

Developing Creative and Critical Thinking Skills in an Authentic Learning Environment

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Graphical abstract



Abstract

The Malaysian Ministry of Education has called for a need to produce skilled graduates that are highly employable. In this study, Herrington and Kervin's Authentic Learning principles were adapted into the design of an Authentic Learning environment that is driven by a problem-based group project. The impact of this learning environment on engaging students' creative and critical thinking as well as the students' perception towards the Authentic Learning environment was studied. The learning environment was designed to center on an authentic problem-based group project and was supported by multimedia and web technologies. Results indicate that Authentic Learning principles, when adapted into a learning environment engaged the use of higher-order thinking skills, encouraged the cultivation of crucial skills, made learning an active process, and enhanced understanding. Students responded positively towards the Authentic Learning environment as learning became more relevant. The positive results of this study provide support for the development of more Authentic Learning environments to engage students' creative and critical thinking skills, thereby answering the call of the national agenda to produce industry-ready graduates with skills that make them highly employable.

Keywords: Authentic learning; creative thinking; critical thinking; problem-solving; multimedia; web technologies

Abstrak

Kementerian Pendidikan Malaysia telah menyeru untuk menghasilkan graduan yang mahir dan dituntut oleh industri. Dalam kajian ini, prinsip "Authentic Learning" yang dikemukakan oleh Herrington dan Kervin telah disesuaikan ke dalam reka bentuk persekitaran pembelajaran yang didorong oleh projek kumpulan berasaskan masalah. Kesan persekitaran pembelajaran ini kepada pemikiran kreatif dan kritis pelajar dan juga persepsi pelajar terhadap persekitaran pembelajaran yang sah telah dikaji. Persekitaran pembelajaran telah direka dengan pusat pada projek kumpulan berasaskan masalah yang sah dan disokong oleh multimedia dan teknologi web. Keputusan menunjukkan bahawa prinsip-prinsip "Authentic Learning", apabila disesuaikan ke dalam persekitaran pembelajaran, berupaya melibatkan penggunaan kemahiran berfikir yang berperingkat lebih tinggi, mengaktifkan proses pembelajaran, menggalakkan pembangunan kemahiran kerjaya penting dan pemahaman dipertingkatkan. Pelajar membalas dengan positif terhadap persekitaran pembelajaran yang sah disebabkan pembelajaran menjadi lebih relevan. Keputusan positif kajian ini memberi sokongan kepada lebih pembangunan persekitaran pembelajaran yang sah untuk mendorong pemikiran kreatif dan kritis. Yang sedemikian, ini dapat memenuhi agenda negara untuk meningkatkan kemahiran industri graduan dan seterusnya meningkatkan peluang pekerjaan graduan.

Kata kunci: *Authentic learning*; pemikiran kreatif; pemikiran kritis; penyelesaian masalah; multimedia; teknologi web

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1.0 INTRODUCTION

The Malaysian education landscape has been shifting towards teaching and learning strategies that would bring about graduates that are able meet industry employability demands with the

Ministry of Education in Malaysia highlighting Graduate Employability as one of the Critical Agenda Projects (CAPs) in the National Higher Education Strategic Plan (PSPTN, 2007). Research indicates that current graduates lack crucial skills needed by the industry such as creative and critical thinking

skills, communication skills and problem solving skills (Tan, Teo, and Chye, 2009; Ramakrishnan and Yasin, 2012). As of 2010 in Malaysia, the number of graduates unable to secure employment remains high at 30,000 graduates (Malaysian National News Agency, 2010). The National Higher Education Strategic Plan is currently in the Action Plan phase and is looking at focusing on teaching and learning practices that increases higher-order skills in students (PSPTN, 2011). These skills include communication skills, teamwork skills, critical thinking skills, problem-solving skills and leadership skills (MOHE, 2006). Although the Malaysian Ministry of Education's action plan involves improving these skills through internships, entrepreneurship programs and so on (PSPTN, 2011), Barrie (2004) argues that these skills are meant to be outcomes achieved through the usual learning process at a tertiary level and do not require additional curriculum in order to be achieved.

Currently many institutions of higher education are still using conventional pedagogy in their teaching (Khalid, Yusof, Heng, and Yunus, 2006) where learning remains a passive experience for students (Anglin and Anglin, 2009). This is especially so when the learning materials are delivered in a way that does not encourage students to think critically about the content (McCarthy and Anderson, 2000). Hence universities are now moving towards a stronger emphasis on teaching and learning strategies that allows students to see the relevancy of the learning content and how it can be applied into their future careers when they graduate (Jones, Casper, Dermoudy, Osborn, and Yates, 2010). In addition to that, there is a call for more Authentic Learning strategies in teaching and learning as Authentic Learning strategies are able to create learning environments that cultivate graduates who would be able to assimilate themselves into the real working world (Lombardi, 2007). Research also notes that web technologies have emerged as potential enablers for more student-centered learning (Lunenburg, 2011) and in Malaysia leveraging the use of Information Communication Technology (ICT) to increase the quality of learning has been listed in the Malaysian Education Blueprint 2013 – 2025 as one of the eleven shifts to transform the national education system (Malaysian Education Blueprint, 2012). While technological advancements have the potential to shift the education system in terms of the roles of educators and learners (Mahajan, 2012), technology-backed classrooms would not achieve its true potential without a sound theoretical framework (Spiro, Feltovich, Jacobson, and Coulson, 1991). Therefore in this study, an Authentic Learning approach based on Herrington and Kervin's (2007) Authentic Learning principles was used to develop an Authentic Learning environment in a technology-backed classroom with a project-based curriculum. This study sought to investigate these two research questions:

1. What are student's perceptions towards this learning environment?
2. What is the impact of Authentic Learning strategies in developing students' creative thinking, critical thinking and problem-solving skills?

