APPLYING AUTHENTIC LEARNING STRATEGIES IN A MULTIMEDIA AND WEB LEARNING ENVIRONMENT (MWLE): MALAYSIAN STUDENTS' PERSPECTIVE

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ABSTRACT

The advancements of ICT have impacted significantly on educators to utilise the technologies in their classrooms (Sivapalan & Wan Fatimah, 2010). There is also a significant move to make curriculum and content more authentic and relevant for student learning (Apple, 2008) and to allow students to become creative thinkers and problem solvers. However, there is more to utilizing information technology than merely uploading teaching materials online (Palloff & Pratt, 2001), and educators still lack the confidence in designing proper learning environments that engage and educate (Chung 2008). This paper presents a study conducted that incorporated Herrington and Kervin's (2007) authentic learning strategies into a multimedia learning environment (MWLE) and reports on its impact on student learning. Results showed that students reported positively towards learning in this environment and to the authentic activities in the modules, which allowed them to do well in their project. These results strongly support authentic learning strategies as a means to innovate and engage students in technology-backed 21st century classrooms.

INTRODUCTION

As we move into 21st century teaching, more relevant, authentic and applied teaching and learning strategies need to be incorporated into learning environments to innovate the student learning process. The availability of many types of technologies have resulted in learners who not only can multi-task between various digital technologies, but who are also "multi-processors", i.e. are able to process many activities at the same time (Brown, 2002). The impact and influence of the Web and multimedia technologies means there is a new dimension of literacy, one that moves away from teacher-based authority to more discovery-based and applied learning, that requires students to become more creative and critical thinkers, problem-solvers and collaborators (Brown, 2002, Lombardi, 2007; Tan, Teo & Chye, 2009). Apple's Classroom of Tomorrow (ACOT2) identified six areas of focus in designing learning environments: 1) understanding 21st century skills and outcomes, 2) relevant and applied curriculum, 3) informative assessments, 4) creating a culture of innovation and creativity, 5) social and emotional connections with students, and 6) ubiquitous access to technology (Apple, 2008). The 2010 Horizon Report (Horizon, 2010) suggests many future technologies to watch, all of which place much emphasis on increased levels of student engagement and collaboration. With these challenges in mind, educators are now looking to equip themselves with proper pedagogies and technological literacies to address these new dimensions in teaching and learning.

In Malaysia, institutions of higher learning have heeded the Government's call to incorporate multimedia materials into the learning environments and classrooms (MOE, 2008), and create graduates that are more equipped with problem-solving skills and creative thinking skills (Hong, Lai & Holton, 2003;Lee, 2005; Norhayati & Siew, 2004; Neo, 2005, 2010). Constructivist-based classrooms and learner-focus content are being developed that marry both Web technology and multimedia content within the learning environments for more engaged student learning. However, there is more to utilizing information technology than merely uploading teaching materials online (Palloff & Pratt, 2001), and there is still a lack of confidence among educators in the design and development of content materials for the Web (Chung 2008), as much of the

learning environments in Malaysia are still curriculum-based. Furthermore, Herrington and Kervin (2007) argue that in many classrooms, technology is often employed for the wrong reasons, where the teacher is usually the one who is using the technology to deliver content to the students. The content is usually an extension of their course notes delivered in PowerPoint slides, which students will then download into their computer, and ultimately print out to study from, or simply video/film demonstrations that take the place of lectures. As such, the technology itself is the focus of the classroom learning process, and not on the content or subject matter. And when added to that the need to create industry-ready graduates that would be able to enter seamlessly into the workforce, educators are thus challenged to develop learning environments that engage and motivate while providing authentic and relevant content to students, using theoretically sound pedagogies. As such, there is a need to provide learners with an authentic learning environment where they can be highly motivated to learn while enhancing their processing skills and engage in more cognitively challenging activities. This study seeks to investigate adapting authentic learning strategies proposed by Herrington and Kervin (2007) and its impact on the student learning process within a multimedia learning environment (MWLE). The learning environment would blend various learning strategies such as Web-based courseware materials to engage students' cognitive processing skills, a multimedia group project that would require them to collaborate and build management and teamwork skills, and Web 2.0 tools to enable them to collaborate and socially network with each other.

