



Enhancing student learning using multimedia and web technologies: Students' perceptions of an authentic learning experience in a Malaysian classroom

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There is still a lack of confidence in the effectiveness of online education as education materials are being developed without proper consideration as to their design and content representation (Chung, 2008). Adding to that, we are now in a world where the ability to identify and solve real-world complex problems has become a career transcending skill (Levy & Murnane, 2005) hence creating the need for incorporating authentic learning principles into learning content as it creates an environment that allows students to gain crucial real-world skills (Lombardi, 2007). Therefore this paper reports a study conducted to assess the impact of incorporating authentic learning principles (Herrington & Kervin, 2007) into a web-based multimedia learning module, and embedding it within a student-centred learning environment, on the student learning process. Students were presented with a multimedia-mediated web-based learning module, developed within the curriculum of the class, and their feedback was solicited. Results showed that students were very positive towards the incorporation of interactive authentic activities and found the authentic learning environment to be very relevant to their learning and became more engaged and actively involved in their learning process. These results show strong and encouraging support for the development of multimedia web-based modules that are grounded in authentic learning and sound design principles, and an innovative teaching and learning strategy in a technology-backed class.

Keywords: Multimedia learning, web-based learning, student-centered learning, authentic learning environment

Introduction

The advancements of information communication technology (ICT) have generated interest amongst educators to utilize the technologies available for the purposes of teaching (Sivapalan and Wan Fatimah, 2010). As such, the Malaysian Ministry of Education have made known their intention for making ICT-enhanced teaching and learning common features in Malaysian schools, even going as far as encouraging the development of teaching and learning coursewares for the classroom (MOE, 2004). However, these technological advancements are often not used for the right reasons. They are merely used out of convenience, as a method of entertaining students or even because of administrative pressure (Herrington & Kervin, 2007). According to Palloff & Pratt (2001), there is more to using technology than merely uploading teaching materials online. Wijekumar (2005) notes that web-based learning environments should be well designed and used as intended in order for it to be an asset to the education industry. It should be designed specifically with an interactive, electronic medium that accommodates various media types and incorporated in the classroom in many ways (Bonk, Cummings, Hara, Fischler & Lee, 2000). Online modules should also be designed to be as authentic as possible by

incorporating content and activities to reflect the way the knowledge is used in real life situations (Herrington & Herrington, 2006).

Amongst Malaysian researchers, the focus of online interactive multimedia modules is often the interface design and adding interactive multimedia elements (Sivapalan and Wan Fatimah, 2010; Kamaruddin, 2010). There has been a lack of focus on creating authentic learning web environments. The Education Minister of Malaysia mentioned a need to move towards education that equips students with life skills in order to prepare them career-wise (Abdullah, 2010) whereas Malaysian students themselves feel the need to learn problem-solving skills instead of merely regurgitating memorized facts (Lee, 2010). Even Chung (2008) mentioned that there is a lack of confidence among students, parents and educators that education online, particularly in Malaysia, could be an effective medium for imparting knowledge or skills. An authentic learning environment is therefore crucial towards preparing and equipping students with the necessary knowledge and skills to face the working world (Lombardi, 2007). Hence there is a crucial need to develop interactive multimedia web-based learning environments that incorporate authentic learning principles. Therefore, in order to effectively utilize technology, Herrington & Kervin (2007) suggest that the focus needs to shift from the teachers to the students and proposed 10 principles of authentic learning which include providing authentic context that reflect the way knowledge will be used in real-life, having authentic activities, access to expert performances and the modelling processes, multiple roles and perspectives, support collaborative construction of knowledge, promoting reflection to enable abstractions to be formed, promoting articulation to enable tacit knowledge be made explicit, providing coaching by the teacher at critical times, scaffolding and fading of teacher support, authentic, integrated assessment of learning within the tasks, and professional learning to keep up with the rapidly changing technology, all of which were adapted for this study.