■ 2.0 LITERATURE REVIEW

2.1 Authentic Learning Environments

Authentic Learning places strong emphasis on solving problems that are ill-defined, complex and closely resemble real-world problems (Herrington and Kervin, 2007) and educators have found that students cultivated more professional skills with the incorporation of Authentic Learning principles into a learning environment (Ma and Lee, 2012). Authentic Learning principles

has its roots in constructivism and originated from Resnick's (1987) idea of bridging the gap between knowledge learnt formally in a classroom with the application of that knowledge in a real-world setting (Herrington and Kervin, 2007). Authentic Learning principles create learning environments that enable students to acquire higher-order analysis skills and learn complex communication skills as Authentic Learning forces students to realize that real-world problems can't be solved by textbook answers, as such this would give them assistance when they graduate and begin working (Lombardi, 2007; Levy and Murnane, 2005; Lam, Au Yeung, Cheung and McNaught, 2008). Levy and Murnane (2005) posits that the ability to identify complex problems and solve these ill-defined problems by recognizing when and what strategies to use determines a graduate's opportunity for career advancements. Universities are now looking at Authentic Learning as a means to be more learner-focused and to improve the way students learn (Lombardi, 2007; March, Jensen, Porter and Breakwell, 2011; Miller, 2012). The benefits brought about by Authentic Learning are often realized through problem-based activities that are relevant and require the participation of a community of learners (Lombardi, 2007). An authentic complex problem-based activity such as a group project should engage students in critically identifying the problems, looking at the problem from various perspectives, pulling knowledge from various channels and consequently finding a solution to the problem (Reeves, Herrington, and Oliver, 2002). Research shows that students who experience Authentic Learning as part of their learning process develop skills like being able to discern and judge information, are able to follow less simplistic arguments with better patience, are able to synthesize new found context and have the flexibility to surpass their boundaries when they work (Jenkins, Clinton, Purushotma, Robison, and Weigel, 2006). Therefore Authentic Learning that provides student-centered strategies and real-world relevancy, when supported by multimedia and web technologies, can bring about benefits to both students and educators (Li, 2013).

2.2 Creative and Critical Thinking Skills

Critical thinking focuses on making decision based on reflective thinking and often encompasses problem-solving, both of which involves higher-order thinking (Norris and Ennis, 1989). When students are in an environment that encourages thinking critically about what they are learning, the learning content becomes relevant and brings about a transformation in the nature of how students think (Lunenburg, 2011). Scriven and Paul (1992) define critical thinking as "intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action". Critical thinking and problem-solving skills were identified by the Malaysian Ministry of Education as key generic student attributes (GSA) all graduates should acquire (MOHE, 2006) as research found critical thinking and problem-solving skills to be key fundamental skills sought after by the industry (Tan, Teo, and Chye, 2009; Ramakrishnan and Yasin, 2012). Though not listed as one of the GSA outlined by MOHE (2006), creative thinking remains an important aspect that influences the development of critical thinking skills (Tan, Chye, and Teo, 2009). Creative thinking facilitates effective critical thinking and solving of complex problems by encouraging flexible thinking and coming up with innovative ideas or approaches to solving the problem (Tan, Teo, and Chye, 2009). According to Schnotz, Baadte, Müller, and Rasch (2010), thinking and problem solving that can be considered creative is

when innovative approaches are used to solve similar problems, rather than repetitive usage of a previous problem-solving routine. Conventional teaching has been criticized for being unable to bring about creative thinking in students particularly when the need for creative thinking has been on the rise (Tan, Chye, and Teo, 2009). Mumford, Medeiros and Partlow (2012) states that creative problem-solving is an achievement that is the basis for progress in the world. Hence greater emphasis on learning strategies that cultivate creative thinking is crucial to further enhance critical thinking and problem-solving performance of students (Kuo, Chen, and Hwang, 2013).

2.3 Support of Multimedia and Web Technologies

Multimedia and web technologies form the essential support needed for an authentic learning environment because of the many benefits brought about by these technological advancements. In addition to that, the Malaysian Ministry of Education recognizes the importance of technology in improving the quality of teaching and learning in the education system (MOE, 2012). Multimedia has been said to bring about various benefits to education such as allowing users to be in control of how their information is delivered, supporting interactivity which enhances engagement with learners, enhance understanding by conceptualizing and contextualizing learning materials, increasing active participation in the learning process and promotes reflection of acquired knowledge (Cairncross and Mannion, 2001). When used as non-linear tools, multimedia supports the engagement of important skills such as contextual learning, critical thinking and communication skills (Mahajan, 2012). Interactive multimedia allows students to be in control of their learning and the pace in which they learn (Ellis and Howard, 2012), when used in the right context multimedia adds entertainment value which enhances motivation (Alessi and Trollip, 2001). However, Cairncross and Mannion (2001) caution that careful consideration had to be taken when implementing interactive multimedia in a learning environment.

