Enhancing Problem-Solving Skills in an Authentic Blended Learning Environment: A Malaysian Context

Heidi Tan Yeen-Ju, Neo Mai, and Bhawani Selvaretnam

***Abstract*—Graduate unemployment rate in Malaysia is an increasing problem and often linked to a lack of problem-solving, critical thinking and communication skills. This paper presents the development of blended learning environment through the integration of authentic learning strategies designed to enhance problem-solving skills amongst Malaysian undergraduate students. The learning environment was blended in its approach and centered on an authentic task. Student feedback was gathered and indicated a positive response towards authentic blended learning environments. Problem-solving, critical thinking, creative thinking, and communication skills were enhanced in this learning environment, providing encouraging support for the use of authentic learning strategies in technology-backed classrooms within higher education institutions.**

***Index Terms*—Authentic learning, blended learning, problem-solving, web technologies.**

I. Introduction

For the past few years, the education landscape in Malaysia is one that has been shifting towards an education system that would best equip students with skills they need to be prepared for the working world [1]. This is to be in line with the global education landscape that has been placing higher importance on cultivating higher order level of thinking [2]. The Malaysian Ministry of Education highlighted in their National Higher Education Strategic Plan [3] that higher education institutions need to focus on teaching and learning practices that are able to increase a graduates' employability. Current research indicates that most graduates have problems securing a job due to a lack of problem-solving skills and communication skills that are highly sought after by the industry [4]. According to [5], learning environments should be built to focus more on problem-solving as it brings about more learning [6]. Learning environments that focus on problem-solving also tend to encourage students to utilize existing knowledge to explore possible solutions to a problem and that process of problem-solving allows students to gain new knowledge and consolidate new knowledge with prior knowledge [7].

Ref. [8] notes that the ultimate goal of learning to solve problems is to be able to identify similar problems that may occur in the future and to be able to solve those problems within a shorter timeframe. Research also provides evidence that web technologies are becoming increasingly important aspects when designing learning environments [9]. However implementation of web technologies into a learning environment still requires a sound theoretical framework for its benefits to be realized [10]. Therefore, colleges and universities are beginning to rely on authentic learning strategies as authentic learning is able to create a learning environment that enables students to gain important higher order thinking skills and complex communication which would help graduates when they enter the working world [11], [12]. Hence, this study sought to answer this research question: How can an authentic blended learning environment enhance students' problem-solving skills?

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II. Authentic Learning in a Technology-Backed Learning Environment

Problem-solving skills and critical analysis skills have been noted in research to be fundamental skills that undergraduate students should develop before graduating [13]. Problem-solving and critical thinking are often synonymous [14] and have been shown in research to be enhanced in collaborative learning environments [15], [16]. Authentic learning emerges as a suitable solution to fostering problem-solving skills as it places emphasis on problems that are real, relevant, complex, ill-defined and finding the solutions to solving these type of problems [11]. Authentic learning strategies are said to create learning environments that not only provide real-world relevancy to students [17], [18] but also providing an environment that encourages the development of higher order thinking skills [12]. Learning environments that are authentic provide students with authentic context which includes having a purpose or goal to achieve and allows students to see how the knowledge they gain will be used in a real-life context [19]. A key driver in an authentic learning environment is the designing of an authentic task that provides the right context and learning experience, the addition of web technologies can help strengthen the impact authentic tasks have on the student learning process [20].

Web technology creates a learning environment that opens the door for students to gain access to a wide repository of information and as such learning environments supported by web technologies are able to foster collaboration and communication activities amongst students [21]. The web as a whole has become a popular application when it comes to implementing online learning in classrooms [22]. According

to [20], authentic learning strategies that are implemented in higher education are best implemented with the support of web technology. As of late, educators have been interested in utilizing web 2.0 tools such as blogs, wikis, podcasts as potentially effective education tools [23]-[25]. Web 2.0 tools have the potential to engage content creators to share knowledge and may encourage collaboration amongst students [26]. In addition, collaboration online has been shown to encourage critical thinking skills and communicative skills [27].