Web-based authentic learning environments

Authentic learning focuses on complex problems one would face in the real-world and the solutions to these problems; this in turn creates an environment in which students are able to cultivate important skills like higher order analysis and complex communication that would assist them in the real world (Herrington & Kervin, 2007; Lombardi, 2007). It is this ability to identify and solve problems using recognition and metacognition that sets apart those with skills to help them advance in their careers from those who have little opportunity to move forward (Levy & Murnane, 2005). Authentic learning breaks the traditional student mentality that every problem has a right answer that needs to be memorized by hard work (Lombardi, 2007). Traditionally authentic learning is implemented through programs like internships and practicum, however Lave & Wenger (1991) argue that the quality and consistency of real-life apprenticeships vary enormously because of practical constraints, risks of danger and so on. It is impossible for educators to ensure all their learners enter into apprenticeships that offer the same valuable experience as it is something that is beyond their control. Therefore, a virtual environment like a web-based learning environment equipped with real-life relevance would provide a safe learning ground for students to explore and still gain the skills required when they are placed in a real work environment (Herrington & Kervin, 2007). A web-based learning environment would also allow students' room for trial and error by repeating the authentic activities provided, something not often possible in real world environments (Lombardi, 2007) where an educational software that allowed educators to try and test teaching methods in a simulated environment was used to help new teachers manage behavioural and learning issues in the classroom, something they found hard to do effectively in real-world practice. In exploring authentic learning environments in a web-based context, it has become increasingly important for the benefits of authentic activities to be brought about through the careful design of web-based learning environments (Herrington, Reeves, Oliver & Woo, 2004). A web-based learning environment can be defined as a computer-based and computer supported education and training system that uses the web as the representation and delivery medium of learning materials. Web-based learning environments have the advantages of reusability, interoperability and accessibility, provided by the Internet, which play a crucial role in the development of modern learning environments (Kerdprasop & Kerdprasop, 2008). The web has become a popular application for online learning (Nam & Smith-Jackson, 2007) largely because the web is currently at a point where it is possible to stream video, have audio-conferencing, podcasts, videocasts and more (Anderson, 2008). As such, many researchers have begun incorporating authentic learning into web-based learning environments and are exploring the use of technology to support authentic learning (Herrington, Reeves, Oliver & Woo, 2004; Herrington & Kervin, 2007).

Multimedia-supported learning

Many web learning applications are now designed such that information is presented online in websites and enhanced with multimedia features and interactivity, and follow certain design concepts (Svensson & Ostlund, 2007). These web learning applications are created using a development process which incorporates multimedia into the designing of instructional curricula (Oliver, Herrington, Herrington & Sparrow, 1996). However, Maddux, Johnson, & Willis (1997) warns of the possibility of tools being wrongly utilized as web learning applications are computer-based and the computer is a tool like any other tool. In addition to that, Wijekumar (2005) mentions that a web-based learning course is not about having PowerPoint notes online, adding an electronic quiz and some discussion questions. This method that lacks user interaction can be categorized as a Type I usage of computers as suggested by Maddux & Cummings (1987) where the computer merely makes traditional teaching methods easier but is void of active user involvement. On the other hand, Maddux & Cummings (1987) also mention a Type II usage of computers where it is user-oriented, focuses on problem-solving skills and the computer aids cognitive processes. According to Wang, Yetsko, Licitra, & Armstrong (2005), interactive courseware that uses multimedia can promote active learning. Learning courses that are interactive should contain a good mix of various multimedia components such as video, audio, games, simulations and interactions to maximize its' effects on learning.

According to Oliver, Herrington, Herrington, & Sparrow (1996), 'multimedia appears to be an environment that supports the forms of exploration and activity required' for learning theoretical approaches in real life situations. This is in line with how authentic activities can be incorporated into online modules by using multimedia as a technological support, since authentic activities require learners to apply theoretical knowledge into real context. Cairncross & Mannon (2001) believe that the learning process can be enhanced through integrating multimedia as it provides users control over the delivery of information and supports interactivity. They also stress that 'multimedia can support multiple representations of the same piece of information in a variety of formats' which gives learners an authentic learning environment by providing multiple roles and perspectives. Therefore in this study, a web-based authentic learning environment that combined Herrington & Kervin's (2007) principles of authentic learning with multimedia and web technologies (Table 1) was created to investigate its impact on the student's learning process. The environment contained the following components: 1) an interactive learning module based on the curriculum of the class, 2) the implementation of the content of the module in the classroom, and 3) blogs or wikis to document their learning process and their engagement in the environment. The class was blended in its approach whereby students had face-to-face lecture sessions with the lecturer, online learning as well as online discussions. Students would proceed online to study the module first and then the lecturer would discuss it in class so as to iron out any queries the students would have. Students also had blogs to post up discussions of their work throughout the project which are checked by the lecturers and tutors.