The web has become a versatile medium for the delivery of information with the capability for streaming videos, audio pod casts, videocasts and more (Anderson, 2008). The use of web technologies as an education tool opens a myriad of possible teaching and learning environments, not possible in traditional classrooms, for educators and learners to experience (Kerdprasop and Kerdprasop, 2008; Masrom, Zainon, and Rahiman, 2008). The web provides a learning environment that is asynchronous, allowing students the convenience of accessing learning materials anytime they want, giving them ample opportunities to reflect on the learning materials and also providing a flexible platform to post up discussions (Palloff and Pratt, 2001). Learning environments that utilize web technologies allows students to communicate at a pace they feel most comfortable with as it eliminates the need to give an instantaneous response (McCarthy, 2010). In recent years, collaborative web tools such as blogs, wikis, and podcasts have emerged as potentially competent tools for education purposes (McCarthy, 2010; Rockinson-Szapkiw, Dunn and Holder, 2011; Sisteck-Chandler, 2012). These web technologies are easy to use, propagate information quickly and encourage user generated content, thus has the potential to encourage student participation and collaboration (Boulos, Maramba, and Wheeler, 2006; McCarthy, 2010). When implemented and used in the right context, web technologies can “complement, enhance, and add new collaborative dimensions to the classroom” (Parker and Chao, 2007). With all the potential benefits to education, multimedia and web technologies were

used in this study to support the creation of the Authentic Learning environment.

3.0 METHODOLOGY

3.1 Research Sample

This study was conducted over a period of 14 study weeks at Multimedia University. The study involved the voluntary participation of undergraduate students from the Faculty of Management who were enrolled in a core subject called Digital Media. The objective of the subject was to introduce management students to digital media techniques and at the end of the program students would not only be able to understand the characteristics of multimedia elements but also the process of content creation using multimedia. The class comprised of 35 students from various management courses who had no prior knowledge in multimedia authoring or using multimedia authoring tools. Students were of various ethnicities and there were 21 male and 14 female students.

3.2 Designing the Authentic Learning Environment

In this study, the learning environment was designed with the adaptation of Herrington and Kervin’s (2007) 9 Authentic Learning principles together with the support of multimedia and web technologies. The learning environment centered on a problem-based group project that was designed to be authentic, relevant and closely mimicking similar problems students might face in the real-world when they graduate. Students had to work collaboratively in groups of 3-4 to solve the ill-defined complex problem which required students to redesign the existing Faculty of Management’s website. As part of the class structure and project, students were required to access an online web-based learning environment that contained an interactive multimedia learning module. The interactive multimedia learning module was also designed with the adaptation of Authentic Learning principles and allowed students to learn important design principles of which can be applied into the completion of their project. The online learning environment also provided students with web tools to enable students to freely collaborate, to reflect on their learning process, to articulate and defend their ideas and as a method of communication between peers and the lecturer.

The development of the Authentic Learning environment in this research study consists of the development of multimedia interactive modules based on class curriculum. One of the modules developed and used in this research study was titled Principles of Visual Design and incorporated Authentic Learning principles outlined by Herrington and Kervin (2007). This was to ensure that the online learning environment was authentic and relevant towards the student’s completion of their class project. Web tools were also provided to the students in the form of blogs and social media platform. The blogs allowed students to document their learning process, present their ideas and showcase their work-in-progress. Facebook was used as the social media platform for students to utilize to communicate with their peers and lecturer, conduct online discussions and to work collaboratively on their class project. Figure 1 shows an overview diagram of the key components in this learning environment, centering on a problem-based group project which is supported by interactive multimedia Authentic Learning module as well as web based tools like blogs and Facebook.

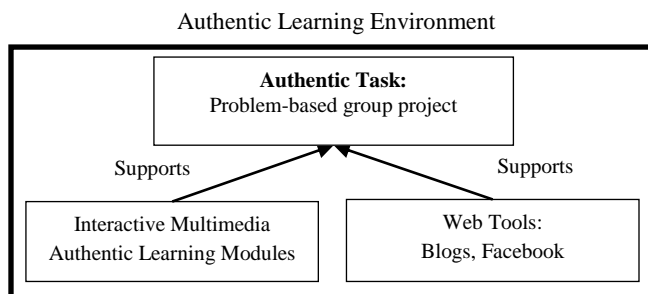


Figure 1 Components of the authentic learning environment

Table 1 lists the Authentic Learning principles, the guidelines for implementation and how they were adapted into the learning environment through the group project and web based learning environment. For the purpose of this study, 9 theoretically based principles were adapted from the 10 suggestions for implementation as listed in Herrington and

Kervin's 2007 paper. This was so because the 10th was a suggestion for educators to constantly keep up with the latest technological developments.

Table 1 Principles of authentic learning by Herrington and Kervin (2007)