Authentic Learning Strategies in Technology-Backed Environments
Current research shows that many graduates today are ill-equipped with problem-solving and communication skills needed to meet the demands of the IT industries (Tan, Teo & Chye, 2009). This mismatch has prompted Malaysian educators to seek new ways to inculcate the appropriate skills and knowledge into the students in order to meet the rising expectations of the IT society. Research shows that students need skills to plan and evaluate their learning activities and to synthesize the information they garner (Laurillard, 1993). Jonassen (1999) suggested that students would learn better through a constructivist learning environment and Herrington, Reeves, Oliver and Woo (2004) suggested that these learning environments should be authentic and relevant to the student in order to better engage them. Herrington and Herrington (2006) further posit that content 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. The learning activities would call for students to become active participants in their own learning processes, learn to solve problems and work collaboratively. Peers would play an important role in encouraging the student's learning process and will expose students to multiple perspectives and solutions to their problems, and as such, imbue themselves with skills such as active learning, critical and creative thinking skills, and teamwork.

Authentic learning is defined as a learning that "…*focuses on real-world, complex problems and their solutions, using role-playing exercises, problem-based activities, case studies, and participation in virtual communities of practice. The learning environments are inherently multidisciplinary*" (Lombardi, 2007, p.2). Authentic learning is important because it allows for students to experience real-world problems while in a learning environment (Herrington, Reeves, Oliver & Woo, 2004; Herrington & Herrington, 2006). Brown (1999) posits that students should be able to solve problems and recognize solutions, and understand what it is like to be held responsible for their work and their final outcomes, and in doing so, enable them to become legitimate members of a community of practice. Reeves, Herrington & Oliver (2002) suggested that characteristics of authentic learning environments include real-world relevance embedded into the learning environment's activities, ill-defined activities that would require students to engage in problem identification and problem solutions, complex tasks and the opportunity to examine the problem from multiple perspectives and use a variety of resources to complete it, opportunity to collaborate with others and reflect on the choices and decisions made, individually and socially, multidisciplinary activities that provide and allow students to assume multiple roles and utilize their prior knowledge and skills while experiencing and building new knowledge beyond a single, well-defined domain, asssessments that are seamlessly integrated into the activities and reflect real-world assessments, the creation of whole products or final outcomes that are owned by the learners and a diversity of outcomes, and multiple solutions from learners that reflect their creativity and originality.

In addition to that, the incorporation of multimedia and web technologies would further enhance the student learning process as it supports discovery-based activities. Jonassen, Carr & Yueh (1998) have suggested that technology can become a student's "intellectual partner" and help them analyse, synthesize and organize their knowledge and comprehension. 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, and incorporating authentic learning strategies will have an impact on their cognitive, social and affective behaviors. 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 (Herrington, Reeves & Oliver, 2010). With the advent of multimedia and Web 2.0 technologies, learners are no longer multi-tasking only; they are also "multi-processing" (Brown, 2002). In addition, social networking activities are permeating their learning process and have become extensions of the learner's identity and learning process. This means that students are now processing information, chatting and developing at the same time and no productivity loss is incurred. As such, the learning environments should reflect these new dimensions of learning. In particular, as suggested by Apple's Classroom of Tomorrow Report (Apple, 2008), there are three underlying concepts that would help define and structure this curriculum, which include, allowing student choice in the curriculum and content, which would motivate student to learn, perform, and achieve better, authentic learning tasks and meaningful content to provide "just-in-time-delivery", and the integration of technology to become less visible as a separate entity. Herrington and Kervin (2007) present 10 strategic principles of authentic learning that support technology, and provide educators and learners tremendous opportunities to develop highly motivating and integrative communities of learners. These principles suggest that technology can be used to support authentic learning in a classroom. Therefore, the multimedia learning environment (MWLE) was designed to take create a learning community in the classroom that incorporated Herrington and Kervin's 10 principles of authentic learning strategies.