Table 1: Herrington and Kervin (2007) Principles of Authentic Learning

	Principles of Authentic Learning	Guidelines for Implementation	Interactive Multimedia Web Learning Module
1.	Authentic context	Context that reflects the way knowledge will be used in real life.	Context and content used in the module were taken from actual learning content, text books and the class curriculum.
2.	Authentic activities	Activities that people do in the real world.	Relevant activities are added into the content to help students find and solve problems using the theories they have learnt in the module (eg. in the Design Principle topic students were asked to redesign a signage for a door, embedded into the content itself).
3.	Expert performance	Allowing students to observe the task before it is attempted and to access the modelling of processes.	YouTube videos of expert opinions on certain topics were sourced and integrated into the content.
4.	Multiple roles and perspectives	Different people, media and resources are employed as required to provide a rich array of opinions and points of view.	Explanation of certain topics and terms were linked to various credible external websites for students to explore and see different points of view. In addition to that, multimedia (video, graphics, text, audio and animation) were used to explain the topics.

5.	Collaboration	Allowing students to collaborate with one another to solve problems and articulate what they have learnt.	Module links to existing forums, blogs and online communities to allow students to have a place to discuss and learn the topics taught in the module.
6.	Reflection	Requiring students to reflect upon a broad base of knowledge to solve problems, and to predict, hypothesise, and experiment to produce a solution.	Activities and quizzes in the module encourage students to reflect on what they have learnt.
7.	Articulation	To ensure that students have the opportunity to articulate, negotiate and defend their growing understanding.	Forums and blogs allow students to voice their opinions in discussion, further allowing students to make use of the knowledge they have gained.
8.	Coaching and scaffolding	The teacher merely observes the student and provides support and feedback when necessary.	Contact to lecturer is provided in the module. Activities and quizzes have clear and concise explanations to help guide students through the module.
9.	Integrated authentic assessment	Assessment that is seamless integrated with the activities provided.	Quizzes were given at the end of each topic to allow students to gauge how much they know about that topic, instead of only one main overall quiz.
10.	Professional learning	Keeping up with new technological developments.	The module encouraged students to get involve in an online community of professionals through forums, blogs and so on to keep up with the changes in technology.

The study: Creating the web-based authentic learning environment

This study was conducted with the participation of university students from the Digital Media class which was a compulsory class spanning 14 study weeks. The objective of the class was to provide students with a basic understanding of multimedia and content creation. The class comprised of 23 students (n=23) from the Faculty of Management, Multimedia University. Students in this class were local and international students from various ethnic backgrounds and the class consisted of both male and female students. In the development of the learning environment, the Principles of Authentic Learning listed by Herrington & Kervin (2007) in Table 1 were carefully incorporated into the modules in order to create a web-based authentic learning environment. Table 1 also shows how each principle is adapted into the module to enhance the student's learning process. The interactive online module entitled *Designing the Multimedia Interface* was an actual topic in the Digital Media course curriculum as authentic learning environments require the use of authentic context to reflect the way the knowledge obtained would be applied in real life situations (Herrington & Kervin, 2007). Figure 1 show the overall look and feel of the interactive module designed to allow students to explore issues associated with designing multimedia interfaces.