	Principles of Authentic Learning	Guidelines for Implementation	Problem-based Group Project	Web based learning environment
1.	Authentic context	Context that shows how knowledge is applied in real life.	Students were given a task to redesign a pre-existing website and therefore took on the role of content developers, much like they would in a real work setting.	Content in the interactive multimedia module was taken from actual learning content and text books. The module topic was relevant to the student and would provide knowledge they needed to use in their project.
2.	Authentic activities	Activities that mimic real-life experiences.	Similar to a real-world project development, students delegated the work and took up varied roles and tasks throughout the duration of the project.	The module consisted of mini activities that reflected the way knowledge can be put into practice. Students also carried out discussions online and logged their progress like they would in managing a real project.
3.	Expert performance	Learners attempt a task after observing and consulting an expert.	The lecturer and tutors took on the role of experts, allowing students to consult their work-in-progress and to observe the use of authoring tools.	Student had access to expert performances on the module in the form of videos of experts attempting similar tasks.
4.	Multiple roles and perspectives	Providing a spectrum of viewpoints to explore and learn from.	Students had to do background research to help them complete the group project; therefore this encouraged them to gain access to various resources and viewpoints they can learn from.	The web environment allowed students to do research and to explore different options available which they can adapt towards solving their problem.
5.	Collaboration	Allowing learners to work together and exchange information.	Throughout the duration of the project, students worked in their groups to brainstorm ideas, identify potential issues, and discuss solutions.	Students documented their group discussions on their blogs. Facebook was also used to assist collaboration by sharing updates or setting up meetings.
6.	Reflection	Providing learners opportunities to reflect and consolidate knowledge gained.	The project was complex and required students to constantly reflect on what they have learnt in class and how it can be applied into the completion of the project.	The blogs provided students with a platform for reflecting on their knowledge, allowing them to better understand the relevancy of their project and what they were learning in class.
7.	Articulation	Providing learners opportunities to speak out, discuss and debate ideas.	Students had presentations in class where they could share their ideas and receive feedback from their peers.	Students were able to articulate their understanding and ideas regarding the project through their blogs.
8.	Coaching and scaffolding	The teacher takes the role of facilitator by offering coaching and scaffolding when necessary.	Coaching and scaffolding was provided by the lecturer in class in the form of consultations.	Coaching and scaffolding was continued seamlessly online through the blogs and Facebook. The module contained embedded explanations within the quizzes and mini activities to assist students.
9.	Integrated authentic assessment	Assessments are integrated into the learner's activities in class.	Students were assessed based on in-class quizzes, presentations and in class activities.	Cumulative assessments were also done online through the progress checks on student's blogs.

3.3 The Student Learning Process

Figure 2 provides an overview of the student’s learning process in this Authentic Learning environment. The authentic problem-based group project required students to redesign the Faculty of Management’s official website. Students needed to identify existing issues or problems with the current website, propose solutions that would overcome these problems and execute the proposed solutions within a span of 14 study weeks. Students divided themselves into groups of 3 to 4 students and delegated

roles and responsibilities amongst the group members. Figure 3 displays a screenshot of the interactive multimedia module students went online to view and learn from. Blogs were used as an important component of the project as research has shown that blogs encourage students to be “critical, collaborative, and creative participants in the social construction of knowledge” (Burgess, 2006). Students also utilized Facebook as a social media platform for further collaboration online.