Designing the m-PSLE with Authentic Learning Strategies

The MWLE was designed with 3 components: 1) Content and courseware materials that were Web-based and uploaded for students' asynchronous access. The materials were designed incorporating Herrington and Kervin's (2007) principles of authentic learning for a more authentic learning online environment; 2) An authentic learning task in the form of a multimedia project which would require students to work in groups and determine their solutions to their problems.; and 3) multimedia and web tools that were fully utilized to enable students to develop, research, collaborate and network amongst themselves. These tools include development tools such as Adobe Flash, Dreamweaver, Youtube, Wikipedia and Google for research, Yahoo IM and Skype for collaboration, and Yahoo Blogger and Facebook for communication among peers and experts. Figure 1 shows a conceptual design of the students' learning process in this environment.
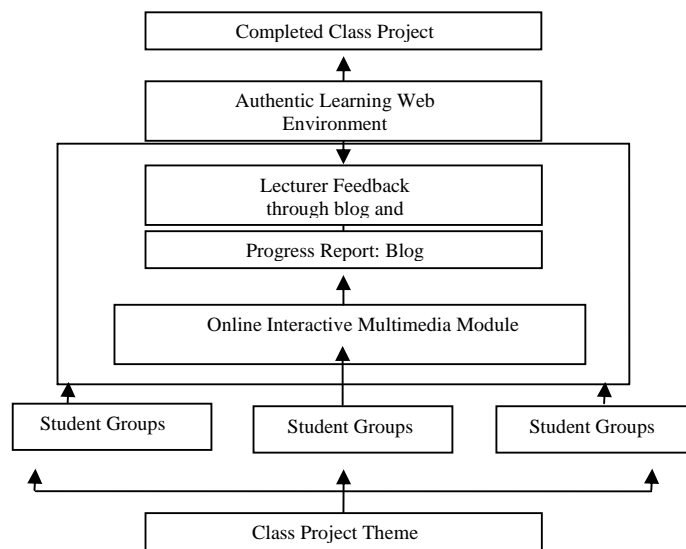

Figure 1 The student's learning process in the MWLE

The study consisted of 41 students (N=41) taking the Interactive Multimedia class in the Multimedia University, from the Faculty of Management, both female (45.2%) and male (54.8%), local (81%) and international (19%). Students were given both lectures (face-to-face and web-based) on topics pertaining to multimedia development, and lab tutorials once a week on Adobe Flash and Dreamweaver. The class was also told to imagine themselves as employees of a multimedia development company and given the task to design a cutting edge online magazine for client. This project was authentic and relevant to the students as they were going to be interviewing for internship placements in real multimedia firms in the Malaysian SuperCorridor (MSC) in the next year. The theme of the class project was "Online magazine" and the entire class had to decide and

determine the overall monthly online magazine to be created. Students then divided themselves into groups of 5 to develop a section of the magazine. The section would be a fully interactive multimedia application created using Adobe Flash, and each member would be responsible for at least one part of the application. This was to prevent any "piggybacking" in the group, as well to ensure that each member would use their Flash skills which they were taught in their tutorial classes. Herrington and Kervin's (2007) authentic learning strategies were adapted and incorporated into this MWLE in both the online web modules as well as in the classroom. Specifically these principles were present in both the online modules designed for students' to learn from and in the group project that they undertook:

1. **Authentic context –** Context that reflects the way knowledge will be used in real life.
Web modules: The class syllabus was used to provide the context of the module. The content of the modules were relevant to the success of the development of their multimedia project
Group Project: Students assumed the role of employees of a multimedia development firm and given a multimedia project themed "Online magazine" where they would have to develop a collective online magazine with sections for different topics, similar to real-life e-magazines.
2. **Authentic activities –** Activities that people do in the real world.
Web modules: In various points of the module, 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 signage for a door, embedded into the content itself; see Figure 2).
Group Project: Student groups were given various tasks during the development of their project, which included presenting their proposal for approval of the client, brainstorming and group discussions, presentations of work-in-progress and preparation of project documentation, which mirrored activities in a real-life project development setting. Groups were also asked to set up team blogs in Yahoo Blogger and a Facebook page to post and update their progress of their work.
3. **Expert performance --** Allowing students to observe the task before it is attempted and to access the modelling of processes.
Web-modules: YouTube videos of expert opinions on certain topics were sourced and integrated into the content.
Group project: Student groups kept in constant contact with their lecturer and tutors as consultations were held to discuss their progress. Students also consulted their seniors and peers who had had more experience with multimedia project developments, as well as for advance technical skill advice. They also used the web to search for forums that provided solutions to their technical and development issues.
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.
Web modules: 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.
Group project: Students assumed many roles in the project. Besides being a multimedia developer for their own particular section in the application, they also assumed the roles of Group Leaders, Secretary, Graphics Designer, Sound Engineer, Voice Talent, to name a few.
5. **Collaboration --** Allowing students to collaborate with one another to solve problems and articulate what they have learnt.
Web modules: The modules provide 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.
Group Project: Brainstorming activities resulted in students having to discuss and compromise on their ideas, and to share prior knowledge and expertise where necessary. Groups posted their progress on their group blogs which solicited comments and feedback from their members as well as from their other peers, and from the lecturer/tutors. Group presentations elicited constructive peer comments and suggestions from other groups who also gave praise and support.
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.
Web modules: Activities and quizzes in the module encourage students to reflect on what they have learnt.
Group Project: Each group gave 3 presentations throughout the duration and each presentation resulted in peer and lecturer/tutor feedback which students used to reflect on their work. They also had to post their progress on their blogs and in the class Facebook page.
7. **Articulation --** To ensure that students have the opportunity to articulate, negotiate and defend their growing understanding.
Web modules: Forums and blogs allow students to voice their opinions in discussion, further allowing students to make use of the knowledge they have gained.

Group project: Groups had to articulate their concepts and ideas via storyboards and sketches and presentation to the class.

8. **Coaching and scaffolding --** The teacher merely observes the student and provides support and feedback when necessary.

Web modules: Contact to lecturer is provided in the module. Activities and quizzes have clear and concise explanations to help guide students through the module.

Group Project: Consultations were held at the end of each class for face-to-face discussions. Yahoo IMs, and blog and Facebook comments were provided by the lecturer and tutors for all progress updates by the groups.

9. **Integrated authentic assessment --** Assessment that is seamlessly integrated with the activities provided.

Web modules: 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.

Group project: Groups were assessed through in-class quizzes, their storyboards, their presentations, their blog updates and presentations. Progress discussions were made every 2 weeks to provide them with cumulative assessments and feedback. They were also given progressive tutorial assignments on Flash development to assess their technical skills.

10. **Professional learning --** Keeping up with new technological developments.

Web module: The module encouraged students to get involved in an online community of professionals through forums, blogs and so on to keep up with the changes in technology.

Group project: Students were using a variety of technologies, ranging from development software (Flash, Dreamweaver, and any other supporting software of their choice), online research tools (Youtube, Wikipedia, Google, etc), communication tools (Yahoo! Instant Messenger, Skype, gmail chat, sms, etc.) and social networking tools (Yahoo! Blogger, Facebook, etc.) Figure 2 shows some examples of the different modules' interfaces that were designed with these authentic learning strategies. In this figure, authentic activities were incorporated into the lecture on design to allow the students to try and design an appropriate door signage, while Figure 3 adapts expert performance, multiple roles, and coaching strategies into the module to better understand the content.

Figure 2 Embedding authentic activities into the module "Designing the Multimedia Interface"

Activities such as these were incorporated into the modules at various parts of the chapters, and not simply at the end of the module, to enable students to demonstrate their understanding of the content learned before they continue to the next parts. These activities are also authentic in nature as they reflect a genuine design problem that multimedia developers face in real working conditions. For example, in the module on "*Designing The Multimedia Interface*" (see Figure 2), students were provided with interface-related activities so that they can practice what they had learned in the preceding chapters. In doing so, students were able to interact with the content while they were learning, thus building upon their knowledge.