III. Designing the Authentic Blended Learning Environment

This study was carried out with the voluntary participation of undergraduate students from Multimedia University. The students were from the Faculty of Management taking a 14 week core subject with the Faculty of Creative Multimedia called Digital Media. The objective of the subject is to expose students to the basic characteristics of multimedia elements and techniques in content creation for the web. The class comprised of 79 students from various ethnic backgrounds and of which 44 were female students and 35 were male students. These students had no background in multimedia and no experience using multimedia authoring tools.

The authentic blended learning environment was built by adapting [28]'s 9 theoretically based authentic learning principles and the environment centered on an authentic task which presented a problem-based project for students to solve. The authentic task was designed to be an ill-defined and complex problem, mimicking a project that students may encounter in the working world. The project required students to redesign any existing website of their choice by working in groups of 5 to 6 people. The blended learning environment consisted of an online learning environment as well as face to face learning within the physical classroom. The online component consists of interactive multimedia authentic learning modules which provided students with relevant knowledge towards the completion of the project, blogs for students to document their work and Facebook for students to collaborate online. In the classroom the lecturer would have weekly discussions with the class on various related topics; students would have group discussions and consultation sessions with the lecturer. Fig. 1 shows a diagram of the class structure in the authentic blended learning environment.

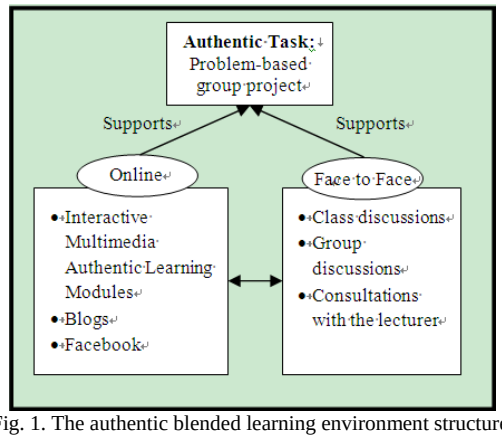

Fig. 1. The authentic blended learning environment structure.

The authentic learning principles as outlined by Herrington and Kervin (2007) were adapted and implemented throughout the learning environment; the details of its implementation are as below:

A. Authentic Context

Authentic context requires providing a physical or virtual environment that reflects the way knowledge can be used in real life.

Implementation: Content used to create the online learning modules were taken from actual class curriculum to allow for seamless integration into the learning environment. The content in the module were essential towards the completion of the project and this allowed students to see how knowledge can be applied in real life. The project itself also emulates an actual real-life project providing students with a way to apply their knowledge and skills.

B. Authentic Activities

Authentic activities are tasks that are complex, ill-defined, have clear goals and a real-world setting.

Implementation: The project was complex with no definite way of solving it. Students were given the role of decision makers and had to take up various roles throughout the project development.

C. Expert Performance

Leaners are provided with opportunities to observe a task being performed by an expert before trying it themselves.

Implementation: Consultation sessions were held regularly in class between the students and their lecturer. Tutors allowed students to observe the use of authoring tools before students attempted the task. Online, students were encouraged to look at forums and videos of experts on topics related to the subject.

D. Multiple Roles and Perspectives

The learning environment should provide a wide array of viewpoints on a topic.

Implementation: Students fully utilized web tools provided in the online learning environment such as search engines to source for precedent studies and ideas. Students were also able to access various media through the interactive modules.

E. Collaboration

Ensuring the learning environment allows for working together and social support.

Implementation: The project was a group-based project and students utilized technology to collaborate. Whether face to face or online, students worked together in their groups to formulate ideas and brainstorm solutions for their project.

F. Reflection

Allowing leaners to think about and reflect on the knowledge gained.

Implementation: In the online learning environment, blogs provided students with a platform for reflection as they would document what they learnt, what they did and what decisions were made regarding the project.