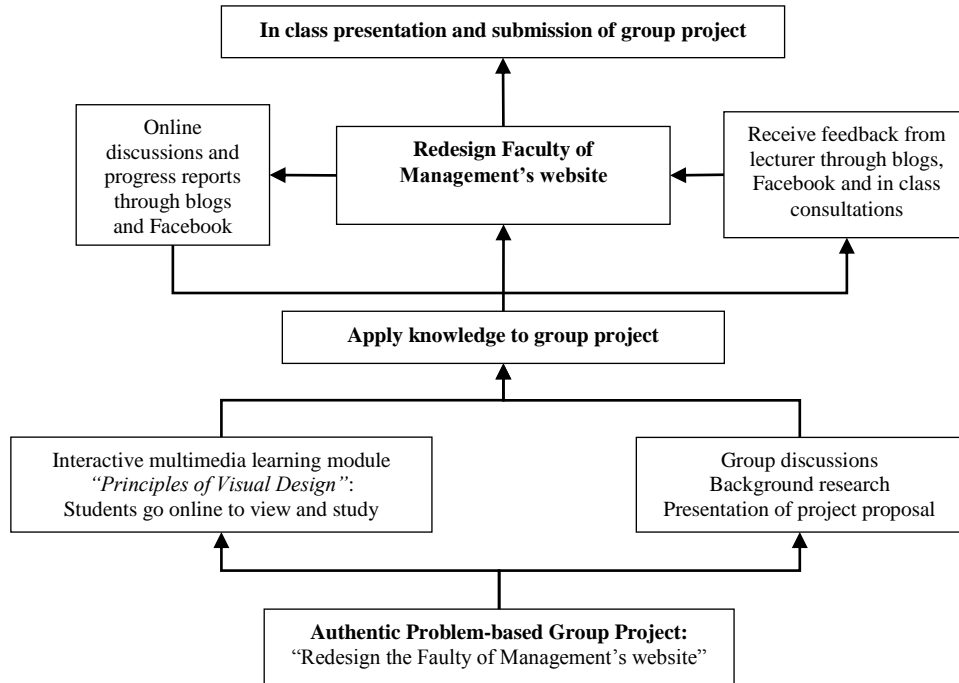


Figure 2 Student learning process in the authentic learning environment

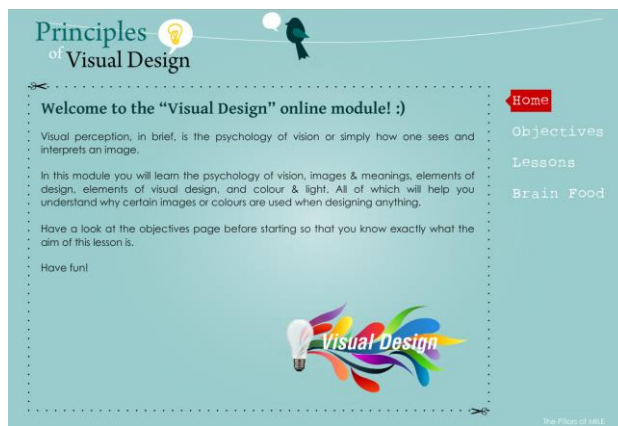


Figure 3 Principles of visual design module

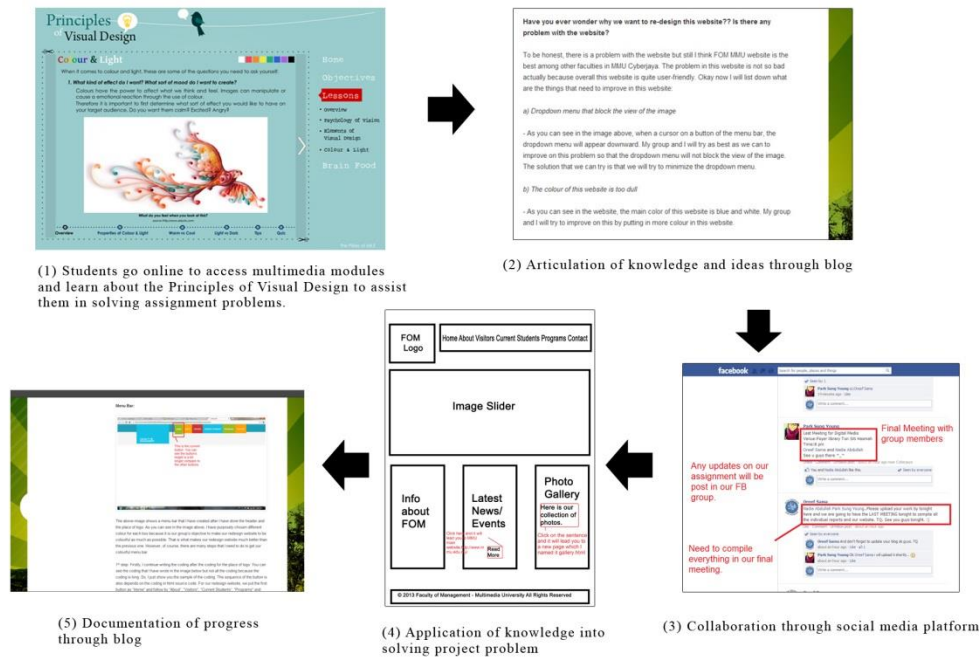


Figure 4 Visual example of one group's learning process

Figure 4 shows a visual example of one student group's process in solving the group project problem after being presented with the authentic task. The learning process experienced by the students in this Authentic Learning environment is as shown in Figure 4 from 1 to 5:

1. After being presented with the task, students were given access to the module that had been uploaded into an online learning environment. The module contained topics meant to provide students with crucial knowledge that would assist them in completing the project. Students were given one week to go through the module before coming back to class and having a discussion on the topics in the module. This created an environment that allowed students to share their knowledge and gain a better understand of the topics through the lecturer's perspective. The module was available online throughout the 14 study weeks to allow students to view it anytime and anywhere.
2. Outside of the classroom, students used their blogs to further consolidate their ideas and demonstrate their understanding of the topics learnt. Students utilized the blogs to post up research done and how they would apply the knowledge gained towards their project. In the example shown in Figure 4, students demonstrated critical thinking and problem solving skills as they documented their analysis of the problems identified in the project. Feedback and suggestions were also provided by the lecturer and students through the comment function of the blogs.
3. Apart from discussions in the classroom, students also collaborated online by using Facebook. The social media platform allowed students to seamlessly continue discussions online, brainstorm ideas and plan meetings with their group members. Facebook also allowed students to quickly post up announcements to the class and give their peers feedback on the project.
4. To further create an authentic real-world learning experience, each group had to submit a proposal on their objectives and how they plan to solve the project before they were allowed to start on the redesigning of the Faculty of Management's website. This allowed students to reflect on the knowledge they have gained throughout the learning process and apply the knowledge towards

solving the problem. Students were also required to present their proposal and defend their proposed solutions for the project.

5. Throughout the learning process, students documented their ideas, work-in-progress, sketches, and research on their blogs. Students both gave and received constructive criticism by commenting on each other's blogs. Authentic integrated assessment was also conducted by monitoring the progress of the project as documented by the students. The lecturer also provided scaffolding and guidance when deemed necessary.

At the end of the project, students presented their final outcomes in class before submitting their projects. The learning environment was designed to give students an Authentic Learning experience in which students took on the roles of content creators, project managers, team leaders, team members and experience the process of working in a group to solve an ill-defined complex problem. Figure 5 shows a screenshot of the original Faculty of Management website that students had to redesign and Figure 6 shows an example of one group's final project outcome.

As part of the overall assessment, three instruments were used to assess student learning outcomes, perceptions and attitudes and student comments: pre-test, post-test, surveys, open-ended questions and comments from student blogs. The pre-test and post-test consisted of 20 multiple choice questions which were based on the content in the learning module. The questionnaires which consisted of 30 survey items measured on a 5-point Likert scale and 5 open-ended questions were designed based on guidelines outlined in literature to assess student perception and attitude in these particular areas: (1) the authentic problem-based project (Norris and Ennis, 1989; Scriven and Paul, 1992; Schnotz, Baadte, Müller, and Rasch, 2010; Grant, 2002; Herrington and Kervin, 2007, Lombardi, 2007), (2) working in groups (Herrington and Kervin, 2007; Lombardi, 2007; Reeves, Herrington, and Oliver, 2002), (3) the online learning environment (Mahajan, 2012, Kerdprasop and Kerdprasop, 2008, Huang, 2005, Alessi and Trollip, 2001).