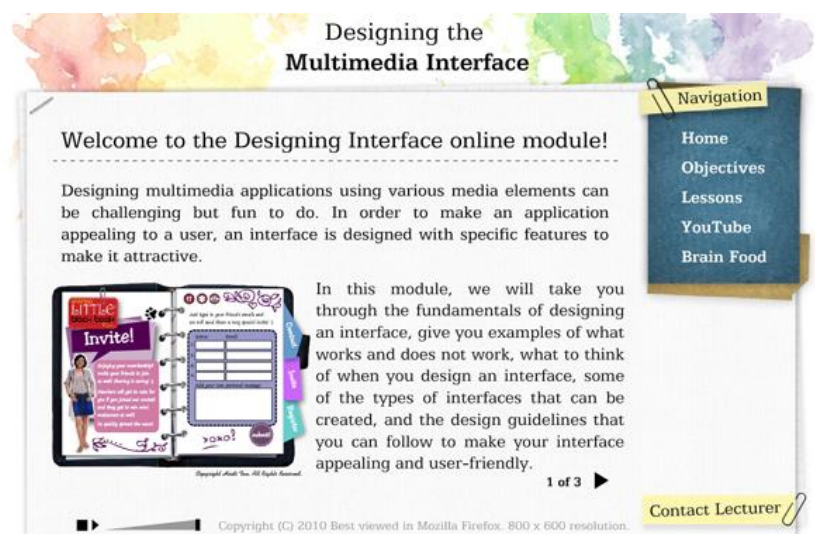


Figure 1: The home page of the Interactive Multimedia Web Learning Module



Figure 2: Lessons



Figure 3: The YouTube Videos page

Authentic context is further achieved by exposing the students to the objectives of this topic as it describes to students the purpose of learning how to design multimedia interfaces. This would help them see the connection in applying theoretical knowledge to real life situations. Real examples were used to illustrate key concepts and ideas in the module as seen in Figure 2 using a real existing website to strengthen the relevance of the content taught in the module. Videos sourced from YouTube.com were added into the module to provide expert performances as they were videos of experts in interface design (Figure 3) to allow students to see that their learning environment was not limited to the module alone but that they can learn even from their favourite social networking websites. These in turn encouraged students to explore the topic more through the external links provided in the module. Aside from videos, the module also utilizes animation, text, graphics and sound to provide multiple role and representations of the same piece of information presented to the students (Cairncross & Mannon, 2001). Authentic activities were integrated into the module as interactive activities that contain real-world complex problems. Solving these problems not only helped the students really understand what they have learnt but also provided them with a safe environment for trial and error before they face the real working world. Coaching and scaffolding as well as integrated assessments were provided after each sub-topic as a mini quiz. When students answered a question, feedback was given regardless if the answer was right or wrong. The feedback was there to provide coaching and tips were given to help students reflect on what they had just learnt.

Integration of the module into the class structure

An authentic learning environment is one where students collaborate with one another to solve problems and articulate to one another the knowledge they have gained (Herrington & Kervin, 2007). To encourage these forms of authentic learning in the Digital Media class, all the students participated in a class project where they divided themselves into a few small groups and came up with an online “Shopping Mall”. Each group was in charge of creating the interface for their “shop” and all the shops were linked to a main page (Figure 4).

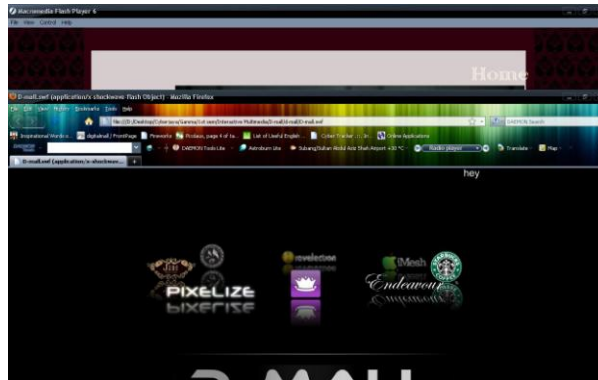


Figure 4: The main shopping mall page

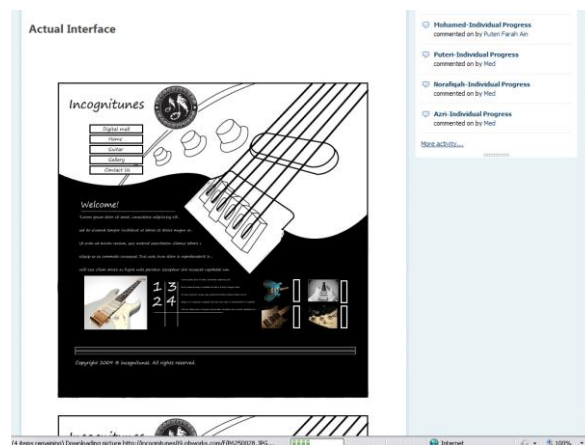


Figure 5: Work in progress

This was an on going project throughout the 14 weeks and during that time, students were exposed to the Interactive Multimedia Web Learning Module, which was meant to help them in the design of their “online shop” interface. Figure 5 shows one of the group’s interface design and demonstrates a clear understanding of the content taught in the module. Students were asked to create PBWiki pages as a work in progress blog (Figure 6) whereby the lecturer could easily monitor their progress and give coaching or feedback when necessary. This is in line with the authentic learning principles of providing coaching and scaffolding when necessary (Herrington & Kervin, 2007). Authentic learning environments engage students to be in control of their own learning and therefore the educator takes on the role of a coach or facilitator who gives feedback only when the students require it (Honebein, 1996; Herrington & Kervin, 2007). Based on the progress reports posted by the students online, students were using the PBWiki pages to articulate their knowledge, collaborate with their classmates and apply what they have learnt theoretically from the module into a real-life project. Figure 6 show how the class was structured to enable students to be immersed into an authentic learning environment.