Subject matter experts from YouTube were also embedded into the modules to integrate expert information into the content material to provide students with expert support for the topics. These would provide students with

real-life working examples and conditions which would better prepare them for their careers. They can also implement the knowledge acquired here into the development of their final product, thus allowing authentic learning to take place both online and in the classroom. As posited by Herrington & Kervin (2007), such authentic and relevant examples would provide expert exposure and professional learning for the students while acting as a coaching tool for them for when they develop their own application for their class project. By exposing them to real-life experts from all over the world through Web tools, the learning becomes more authentic and relevant to students, thus improving their retention and comprehension of the subject material.

In addition to learning online, the ubiquitous availability of these technological infrastructures promoted increased collaboration and communication among the class. In this class project, students called their online magazine "La Vie", designed their own logo, and decided on the various magazine sections within La Vie, which would be tasked to specific groups to create. The class also created a class Facebook page for the magazine and used it to blog and post ideas, collaborate on design issues and seek help where necessary (see Figure 3). This Facebook page would support class collaboration and postings that would be shared amongst all its members. This Facebook page was in addition to their own individual blogs on their group's project development and their own individual progress in it. Students also posted their progress Facebook to document their group's project and how each member was progressing in it. These blogs would be monitored by the lecturer and tutors and were accessible to everyone in the class.

Figure 3 The Facebook page of the class' interactive online magazine, "La Vie"

The objective for students to blog their about work was to allow them to reflect on their efforts on their project. Williams and Jacobs (2004) had noted that blogs had the potential to be a "transformational technology for learning and teaching". Blogging also helps strengthen the "collaboration" principle of authentic learning (Herrington & Kervin, 2007). The quizzes in the module had enabled them to reflect on their knowledge of the content, and now, with the blogs, they can further reflect on how well they have incorporated that knowledge into their project. If students needed to go back to the modules to get more information, they could do so, as the modules were available to them asynchronously during their course.

The students were given 14 weeks to complete their project and submit their final product. As seen in the class' Facebook page in Figure 4, there were 12 different final products in the class, ranging from "Music" to "Travel" to "Sports" , "City Spy" and "Food", and so on, as each group submitted an interactive multimedia application of their group's magazine section. In each of these sections, the student groups would have to design and develop an interactive application that reflected that section's overall concept, while adhering to the

overall magazine's theme. In Figure 4, for example, one student group designed a section called, "City Spy", highlighting events of the month on selected Asian cities, Kuala Lumpur (Malaysia), Jakarta (Indonesia), Singapore (Singapore), Sydney (Australia), and Bangkok (Thailand). Each of the 5 members in each group would be tasked to develop and write on each of these 5 cities.
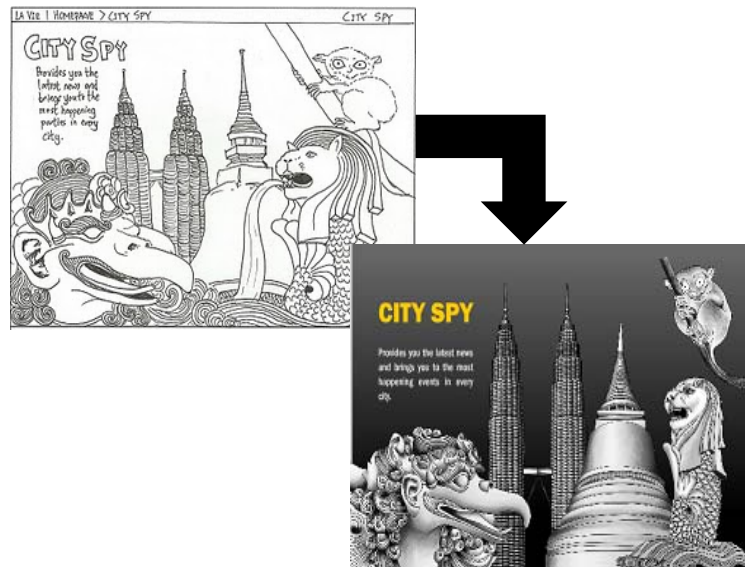

Figure 4 One group's sketch on their concept of the magazine section, City Spy", translated into the final application

These applications were assessed on their creativity, complexity, the overall layout and interface design of the application, the interactivity and use of multimedia elements, and their work-in-progress documentations. Overall, all students scored As and Bs in their final results.

