STUDENTS' PERCEPTIONS IN DEVELOPING A MULTIMEDIA PROJECT WITHIN A CONSTRUCTIVIST LEARNING ENVIRONMENT: A MALAYSIAN EXPERIENCE

Dr. Mai NEO & Dr. Tse-Kian NEO (Ken)
Faculty of Creative Multimedia
Multimedia University,
Cyberjaya, Malaysia

Dr. Mai Neo
Senior Lecturer
Faculty of Creative Multimedia
Multimedia University
1, Jalan Multimedia, Cyberjaya, Malaysia
Email: neo.mai@mmu.edu.my

ABSTRACT
This paper presents a research study that was conducted in the Faculty of Creative Multimedia, Multimedia University, Malaysia, to investigate students' perceptions in developing a multimedia project within a constructivist-based learning environment. Students worked in groups to create an interactive multimedia application using an authoring tool, and were solely responsible for every project development decision. They were then given a survey and asked for their comments and feedback to elicit their perceptions and attitudes towards this learning environment. A factorial analysis was performed on the survey and results showed that 5 factors influenced students' perceptions in developing a multimedia project within a constructivist learning environment. Multiple regression analysis further showed that motivation played a significant role in students' perception towards developing a multimedia project in this learning environment. These results were further supported by their survey comments and feedback.

Results of the study showed that by setting an authentic task, via a multimedia project, into a constructivist learning environment, students became highly motivated learners and active in their learning process and provided strong support and encouragement for Malaysian educators to incorporate multimedia technology and constructivist learning into their classrooms.
Keywords: constructivism, multimedia, Malaysia, projects

INTRODUCTION

The infusion of Information Communication Technology (ICT) and, in particular, multimedia technology into education, has created a significant impact on the instructional content development and the methods of communicating information to the learners. It is leading to the evolution of new concepts and innovative teaching techniques in the instruction-learning process. This changing landscape of education focusses on learning, rather than on teaching and pedagogy, curriculum and instruction. It seeks to create a generation of learners whose learning is defined as *"the ability to retain, synthesize, and apply conceptually complex information in meaningful ways"* (Lambert & McCombs, 1998) to encourage better student learning through the learning objectives of project-based learning or learning by doing (Schank, Berman & Macpherson, 1999) and to enable problem-solving, analysis, creativity and communication to take place in the classroom (Bates, 2000). In addition to this, multimedia technology has been shown to affect students' motivation and self-esteem levels, as well as allow them to be creative and self-directed thinkers (Agnew, Kellerman & Meyer, 1996; Yildirim, 2006).

In Malaysia, the traditional mode of learning is still being used in many institutions of learning. However, in the context of introducing technology and multimedia in learning, the Malaysian Government is echoing this learner-centred learning initiative with a call for Malaysian institutions of higher learning to integrate ICT into their classrooms (Mat, 2000). Institutions of higher learning in Malaysia have begun to incorporate multimedia materials in problem-based learning and storytelling environments (Hong, Lai & Holton, 2003), in developing e-learning methods (Lee, 2005; Norhayati & Siew, 2004) and in web-based courses (Rohaida & Kamariah, 2000; Neo, 2005). Research in Malaysia has shown that using constructivism and multimedia technology is becoming increasingly important in teaching and learning in higher education in order to promote and enhance the teaching and learning process (Wong, Kamariah & Tang, 2003; Lee, 2005), to allow learning to take place in authentic contexts (Herrington, Reeves, Oliver & Woo, 2004) and to enablee teachers to better communicate knowledge to their students in the classrooms (Wong et. al, 2003). As such, this study was developed to

investigate students' perceptions in using a multimedia project embedded within a constructivist learning environment and its impact on their learning process. This study was designed to show that, through their perceptions and feedback on the project, students would be able to reveal their ability to acquire skills integral to the meeting the demands of the workplace, such as collaborative and teamwork skills, problem-solving, learning motivation, critical thinking and understanding of a topic area, and see the real-world relevance of their work.

The constructivist-based learning environment

A constructivist learning environment is "a place where learners may work together and support each other as they use a variety of tools and information resources in their pursuit of learning goals and problem-solving activities" (Wilson, 1995), and that learning is a personal interpretation of the world, where learners create interpretations of the world based on their past experience and interpretations (Jonassen, 1994; Perkins, 1991; Cunningham, 1991; Wilson, 1995; Duffy & Cunningham, 1996; Jonassen & Henning, 1999). In constructivism, the teacher is no longer perceived as the sole authority of the knowledge, but rather as the facilitator of learning, guiding and supporting learners in the process of constructing knowledge (Berg, 1999) and providing the students with experiences that allow them to develop problem-solving, critical-thinking and creative skills, and apply them in a meaningful manner.