Student projects were assessed based on these criteria: 1) Overall layout and interface design of the website, 2) Interactivity and use of multimedia elements, 3) look and feel of the project, and 4) work in progress documentation. As a result of the learning environment, student grades ranged from A (34% of students) to B (66% of students), showing that they were able to complete their assignment according to the criteria.

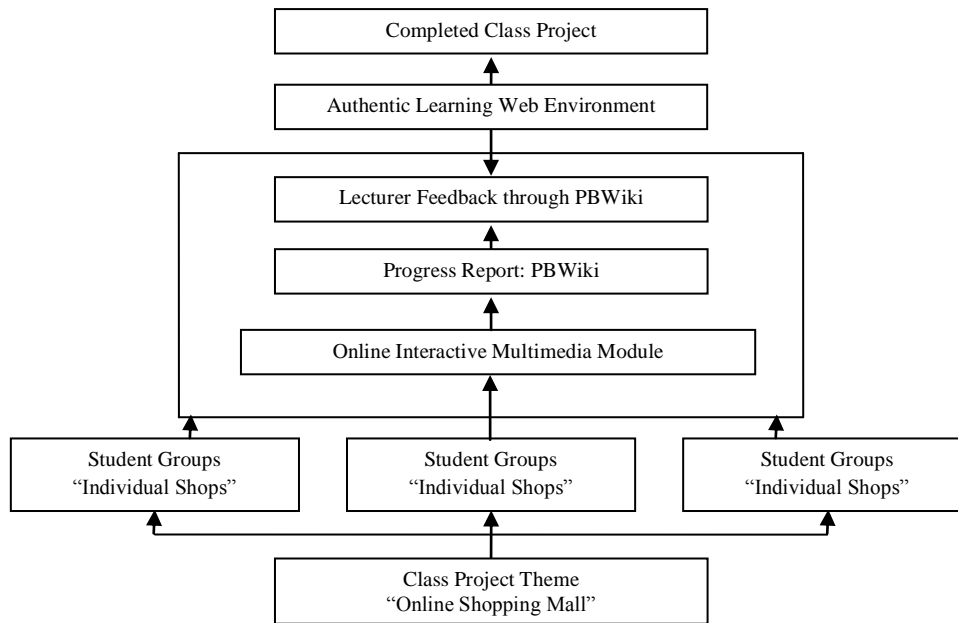


Figure 6: Workflow of the class structure with authentic learning web environment integrated

Data analysis and results

Students were given a pretest based on the module a few weeks before they were viewed the module. Students were given a 2 week period to study the topic taught on the module and were given a posttest to gauge their comprehension of the topic taught in the web module. The pretest and posttest were designed to have the same questions but in the posttest, the questions were randomized to avoid the ‘memory effect’. The results of the pretest and posttest are shown in Table 2 and are broken down into the means (M) of both tests and their Standard Deviation (Std Dev).

Table 2: Paired Samples Statistics

		Mean (M)	Std. Deviation
Pair 1	pretest	7.47	2.503
	posttest	8.73	2.520

The posttest has a higher mean (M=8.73) compared to the pretest (M=7.47) which indicates a positive change in the student’s learning outcome. However in order to ascertain the significance of the change in mean (M) for both tests, the results of the student’s pretest and posttest was statistically analyzed using a paired sample T-test method. Using this method, statistical significance (Sig.) is accepted where P is less than 0.05 (P<0.05) when testing for 95% confidence. Table 3 shows that the result of the pretest and posttest broken down into various statistics. The statistical significance (Sig.) is 0.022 which is accepted as statistically significant. This proved that the students have indeed made significant progress in their learning process after using the online module.

Table 3: Paired Samples T-Test Results

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pretest-posttest	-1.267	1.907	.492	-2.323	-.210	-2.572	14	.022

Students were also given a 30 item survey with open-ended questions measured on 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). The items of the survey were to solicit students' feedback and perceptions on how relevant was the content to their learning, and their perceptions towards the module, the web environment and learning with multimedia. The open-ended questions were designed to probe deeper and solicit their comments about the Interactive Multimedia Web Learning Module. The survey was distributed to the students in class after a lecture session. Table 4 shows the results of the survey and is broken down into the frequency (f) and percentage (%) of student responses, means (M) for the items that yielded positive feedback (Agree and Strongly Agree on the survey scale) and the standard deviation (Std Dev) of each item in the survey. The survey also yielded a Cronbach Alpha of 0.878, which, according to DeVellis (1991), is above 0.60, and is therefore, reliable.