ANALYSIS OF DATA
To investigate the impact of this authentic learning environment, students were given pretests 2 weeks before viewing the online modules and posttests immediately after the treatment.   Table 1 shows the results of the pre and post test for the one of the online modules, "*Multimedia Authoring*":

Table 1 Paired Samples Statistics and Paired Samples T-Test Results

	Paired Differences				
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference	
				Lower	Upper
Pretest-posttest	-3.29	2.657	.415	-4.131	-2.454
Pretest score	9.00	2.012	t	df	Sig. (2-tailed)
Posttest score	12.29	2.657	-7.934	40	.000

Results show that students scored a higher mean of 12.29 after going through the module than before taking it (mean = 9.00), indicating an increase in understanding of the content when authentic and multimedia components were presented. A paired sample t-test as 95% confidence level was also conducted to measure the significance of the 3.29 change in learning scores. Results show that the change was statistically significant (p<0.05), indicating that students enhanced their learning outcomes after using the web module.

In addition, students were also given a survey to gauge their perceptions on learning from a web module, the authentic principles and relevance of the content, and the overall attitude and perceptions of the MWLE. The survey was measure on a 5-point Likert scale where 1 = Strongly Disagree (SD), 2 = Disagree(D), 3 = Undecided(U), 4 = Agree(A) and 5 = Strongly Agree(SA). Analysis of the data yielded a Cronbach Alpha of 0.974, which indicates a high reliability of survey items. Results from the survey are shown in below (means reflected results of students who answered positively, from 4 and above on the scale) and can be seen to address

three categories: 1) Learning on the Web (Table 2); 2) Learning with Multimedia (Table 3); and 3) Authentic learning in the environment (Table 3).

Table 2 Students' perceptions of Learning on the Web (ranked in descending order)

Survey Item (Learning with Multimedia) N=41 (Cronbach Alpha = 0.974)	Mean (m)	SD	% (p)
1. Overall, I like this web module	4.34	.728	90.2
2. I can understand the topic better after using the module	4.27	.837	87.8
3. I prefer this learning method in my learning process	4.17	.704	87.8
4. I enjoyed learning in the Web environment	4.12	.872	82.9
5. I enjoyed the accessibility the web environment gave me	4.10	.768	80.5
6. I find learning with the web interesting and engaging	4.05	.669	85.4
7. The Web environment motivated me to explore the topic more	3.83	.803	70.7
Comments: *"I like interactive web module because I can understand the topic better* *"Really good, because I actually read it and did not get bored!"* *"This is online learning, so this method is easy to use and a lot of notes or knowledge uploaded there, so it easy to learn this subject".* *"Help me to learn the important point and very clear in concept of web module."* *"I really like the interactivity and the flow of the website."*			

1) Learning on the Web: Results showed that overall, students liked using the web module (Item #1, m=4.34, p=90.2) and enjoyed the Web environment very much (Item # 4, m= 4.12, p=82.9). They also reported preferring to learn through this method (Item #3, m= 4.17, p=87.8), with 87.8% of them reporting that they understood the topic better after going through the module (Item #2, m=4.27). 80.5% of students reported that they enjoyed the accessibility to the web environment (Item #5, m=4.10), with 85.4% reporting being interested and engaged in learning on the web (Item # 6, m=4.05, p=85.4). Learning on the Web was also motivating for them as 70.7% of students reported that learning in this Web environment motivated them to learn more about the topic (Item #7, m=3.83). These results are supported by students who commented on the survey that *"I like interactive web module because I can understand the topic better", "Really good, because I actually read it and did not get bored!"* and, *"This is online learning, so this method is easy to use and a lot of notes or knowledge uploaded there, so it easy to learn this subject".*   They also commented that the web environment *"Help me to learn the important point and very clear in concept of web module"* and *"I really like the interactivity and the flow of the website."*