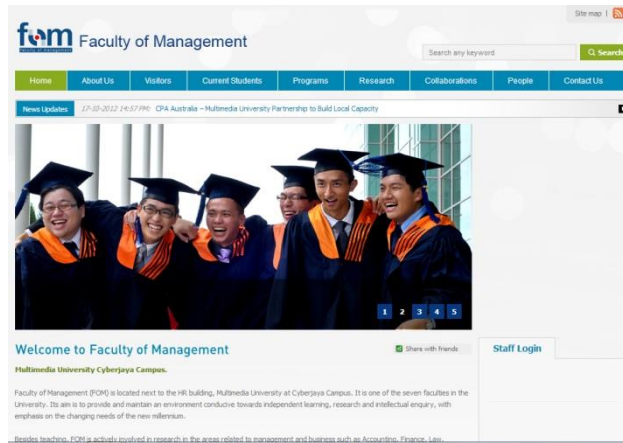


Figure 5 The original website of the Faculty of Management



Figure 6 Example of a final project outcome by one group

4.0 RESULTS AND DISCUSSION

To gauge student learning outcomes, students were given a pre-test with questions based on the content from the Principles of Visual Design module. The pre-test was given on the first day of class, before students were informed about the module. Following that, a post-test was taken immediately after students had been given a week to access the module online. The pre-test and post-test contained the same questions which were

randomized to avoid students remembering the questions and answers. The results of the pre-test and post-test are shown in Table 2 and are broken down into the means (M) and Standard Deviations (Std Dev) of the tests.

Table 2 Paired samples statistics

	Mean	N	Std. Deviation	Std. Error Mean
Pre-test	7.59	34	2.924	0.502
Post-test	10.71	34	3.580	0.614

Table 3 Test of normality

Shapiro-Wilk			
	Statistic	df	Sig.
diffscore	.958	35	.204

Table 4 Paired samples test

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pretest - Posttest	-3.118	3.641	0.624	-4.388	-1.847	-4.993	33	0.000

As shown in Table 2, students scored higher in the post-test with results indicating a positive change (mean = 10.71) as compared to the pre-test which had a mean of 7.59. Before running a paired samples t-test at 95% confidence to look at the statistical significance of the results from Table 2, a normality test was conducted to determine if the scores were normally distributed. The Shapiro-Wilk test was used to test for normality as the sample size was less than 50 (N=34) and the test result as shown in Table 3 (Sig. at 0.204) was non-significant ($P>0.05$), indicating that the distribution of the sample of scores in this pre and post-test was not significantly different from a normal distribution and therefore can be generalized as normally distributed (Field, 2013). As the scores were normally distributed, a paired samples t-test was conducted to analyze the statistical significance of the results. The statistical significance (Sig.) as shown in Table 4 is 0.000 which is accepted as statistically significant ($P<0.05$) when testing for 95% confidence. This indicates that after using the module, students made statistically significant progress in their learning outcomes.

Students were also given questionnaires to assess their attitude towards the project, how they felt about working in groups and perceptions on the online learning environment (blog and interactive multimedia module). The questionnaires contained survey items designed based on literature guidelines

and was measured using a 5-point Likert scale in which 1 = Strongly Disagree (SD), 2 = Disagree (D), 3 = Undecided (U), 4 = Agree (A) and 5 = Strongly Agree (SA). Two surveys were conducted during class hours at the end of the trimester after students had completed their project and were a means to evaluate the Authentic Learning environment. Apart from the surveys, student comments were solicited through their blogs and via open-ended questions that were attached to the questionnaires. The survey items were analyzed using SPSS and the results of two surveys are shown in Table 5: (1) problem-based group project and (2) online learning environment. The survey items related to the problem-based group project yielded a Cronbach's Alpha of 0.870 whilst the survey items related to the online learning environment yielded a Cronbach's Alpha of 0.845; both results of the reliability test can be deemed reliable (above 0.60) according to DeVellis (1991). The results of the survey are broken down into the means (M), standard deviation (SD) and percentage (P) and are displayed in a descending means order. A selection of student comments quoted ad verbatim are also listed next to the survey items in Table 5 to show student's positive support towards each component in the Authentic Learning environment.