Table 4: Survey results

No	Survey Item	SD f (%)	D f(%)	U f(%)	A f(%)	SA f(%)	Mean (M)	Std Dev
1	Overall, I like this web module	0 (0.00)	0 (0.00)	0 (0.00)	10 (71.4)	4 (28.6)	4.29	.469
2	The videos in the module were relevant to my learning	0 (0.00)	0 (0.00)	1 (7.1)	8 (57.1)	5 (35.7)	4.29	.611
3	Multimedia helped me understand the topics better	0 (0.00)	0 (0.00)	0 (0.00)	11 (78.6)	3 (21.4)	4.21	.426
4	I enjoyed learning with multimedia	0 (0.00)	0 (0.00)	1 (7.1)	9 (64.3)	4 (28.6)	4.21	.579
5	I find learning with the web interesting and engaging	0 (0.00)	0 (0.00)	1 (7.1)	9 (64.3)	4 (28.6)	4.21	.579
6	The font type and font size used were easy to read	0 (0.00)	0 (0.00)	1 (7.1)	9 (64.3)	4 (28.6)	4.21	.579
7	I liked the use of multimedia to illustrate ideas and concepts	0 (0.00)	0 (0.00)	0 (0.00)	11 (78.6)	3 (21.4)	4.21	.426
8	I like having multimedia elements in the content	0 (0.00)	0 (0.00)	0 (0.00)	11 (78.6)	3 (21.4)	4.21	.426
9	The web environment motivated me to explore the topic more	0 (0.00)	1 (7.1)	0 (0.00)	9 (64.3)	4 (28.6)	4.14	.770
10	The graphics in the multimedia application were clear enough for me to understand	0 (0.00)	0 (0.00)	0 (0.00)	13 (82.9)	1 (7.1)	4.07	.267
11	I liked that there were links to external websites like Wikipedia	0 (0.00)	0 (0.00)	1 (7.1)	8 (57.1)	5 (35.7)	4.07	.616
12	The buttons and links were easy to understand and brought me to the correct pages	0 (0.00)	0 (0.00)	0 (0.00)	13 (92.9)	1 (7.1)	4.07	.267
13	I enjoyed learning in the web environment	0 (0.00)	0 (0.00)	2 (14.3)	10 (71.4)	2 (14.3)	4.00	.555
14	The links to other relevant websites were useful to my learning	0 (0.00)	1 (7.1)	2 (14.3)	7 (50.0)	4 (28.6)	4.00	.877
15	I can understand the topic better after using the module	0 (0.00)	1 (7.1)	0 (0.00)	11 (78.6)	2 (14.3)	4.00	.679
16	I was clear about the objectives stated in the module	0 (0.00)	0 (0.00)	2 (14.3)	10 (71.4)	2 (14.3)	4.00	.555
17	Interacting with the module motivated me to learn the content	0 (0.00)	0 (0.00)	3 (21.4)	8 (57.1)	3 (21.4)	4.00	.679
18	The content in the module was straightforward and clear	0 (0.00)	0 (0.00)	1 (7.1)	12 (85.7)	1 (7.1)	4.00	.392
19	I can apply what I learned from this web module in real-life	0 (0.00)	0 (0.00)	3 (21.4)	8 (57.1)	3 (21.4)	4.00	.679
20	I felt that the content in the web module was relevant to my learning	0 (0.00)	0 (0.00)	1 (7.1)	12 (85.7)	1 (7.1)	4.00	.392
21	The examples provided in this web module helped me understand the topic better	0 (0.00)	0 (0.00)	2 (14.3)	11 (78.6)	1 (7.1)	3.93	.475
22	I find the multimedia elements in the content appealing	0 (0.00)	0 (0.00)	2 (14.3)	11 (78.6)	1 (7.1)	3.93	.475
23	I enjoyed the accessibility the web environment gave me	0 (0.00)	0 (0.00)	2 (14.3)	11 (78.6)	1 (7.1)	3.93	.475
24	I enjoyed using the module to learn the topic	0 (0.00)	0 (0.00)	4 (28.6)	7 (50.0)	3 (21.4)	3.93	.730
25	I liked the look and feel of the module	0 (0.00)	0 (0.00)	2 (14.3)	12 (85.7)	0 (0.00)	3.86	.363