Table 3 Students' perceptions of Learning with Multimedia (ranked in descending order)

Survey Item (Learning with Multimedia) N=41 (Cronbach Alpha = 0.974)	Mean (m)	SD	% (p)
1. I enjoyed learning with multimedia	4.32	.687	92.7
2. I liked the use of multimedia to illustrate ideas and concepts	4.24	.734	87.8
3. I like having multimedia elements in the content	4.17	.771	90.2
4. Multimedia helped me understand the topics better	4.12	.714	85.4
5. Interacting with the module motivated me to learn the content	4.12	.748	82.9
6. I find the multimedia elements in the content appealing	4.05	.740	87.8
Comments: *"It make me understand better"* *With the web module it save my time a lot rather than reading the boring powerpoint slides,"* *"Its interesting and its relevant to the topic"* *I learnt more using this module through the multimedia elements"* *"It helps to identify which part is important and notify the keywords for the topic"* *" It makes me easy to remember it".*			

2) Learning with Multimedia: Students also reported positively on the use of multimedia in the module. 87.8% of students reported that they found the multimedia elements in the content appealing to them (Item #13, m=4.05). 87.8% students also reported that they liked the use of multimedia elements in the content to illustrate the concepts of "*Multimedia Authoring*" (Item # 9, m=4.24), allowing them to understand the content better (Item # 11, m=4.12, p=85.4). Over 90% of the class reported very favourably to learning with multimedia (Item

#8, m= 4.32, p=92.7), enjoying the multimedia experience in the module (Item # 10, m=4.17, p=90.2), and thus being motivated to learn (Item # 12, m=4.12, p=82.9). Students' comments strongly supported the results on learning with multimedia, as shown in their following comments; *"It make me understand better. With the web module it save my time a lot rather than reading the boring powerpoint slides,"*, *"Its interesting and its relevant to the topic. I learnt more using this module through the multimedia elements"*, and,*"It helps to identify which part is important and notify the keywords for the topic. It makes me easy to remember it"*.

Table 4 Students' perceptions of Authentic Learning (ranked in descending order)

Survey Item (Authentic Learning) N=41 (Cronbach Alpha = 0.974)	Mean (m)	SD	% (p)
1. I felt that the content in the web module was relevant to my learning	4.29	.680	92.7
2. The activities provided in this Web module were authentic and relevant	4.22	.613	90.2
3. I enjoyed using the module to learn the topic	4.22	.852	82.9
4. The examples provided in this Web module helped me understand the topic better	4.10	.700	85.4
5. The quiz in this Interactive Web module helped me reflect on the topics taught	4.02	.790	80.5
6. The links to other relevant websites were useful to my learning	3.95	.865	73.2
7. The videos in the module were relevant to my learning	3.93	.755	80.5
8. I liked that there were links to external websites like Wikipedia	3.83	.738	73.2
9. I can apply what I learned from this Web module in real-life	3.80	.749	65.9

Comments:
"The direct links and some video examples make me easier to understand the topic"
This module helps me in creating an icon is not as easy as I thought"
"Its interesting and its relevant to the topic"
"The content and activities help me to understand stage by stage of the learning process of the topic. The flow and direct links are very useful"
"It has helped me because I not only get to learn the theoretical part of this subject, I also get ideas from the module of how I can implement them practically."