Table 5 Authentic learning environment survey

Problem-based group project					
No	Survey Item	Mean (M)	Std. Deviation (SD)	% (P)	Student Comments (Quoted ad verbatim)
1	The project allowed acquisition of new knowledge and skills	4.46	0.508	100.0	1. It helped me gained new knowledge, to design in a creative way and develop a teamwork. 2. It helped me discover new things...and how to create a website for personal gain or usage in the future... 3. Now I can do more and more project with the background that I have. So now I'm like more creative. 4. In terms of critical thinking I was able to relate what I learn in class when doing the project... 5. It help me find the disadvantages and we accept that everything can be improve when we critical it in the right way. It makes me to think out of the box. Many thing I learned in the class 6. It has taught me to always think outside the box and there are more than one solutions to solving a problem 7. We having a small group discussion during the past time to enhance the idea from every individual and discuss it and doing it together 8. it can improve my creativity and thinking skill that how we as a
2	The project allowed creative thinking	4.35	0.689	88.5	
3	The Web was useful for information on project	4.27	0.667	88.5	
4	Project was authentic and relevant to learning	4.23	0.587	92.3	
5	I was allowed to analyse, synthesise and evaluate information in this project	4.15	0.543	92.3	
6	This project allowed me to develop skills needed for the real-world	4.15	0.675	84.6	
7	Found that solving problems required collaboration and teamwork	4.15	0.732	80.8	
8	Project was challenging yet stimulating	4.12	0.993	84.6	
9	I am satisfied with my contribution	4.12	0.653	84.6	
10	Group work improved problem solving skills	4.04	0.720	76.9	
11	Able to better represent concepts and ideas using digital multimedia	4.04	0.774	73.1	
12	Project enhanced understanding	4.04	0.720	76.9	
13	Project allowed me to think critically about the topics	4.00	0.693	84.6	
14	Can understand the subject better	3.96	0.720	73.1	

	after doing the project				group solve problem that occurred
15	Project enabled creative input of ideas	3.96	0.871	80.8	9. The project helped me in my creativity skills as we were required to re-design the website. We have to think creatively to come up with interesting ideas. My critical thinking skills also. Therased as we need to think logically of what people out there want to see from the website 10. The project help in my creative and critical thinking skills by solve the problem that I faced during the project.
16	Motivated to complete this project	3.92	0.977	84.6	
17	Learn more when working with teammates	3.88	0.952	76.9	
18	Team was able to work together to complete the project	3.85	1.120	69.2	
19	Group was able to achieve goals	3.81	0.895	65.4	
20	I enjoyed collaborating on the project and online	3.54	0.905	61.5	
N=26, Cronbach Alpha= 0.870					
Online learning environment					
No	Survey Item	Mean (M)	Std. Deviation (SD)	% (P)	Student Comments
1	Liked learning through the multimedia modules	4.14	.710	81.8	1. It attracts my attention effectively and it is easier to remember.
2	Comments received made me learn more about my work	4.14	.710	90.9	2. I like using video and images (multimedia) which can show us examples to improve our understanding...
3	Multimedia content made learning fun.	4.09	.971	81.8	3. It was interesting and easy to understand.
4	The graphical user interface was interesting and user-friendly.	4.05	.575	86.4	4. I was able to learn at my own pace which I enjoy very much
5	Able to reflect on work done when reading blog entries	4.00	.756	81.8	5. Fun, compared reading slides, should consider shifting all the content in the pdf to the multimedia module as it makes easier to read.
6	Multimedia modules were easy to use.	4.00	.816	77.3	6. That you are able to review your work and if need be change it.
7	Able to communicate progress to group mates through blogs	3.95	.785	77.3	7. I can read other people's blog to enhance my understanding.
8	Able to learn at own pace.	3.95	.950	77.3	8. I like about we can comment to each other that will improve learning.
9	Felt blogs helped enhanced group skills	3.86	.834	68.2	9. I think it is a good tool to communicate as I want to continue career as marketer so It helps me a lot.
10	Multimedia elements enhanced understanding of content.	3.86	.774	72.7	10. Ability to refer to other blogs help tremendously.
11	The objectives of the modules were clear and well defined.	3.82	.853	77.3	
12	Able to learn using the multimedia content.	3.77	.752	77.3	
13	Able to reflect on learning by writing entries in the blog	3.77	.973	68.2	
14	Able to solve problems by looking at other blogs in the course	3.68	.894	59.1	
15	Content of the modules were easy to understand.	3.68	.780	68.2	
16	Able to document my learning progress on blog	3.64	.848	59.1	
17	Group was able to cooperate together more efficiently	3.64	.953	59.1	
18	Motivated when learning with multimedia modules.	3.64	.848	59.1	
19	Able to solve problems as a group using blogs	3.50	.859	45.5	
20	Liked using blogs for learning	3.32	.945	50.0	
N=22, Cronbach's Alpha=0.845					

Results from the pre-test, post-test, surveys and student comments were triangulated and analysed to answer the research questions this study sought to investigate. In answering research question 1, based on the analysis of the survey results and student feedback through open-ended questions and blog comments, student perceptions towards the Authentic Learning environment can be categorized into these main areas:

1. Relevancy of group project

From the results of the surveys, most students agreed that the group project felt real and relevant to their

learning. Student comments further supported their favorable perception towards the project as they felt that the project allowed them to understand the subject better and helped them develop important skills such as creative thinking skills, critical thinking skills, and problem-solving skills through teamwork. Students found the project challenging but felt motivated to complete the project with some students commenting that they could now work on similar projects in the future.

2. Use of multimedia

Students showed a preference for the use of multimedia in their learning as they felt that it made the learning process more enjoyable and found the topics easier to understand when examples are shown using multimedia elements. Students felt more motivated and engaged to learn with the use of multimedia elements to present information. Students also appreciated how they could learn at their own pace with the multimedia module. Overall students felt that multimedia elements used in the interactive module appealed to them and preferred this method of learning over reading slides.

3. Web environment

Overall, students felt that the web environment was integral to obtaining information related to their project. Students also agreed that the web environment helped their group to communicate better. From the survey results, only half the class indicated they liked the use of blogs in their learning. This was further explained in the student's feedback where students commented that it was a very new way of learning for them and it took a while before they could get familiarized with using the blogs. Some students suggested having a reference in the future on how to use the blogs. Students who were able to get accustomed to the blogs indicated a positive perception to the use of the blogs in the learning environment. They felt that the blogs allowed them to reflect on what they have done and how they can improve themselves. Students were also favorable to being able to refer to other blogs and found that the comments were helpful to their learning.