G. Articulation

Giving learners a public space to speak out, discuss ideas and defend their opinions.

Implementation: Students were able to articulate their growing understanding online through blogs, social media sites like Facebook. They also had the opportunity to present their work in class when it was completed.

H. Coaching and Scaffolding

The teacher takes on a supporting role and facilitates learning by offering coaching and scaffolding.

Implementation: Scaffolding was provided by the lecturer through consultation sessions. Students were provided with useful feedback in class as well as online through the blogs.

I. Integrated Authentic Assessment

Assessments should be integrated into the project and aligned with the task given.

Implementation: Students were given cumulative assessments based on progress checks, presentations, documentation through the blogs and in-class quizzes.

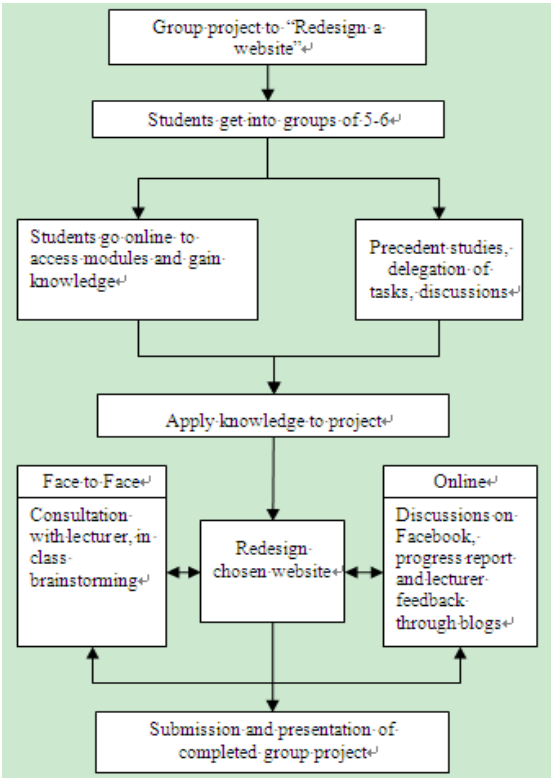

Fig. 2. The student learning process.

The student learning process is shown in Fig. 2 where students were presented with the authentic task to redesign any website of their choice. Students formed their own groups of 5 to 6 people, assigned a project leader and delegated tasks amongst themselves. As part of the project, students were required to do a critical analysis report on the chosen website and list out issues or problems they notice about the website based on what they learn about interface design and visual design from some of the interactive modules. In the beginning of the project, students had to do some precedent studies and research online for examples of well-designed websites. Students also had preliminary discussions to decide their direction and how they would approach the task given. After that, students would then apply knowledge the gained through the interactive modules and online research into their project and begin redesigning the website they have chosen.

Fig. 3. Example of one student's blog.

Fig. 4. Collaborating on Facebook.

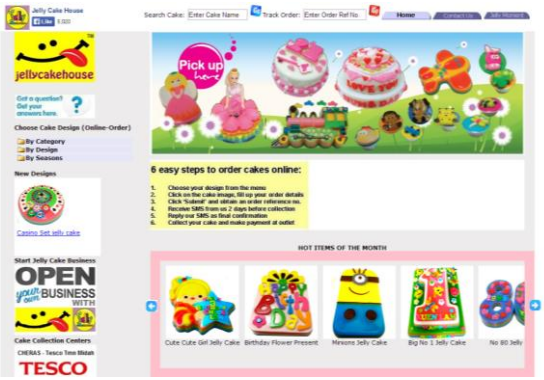

Fig. 5. Example of one original website chosen by one group.