		(0.00)	(0.00)	(14.3)	(85.7)	(0.00)		
26	The activities provided in this web module were authentic and relevant	0 (0.00)	0 (0.00)	2 (14.3)	12 (85.7)	0 (0.00)	3.86	.363
27	The navigation in the module was clear and easy to follow	0 (0.00)	2 (14.3)	1 (7.1)	10 (71.4)	1 (7.1)	3.71	.825
28	I prefer this learning method in my learning process	0 (0.00)	1 (7.1)	3 (21.4)	9 (64.3)	1 (7.1)	3.71	.726
29	I found that there was just the right amount of information on each screen	0 (0.00)	1 (7.1)	3 (21.4)	10 (71.4)	0 (0.00)	3.64	.633
30	The quiz in this interactive web module helped me reflect on the topics taught	0 (0.00)	1 (7.1)	4 (28.6)	9 (64.3)	0 (0.00)	3.57	.646
<i>Cronbach's Alpha=0.878</i>								

The results show that students felt that the content provided in the Web module was authentic and relevant to their learning (Item # 20, M=4.00, Item # 21, M=86, Item # 26, M=3.93). They commented that they felt *"it was interesting rather than downloading it from mmls. It is unique and fun."* They also commented that they felt the module was *"good as we feel it's related to our project"* and also mentioned that *"last time when we opened Photoshop, we just simply design. Now we understand and have a basis on designing multimedia"* showing that students felt the content in the module was relevant to their learning, supporting the survey results.

The findings indicate that authentic learning was achieved as they commented that *"I can apply what I have learnt in my everyday life"* and showed favourable response in the survey in regards to that (Item # 19, M=4.00). When asked about the quizzes provided in the module, students commented that *"I like it because like, I got 4 out of 5 then I can go back and try again and try to get 100%, I like the feeling of achievement"*. Students also commented that *"I like the descriptions in the quiz after answering, it helps"*, *"I did the quiz a few times then I can do the midterm exam already"* and *"I can refresh my mind after reading the notes"*, showing that the quiz in the module helped them reflect on the topic taught (Item # 30, M=3.57). These positive results prove that the environment is indeed an authentic learning environment that is relevant to their learning and is further supported by feedback from the students that *"so far, I have learnt many new works. My creativity sharpens, so far I am satisfied with the topic."*

When asked about the module itself, students reported that they liked how the module looked, its content and navigation, and enjoyed learning from it (Item # 12, M=4.07, Item # 18, M=4.00, Item # 24, M=3.93, Item # 25, M=3.86, Item # 27, M=3.71, Item # 29, M=3.64) and commented that *"I like this interactive web module. There are a lot of interesting things"* and *"I like using the module to learn the topic and the content in the module was straightforward and clear"*, supporting the survey results. All of the students responded that they were clear about the objectives stated in the module (Item # 16, M=4.00), whereas a majority of the students noted that they preferred this learning method in their learning process (Item # 28, M=3.7) when they commented *"I prefer using the module"* and mentioned that they *"prefer 50-50 mix of face-to-face class with the online module"*. Students commented that *"I feel that the most adequate method for retaining knowledge is making the information easy to remember and interesting, both of these were achieved"* indicating that they felt they could understand the topic better after using the module (Item # 15, M=4.00).

The students responded favourably to learning in a web environment (Item # 13, M=4.00) as they found learning with the web interesting and engaging (Item # 5, M=4.21). They also enjoyed the accessibility the web environment gave them (Item # 23, M=3.93) as the students commented that *"it was easier because we can use the module anytime anywhere"* and *"It allowed me to do interactive revision at any time and best suited the needs of the student whilst getting the work done"*. The students felt that they were motivated to explore the topic more (Item # 9, M=4.14) and that they liked having external links to other websites (Item # 11, M=4.07) when they commented *"it's useful"*, *"it's good because we have different levels of learning so with the external links we can get more information"* and *"it have a lot of related videos and related links so that I can discover more about the topic"* indicating those links were relevant to their learning (Item #14, M=4.00).