3) Authentic learning in the environment: With respect to the authentic principles that were incorporated into the module, results showed that the incorporation of authentic learning principles in this environment provided students a platform to learn better and be more engaged in the content, as students did report favourably on these items in the survey. A high majority, 92.7% of students reported that they found the content presented in the module relevant to their learning (Item #14, m= 4.29). They also reported that the activities that were presented to them in the module were authentic and relevant to them (Item #15, m=4.22, p=90.2), and that the examples provided increased their understanding of the topic (Item #17, m=4.10, p=85.4). Students were able to reflect (Item # 18, m=4.02, p=80.5), found the external links useful (Item #19, m=3.95, p=73.2 and Item # 21, m=3.83, p=73.2), as well as the videos presented in the module (Item #20, m=3.93, p=80.5). Overall, 82.9% of students enjoyed using this module to learn the topic (Item #16, m=4.22). Similarly, student feedback also supported this result as students commented that, *"The direct links and some video examples make me easier to understand the topic"*, *This module helps me in creating an icon is not as easy as I thought"*, *"Its interesting and its relevant to the topic"*, *"The content and activities help me to understand stage by stage of the learning process of the topic. The flow and direct links are very useful"*.

DISCUSSION AND CONCLUSION
The results of the study show that student learning was successfully enhanced in the MWLE. The online modules provided supplemental and richer support for students to increase their understanding of the subject matter, and able to use the information to implement into their projects. They were able to learn using multimedia to create multimedia applications and was in line with Cairncross and Mannon (2001)'s suggestion of using interactive multimedia. In addition, authentic learning and deep thinking occurred during the study as students were able to critically process the information needed to solve their project's design problem. Students found the activities in the module exciting as the students felt the activities were authentic and relevant to them. This showed 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) played a crucial role in enhancing a student's learning process.

The Youtube and external links provide them the platform to further research the topic and increased their acquired knowledge, as had been suggested by Herrington and Kervin's (2007). Students were able to demonstrate and support authentic learning as they were able to create a final polished product, and not something that was created in preparation of something else, and supports Herrington, Reeves & Oliver's (2010) research suggestions. Their final outcomes were proof of their learning (Winnips & McLoughlin, 2001) and would be useful to them in the real-world. Many of them reported that they now knew what it took to create an interactive multimedia application and developed the necessary skills to repeat the process when they seek employment.

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 exams and project, and also promoted their reflection on the topics learnt. Doing the quizzes also motivated the students to learn as they felt a sense of achievement when they scored well on the quiz. 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.

The development of the MWLE via project-based learning also supported the incorporation of authentic learning strategies as it provided students with real-world complex situations which they would have to solve collaboratively and cooperatively. By working together to complete the project, students developed realistic teamwork and management skills integral to their careers. They also were able to recognize the relevance of these skills and the environment in which they were learning from, and were quite positive about it, as evidenced from their comments on their survey and in their blogs. The use of Web 2.0 technologies and social networking tools allowed the class to better communicate with each other and solicit constructive feedback, relevant to the effectiveness of their learning process. By uploading their progress onto the web and commenting their peers' work, students developed more reflection on their own work and thus paid more attention to the quality of their project, again supporting the reflection strategy by Herrington and Kervin (2007). Interestingly, although 31.7% of students were undecided of the application of the module's content to real-life (Item #22, Table 2), as a whole, and most importantly, students had fun in the classroom, in learning from the module as well as in doing their project. They were able to claim ownership of their work, be responsible for their learning path and develop a network of collaborators within the classroom setting, which would stand them in good stead for their future careers. In light of this, authentic learning has been shown to be effective in enabling students to learn and become more involved with their learning. Added to that the incorporation of multimedia and web technologies, and students evolved into becoming "multi-processors" of information.

In conclusion, our study has shown that the authentic learning strategies did properly gauge students' attention and further enhanced their learning process, and the results are consistent with Herrington and Kervin's (2007) suggestion that these 10 authentic learning strategies would properly support technology-backed classes. In this study, we have incorporated these strategies into a multimedia learning environment (MWLE) and investigated its impact on student learning. Student feedback and learning outcomes showed that these authentic learning strategies were effective in engaging students and increasing their understanding of the subject matter, providing strong support for the effectiveness of using these authentic learning strategies in an MWLE.

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