Throughout the development of the project, students would have consultations with their lecturer and brainstorming sessions in class. Discussions and collaboration work is seamlessly continued outside of the classroom environment into the online learning environment through blogs and Facebook (Fig. 3 and Fig. 4). The lecturer continues to provide feedback and scaffolding when necessary to help students throughout the duration of the

project. At the end of the project, students were required to submit and present their final outcome. Fig. 5 shows an example of a website chosen by one of the groups before it was redesigned and Fig. 6 shows the final outcome after the group worked on redesigning the website.

Fig. 6. Final project outcome of the group.

IV. Results and Discussion

This study utilized a mixed method research design whereby both quantitative and qualitative research instruments were administered to measure student attitude and perceptions towards their learning experience in the authentic blended learning environment. Data was collected via a likert-scale survey, open-ended questionnaires and interviews with the students. The results were later triangulated to gain an in-depth insight into the students' attitudes and perceptions of the project, working in groups, and the overall learning environment.

Students were given a survey measured on a 5-point Likert scale with 25 survey items, 5 open-ended questions were also given as part of the survey to obtain student comments. The questionnaires were distributed to the students at the end of class after they finished the presentation of their final project outcome. The survey items were statistically analyzed using SPSS and the results are presented in Table I. Result of the survey is broken down into mean (M), standard deviation (SD) and percentage (P). A reliability analysis was done and the survey yielded a Cronbach Alpha of 0.909 which can be considered reliable according to [29] as the value is above 0.6. As seen in Table I, the survey yielded positive responses from the students with all the survey items having means above 3.50.

A. Authenticity and Relevancy

Based on the results, students found that after completing the project they not only will be able to apply what they have learnt (Item#18, *M*=4.13) but also have the confidence to complete a similar project in the future (Item#23, *M*=4.05). Students found that the project was authentic, practical and relevant to their learning (Item#20, *M*=4.13; Item#25, M=3.96). Students also found the project was able to provide them with real world experience (Item#22, *M*=4.08). This is supported by the following examples of feedback from the students (quoted ad verbatim):

"By applying the knowledge and skill that I learnt in lecture and tutorial class, I able to complete the project quite smoothly."

"Because it helps me to build up my skill, thinking for future and real working environment."

"I get to apply the practical skills which make me understand more."

Having a project that was authentic and relevant allowed students to see how they could apply knowledge gained into a practical setting, thus building up their confidence to complete similar projects in the future. Therefore authenticity and relevancy of the learning environment was important in building student confidence and encouraged better understanding of the practical aspect of what they learn.

TABLE I: Project Based Learning Survey

No.	Survey Item	Mean (M)	Std. Deviation (SD)
1	Communication important when working in groups	4.67	.473
2	Acquired new skills through project	4.44	.594
3	Lecturer is important in my learning process	4.44	.693
4	Enjoyed working in groups	4.42	.672
5	Collaboration and teamwork are needed when solving problems	4.42	.569
6	Feedback from the lecturer is important	4.41	.631
7	Enjoyed learning new things online	4.41	.670
8	Lecturer participation in group discussion is important	4.39	.724
9	Understanding was better with the lecturer's guidance	4.37	.644
10	Able to collaborate with group members	4.34	.677
11	Project allowed creative thinking	4.33	.635
12	Receiving feedback from group members was helpful	4.30	.686
13	Problem solving skills improved when working in group	4.29	.719
14	Web was useful in finding information for project	4.24	.664
15	Project allowed developing of real-world skills	4.23	.697
16	Enjoyed collaborating online with peers on the project	4.23	.715
17	Project allowed me to analyse, synthesise and evaluate information	4.23	.659
18	Will be able to apply knowledge to similar projects	4.13	.705
19	Web was important throughout the learning process	4.13	.705
20	Project was practical and relevant	4.13	.705
21	Liked the convenience of using Web tools in my learning	4.10	.727
22	Project gave me real world experience	4.08	.844
23	Have more confidence now to do a similar project	4.05	.714
24	The project allowed me to think critically	4.01	.707
25	The project was authentic and relevant to my learning	3.96	.775
	N = 79, Cronbach Alpha = 909		