According to the results, the majority of students responded positively to having multimedia in their learning content (Item # 2, M=4.29, Item # 6, M=4.21, Item # 8, M=4.21, Item # 10, M=4.07, Item # 22, M=3.93) and they enjoyed learning with multimedia (Item # 3, M=4.2, Item # 4, M=4.21, Item # 7, M=4.21). They commented that *"I think they are cool. They make the module interesting"*, *"I feel it interesting and something new to develop in my work"* and *"New way of studying and learning itself makes user want to try it, it goes for me also, I'm fascinated with multimedia elements, so it kinda easy for me to understand"*. The students also noted that *"I like the use of multimedia to illustrate ideas and concepts"*. When it comes to interacting with the module, all the students agreed that it motivated them to learn the content (Item #17, M=4.00) when they

commented that *"The fact that there were videos and multimedia as these are things I personally enjoy using and made using the module very fun"*. The students commented that *"Graphics, animation, video etc helps to learn new creative tasks such as: I have used Photoshop, Dreamweaver and Flash player for getting help in the assignment"*. Students also enjoyed watching the YouTube videos as they mentioned *"it very helpful as we can watch them do it step by step and also we can pause or rewind it"*. Hence, overall the students like the web module (Item # 1, M=4.29) and gave positive feedback like *"more enjoy and feeling if we compare the other way such as books"*.

The overall findings from the survey and in-depth interviews conducted indicate that the students are favourable towards the incorporation of the online module into their course structure and that the interactive authentic activities and the authentic learning environment was relevant to their learning as they could now apply what they have learnt online in their everyday lives. Students have shown a very positive response towards the use of multimedia and web technologies as they felt that these elements motivated them to learn. As a result, the students became more engaged with the content thus enhanced their learning process.

Discussion

This study has shown that by incorporating authentic learning and design principles (Herrington and Kervin 2007) into the development of multimedia-mediated web-based learning environments, students were able to actively take part in their learning process and were more motivated to explore. In particular:

1. Students found the activities in the module exciting as the students felt the activities were authentic and relevant to them. This confirms Oliver, Herrington, Herrington & Sparrow (1996)'s study that students prefer activities that are relevant to what they are learning and are based on real-world problems as it helps them understand how the theoretical knowledge can be applied in real life situations. Therefore the incorporation of authentic learning principles as mentioned by Herrington and Kervin (2007) play a crucial role in enhancing a student's learning process.
2. The authentic activities from Herrington & Kervin (2007) were effective as students were able to recognize the relevance of the content in the module to their project as they reported that they were able to apply what they learnt from the module into the completion of their project. This resulted in the students scoring well and obtaining As and Bs in their final grade.
3. Adding integrated authentic assessment as mentioned by Herrington & Kervin (2007) was highly beneficial to the students as they mentioned it helped prepare them for their midterm exam and also promote reflection on the topics learnt. Doing the quizzes also motivated the students to learn as they felt a sense of achievement when they score well on the quiz.
4. The module was an interesting new learning process to the students and students enjoyed the engaging multimedia elements within the module. Overall the students preferred this method of learning as it was more enjoyable and they could understand the topic better. This supports Bonk, Cummings, Hara, Fischler & Lee (2000)'s idea that modules should be designed to be interactive and incorporate multimedia elements.
5. Having expert performance and multiple roles and perspectives as mentioned in the principles of authentic learning by Herrington & Kervin (2007) encouraged the students to go deeper than what is taught in the textbook as students reported they found the external links and YouTube videos very useful to their learning. Students were also encouraged to explore the topic taught in the interactive module as they had easy accessibility to resources due to the interactive module being placed in a web environment. Kerdprasop & Kerdprasop (2008) mentioned that one of the advantages of a Web-based learning environment is accessibility and this study has shown that this advantage is highly beneficial towards a student's learning process.
6. Students also were motivated to learn the content thanks to the engaging interactive multimedia elements as the students felt the multimedia elements made learning more interesting and less dull when compared to traditionally reading textbooks, this confirms Wang, Yetsko, Licitra, & Armstrong (2005)'s study on how interactive multimedia supports active learning.

Conclusion

Technology when used effectively and for the right purpose can elevate the learning process for students in this era of technological advancements. As mentioned by Wang, Yetsko, Licitra, & Armstrong (2005), multimedia can indeed effectively promote active learning when it is used in web-based modules that are grounded in authentic learning and sound design principles, with an innovative teaching and learning strategy in a technology-backed class. By integrating Herrington and Kervin's (2007) principles of authentic learning into a

multimedia and web-based learning environment, this study's positive student responses towards this learning environment have indicated an encouraging support to develop more engaging multimedia web-based learning modules. In addition to that, the student's favourable response to the authenticity of the module made the learning process relevant to them and therefore shows the importance of incorporating authentic learning principles into the module in order to create an authentic learning web environment. Hence it is important for educators who are developing web-based modules to ensure the modules follow sound design principles and incorporate authentic learning that is supported by multimedia and web technologies.

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