In answering research question 2, based on the results of the pre-test and post-test, questionnaires and student feedback, the incorporation of Authentic Learning strategies into the design and development of an Authentic Learning environment supported by multimedia and web technologies was able to develop students' creative thinking, critical thinking and problem-solving skills in these aspects:

1. Authenticity and relevancy of the learning environment were important factors in engaging higher-order thinking.

Results from the surveys showed a positive response from students towards the project as it was an authentic and relevant task with an ill-defined problem they had to solve. The complexity and authenticity of the problem-based project challenged students to think creatively and students found it was both real and relevant towards their learning. Creative and critical thinking skills were developed throughout the process, from the research, planning and management of the project to holding varied roles and responsibilities while working in a team. This was evident in the final outcome of the project which showcased an understanding of content creation using multimedia and noted in the progress updates documented on the blogs as they demonstrated higher-order thinking ability used in identifying the problems and finding solutions to these problems. These supports Lombardi (2007) and Levy and Murnane (2005) that Authentic Learning principles are beneficial towards the development of higher-order thinking skills and are able to provide students with important career skills. Relevancy of the project also allowed students to indicate they understood how to apply what they have learnt into a "real-world" situation and noted in their comments that they would now be able to attempt similar projects in

the future. This is consistent with suggestions made by Mahajan (2012).

2. Learning became a student-centred and active process with the support of multimedia and web technologies.

The Authentic Learning environment supported by multimedia and web technologies provided a conducive environment for students to actively take charge of their own learning, supporting McLoughlin and Lee (2007). The online learning environment encouraged students to explore beyond the classroom learning materials and provided students with a wide spectrum of resources to gain knowledge from. This is in line with Kerdprasop and Kerdprasop's (2008) noted benefits of web technologies. The addition of a blogging platform in the learning environment for students to document their work allowed for better reflection, teamwork and problem solving. Learning also became a more enjoyable process with the use of multimedia elements and motivation towards learning was enhanced. This supports Alessi and Trollip (2001) and Huang's (2005) view that with the proper use of multimedia to engage students, students can be better motivated in their learning process.

3. Crucial career skills were engaged when collaboration became an important aspect of the learning process.

The class project required students to work collaboratively in groups to solve the problem thus enabling students to acquire teamwork and leadership skills. Students had to learn communication skills when discussing ideas, brainstorming and problem solving to ensure the team was able to work together efficiently. In class presentations also allowed students to learn important presentation skills and how to articulate their ideas well. Survey results and comments from students indicated that students understood the importance of collaboration and teamwork in order to effectively solve problems, supporting Herrington and Kervin (2007).

4. Understanding was enhanced in this learning environment.

The results from the pre and post-test indicate that students made statistically significant progress in their learning outcome. This is further supported by the results from the surveys, student comments and final project outcome which indicate that students had a clearer understanding of the subject after completing the project. By adapting Authentic Learning principles into the learning environment, students were able to see the relevancy of the topics learnt and found that knowledge acquisition became easier. This supports Lombardi (2007) and Herrington, Reeves, Oliver and Woo's (2004) stand that Authentic Learning environments facilitate better understanding as these environments are able to engage students actively in the learning process.

As a whole, students indicated a favorable response towards the Authentic Learning environment however there were several problems faced by the students as noted in their comments and feedback. The problems students faced were mainly regarding these issues: (1) trouble with group members, (2) internet connection issues, and (3) unfamiliarity with using blogs. Students were given control over their choice of group members and in order to allow students to develop teamwork skills, students had to learn to resolve conflicts in the groups on their own. Unfortunately internet connection issues are out of this study's control and depend on Internet Service Providers. However this issue may be resolved in the future when High

Speed Broadband penetration rate increases in Malaysia. Student's unfamiliarity with using blogs did not detract from the overall response to this Authentic Learning environment, the suggestion to have a reference or guide on using blogs will be taken into consideration for future research studies

5.0 CONCLUSION

In conclusion, while the education landscape in Malaysia has been going through a paradigm shift with the national agenda calling for the use of more ICT in classrooms and the need for more graduates with critical thinking, creative thinking and problem-solving skills (MOE, 2012; Tan, Teo, and Chye, 2009), the intended learning outcomes have yet to be achieved successfully (Luo, Boland and Chan, 2013) although tertiary classrooms in Malaysia have already begun embracing technological support in teaching and learning (Azizan, 2010). Therefore this study had sought to investigate the impact of Authentic Learning on developing student's creative and critical thinking skills when incorporated into the design of a technology-backed learning environment. Results from the study have shown that Authentic Learning when supported by a multimedia and web tools in a learning environment was able to develop students' creative and critical thinking skills. Learning outcomes and student feedback indicated that students were able to think both critically and creatively; results found that collaboration was a contributing factor to students developing career transcending skills; students were able to use higher-order thinking skills and found this learning environment real and relevant to their learning process. Students indicated a favorable perception of the Authentic Learning environment and were generally positive towards the components of the Authentic Learning environment. Hence, this gives positive and encouraging support for the use of an Authentic Learning approach in addressing the Malaysian Ministry of Education's heed for graduates with crucial career-transcending skills, by creating learning environments that effectively develop students' creative and critical thinking.

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