B. Acquisition of Important Skills

Students were able to realize the importance of communication when working in a group (Item#1, *M*=4.67) and that the project also allowed them to acquire new knowledge and skills (Item#2, *M*=4.44). Students found that solving problems required collaboration and teamwork (Item#5, *M*=4.42) and that by working in a group they were able to improve their problem solving skills (Item#13, *M*=4.29). Students agreed that the project allowed them to think critically, creatively and develop skills needed for the real-world (Item#24, *M*=4.01; Item#11, *M*=4.33; Item#15, *M*=4.23). Students felt the project allowed them to analyse, synthesise and evaluate information (Item#17, *M*=4.23). Overall students were able to collaborate well with their group members (Item#10, *M*=4.34) and enjoyed working in groups (Item#4, *M*=4.42). Feedback from students below further support this finding (quoted ad verbatim):

"It improves my communication skills, problem solving skills and my confidence. I am dared and motivated to lead and make sure everything is on track. Thanks!"

"This project helps me to develop my creative and critical thinking skill"

"I like using my critical thinking skills in problem solving the "cluttered" website. To identify the main "tabs" information and removing unwanted links or information from the website.."

The experience of the project provided students with opportunities to gain new skills and improve existing skills. Students' feedback indicated that they were able to acquire important skills such as critical thinking, creative thinking and communication skills, all of which are crucial when it comes to problem-solving. The authentic nature of the project encouraged higher order thinking and enhanced students' problem-solving skills.

C. Scaffolding

Students agreed to strongly agreed that the role of the lecturer was integral to their learning process (Item#3, *M*=4.44) and responded positively towards receiving feedback from the lecturer (Item#6, *M*=4.41). Students felt it was important for the lecturer to participate in their group discussions (Item#8, *M*=4.39) as they were able to understand better with the lecturer's guidance (Item#9, *M*=4.37). Students also it helpful to be receiving feedback from their teammates (Item#12, *M*=4.32). Student comments to verify this (quoted ad verbatim):

"When I faced some problems, I ask them (group members & lecturer) to help and teach me how to solve the problem."

"My group leader taught some skills and I found discussion with tutor and lecturer helped to finish the project."

"Lecturer, tutor and my group members helped me when I was doing this project. We discussed the issues and come out with solution based on our skills and experience."

Students highlighted the importance of the lecturer in providing scaffolding when necessary and indicated they appreciated the guidance they received from the lecturer. Therefore scaffolding emerged as a contributing factor towards the problem-solving process.

D. Web and Online Learning

Students enjoyed learning new things online (Item#7, *M*=4.41) and felt that the web environment was useful in helping them obtain the information they needed to complete their project (Item#14, *M*=4.24). Students also enjoyed collaborating with their peers on the project in the online learning environment (Item#16, *M*=4.23). Students agree that the web played an important role in helping them throughout the learning process (Item#19, *M*=4.13) and liked the convenience of using web tools in their learning (Item#21, *M*=4.10). Some comments from the students (quoted ad verbatim):

"(to solve problems) Discussion on facebook group and doing meeting to discuss much further."

"For me, I use to look on internet if I need any help…"

"… online source was very helpful guide for me to complete final project."

Students found it helpful to search for resources online and to be able to collaborate with their friends through social media networks. The support of the web learning environment encouraged students to further explore topics learnt and to use it as a resource in completing their project.

V. Conclusion

In conclusion, this study has found that students' problem-solving skills were enhanced when the learning environment was one that incorporated authentic learning strategies and was supported by face to face as well as online learning environments. Survey results and favorable feedback from students indicate that in the course of completing the authentic task, students were able to develop important higher order thinking skills like communication skills, problem-solving skills, critical thinking skills and creative thinking skills. Overall students found the learning environment to be relevant to their learning and gave them the confidence to solve similar problems in the future. This provides positive support to the use of authentic blended learning environments towards enhancing problem-solving skills among undergraduates.

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