement experiences, their learning outcomes achievements will also increase. Tsai (2012) stated that use of CL and online activities together will increase the quality of learning. In literature, there are number of studies demonstrating the BCLEs increase academic achievement (Aladejena, 2009; Owston, York & Murtha, 2013). These studies are supported by the results shown in Figure 2. Figure 2 shows CLOs achievement of KC06603 for three sessions (2019/2022 – lecture; 2020/2021 – BL; 2021/2022 – BCL).

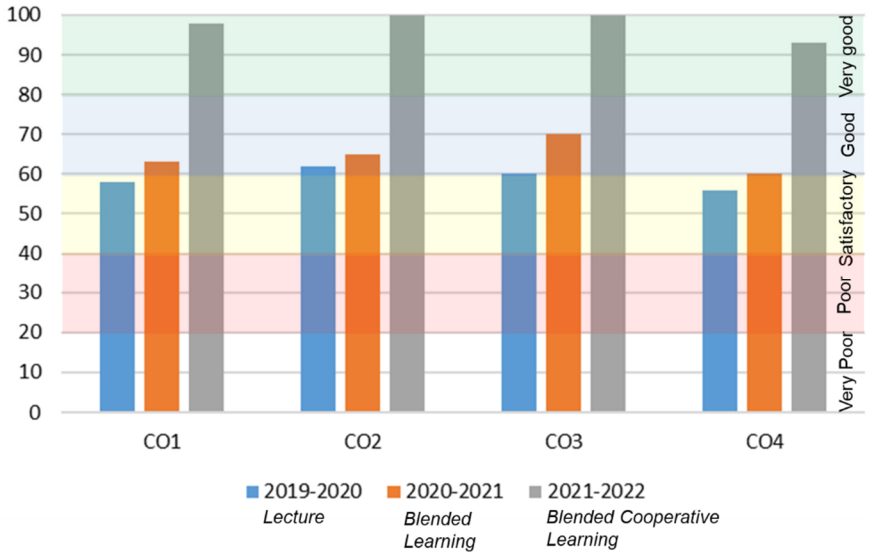

Figure 2: KC06603 CLOs achievements

It can clearly be seen from Figure 2 that BCLE contributed more to the students' CLOs achievements than traditional teaching methods did. It could be stated that the students' levels of academic achievement was high because the BCLE included both online and CL activities; the online course-related materials were available through OpenLearning and Mathworks Online; the students were prepared for the lessons; the students had the chance to revise wherever and whenever they wanted; they maintained interaction in the online environment; they studied for the course using a number of resources (in-class exercises, project, presentations, team-based activities, videos), the students fulfilled the tasks collectively; and because all assessments were administered. Therefore, BCLE is significant in increasing student engagement experiences.

IMPACT OF THE INNOVATION TOWARDS EDUCATION

In addition, students learning behaviour also shows positive changes from independently individual practice into interdependently cooperative practices which can be clearly observed from students learning reflection journals that confidently encouraged team-working principle. Examples of students learning reflection journals for mid-term and end-term during 2021/2022 session can be referred through this link (https://bit.ly/3OqRaIr). Therefore, it can be verified that students' exposure to BCLE able to improve not only students' achievement in CLOs but also their learning experiences. This is the important impact of this innovation towards education.

COMMERCIALIZATION POTENTIAL AND RECOGNITIONS

Generally, TPACK framework is already established. However, in this innovation the general TPACK framework has been adapted and added with UMS SmartV3 (Moodle), OpenLearning, Mathworks Online and Google Meet for technological knowledge; BL and CL for pedagogical knowledge; and outcome-based education, MATLAB programming and industrial case study for content knowledge, refer to Figure 1. With this new updated TPACK framework, it can be potentially registered for intellectual property under Copyright.

Several innovations using general TPACK framework under blended-cooperative method received recognitions in teaching and learning (T&L) innovation such as:

1. Award of excellence in active blended learning UTM 2017, 2018, 2019, 2020
2. UTM New Academia Learning Innovation (NALI) 2019 award in recognition of excellence in T&L
3. Gold award in UTM NALI 2018, 2019 Exhibition and Competition
4. Finalist AKRI 2018 for immersive learning experience (blended)

CONCLUSION

The BCLE is one of the innovation developed using TPACK framework to increase student engagement experiences in online hands-on engineering programming class. Engaging students during the online class is one of the challenging tasks. The application of BCLE has enriched student learning experiences by opening wide range of resources to encourage engagement. Therefore, it can be concluded that students' exposure to BCLE able to improve not only students' achievement in learning outcomes but also their learning experiences.

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