The learning activities in a constructivist learning environment call for students to become active participants in their own learning processes, learn to solve problems and work collaboratively (Heath, 2001; Land & Hannafin, 1996). The learning environment is set in a meaningful, authentic context that allows for learner-centred activities to take place. These activities are social and collaborative in nature, where peers play an important role in encouraging the student's learning process and will expose students to multiple perspectives and solutions to their problems, enabling them to consider "…*varying and discrepant points of view with which to consider the merits of his or her own mental models*" (Oliver, 2000). By working in a group situation, students will have to tap into their group skills and use a variety of activities to accomplish the project's overall objectives. The group would be responsible for their goals and, thus, a collaborative learning experience can be gained. As such, constructivist learning environments are designed so that students will be able to become active participants in their learning process and develop skills that would allow them to think critically, function well as a member of a team, develop collaborative abilities and deepen their understanding of their task and improve student learning.

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 (Teo & Wong, 2000; Tan 2000). 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. As such this study was designed to investigate the perceptions of students when a multimedia project is embedded within a constructivist learning environment, whereby they would experience learning skills such as problem-solving, critical and creative thinking, collaboration and teamwork, and presentation, oral and reflection skills. Jonassen (1999) proposed several important components to be incorporated when designing a constructivist learning environment (CLE):

- Conception of the problem for the students to begin their learning development.
- Interpretation develops solutions to their problems.
- Information sources to support the understanding of the problem.
- Cognitive tools to help learners interpret and manipulate aspects of the problem.
- Conversation and collaboration tools to enable the learners to form communities to negotiate and co-construct meaning for the problem.

Herrington et. al (2004) extended the design of the constructivist learning environment by including an authentic learning setting within the problem structure. This had enabled students to see the relevance of the problem to them and thus became more active in seeking solutions to their problems. Learning took place in a meaningful, authentic context and developed into a social, collaborative activity.

Therefore, this study sought to design a constructivist learning environment that would incorporate the components of Jonassen (1999) as well as set it in an authentic learning setting, as proposed by Herrington et. al (2004). This learning environment would incorporate multimedia technology with an authentic task via the development of a multimedia project, where students would become active participants in their learning process and construct new knowledge.

The student learning process

The study was made up of 53 students (N=53) in their 2nd year of the degree course. They consisted of students from the Faculty of Management, the Faculty of Information Technology and the Faculty of Engineering enrolled in the Interactive Multimedia course for their Bachelors of Multimedia degree. The objective of this course was to imbue students with multimedia project development skills over a 14-week trimester, which culminated in an interactive group project that was multimedia and authored in Macromedia Director. In order to complete this assignment, the students were given an authentic task, i.e. they were to develop an interactive multimedia application/ptototype based on the theme "*Malaysian Culture*" for the Malaysian Tourism Board by the end of the trimester. Table 1 shows this constructivist-based multimedia-mediated student learning environment.

Table 1: The multimedia-mediated constructivist student learning process

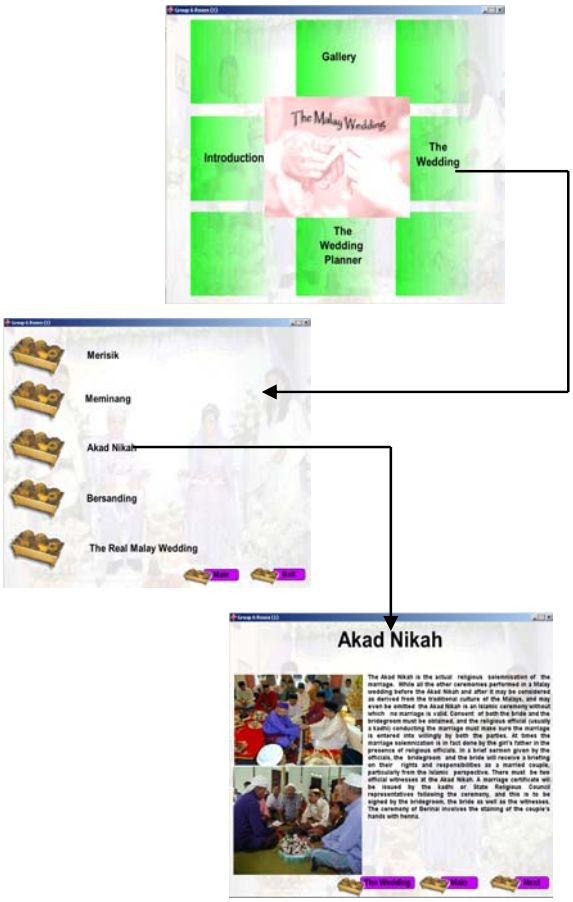
The students' constructivist-based learning process
1. Conception of the authentic problem. **a. Group formation:** Students were given the project requirements at the start of the project and told to form groups of 4-5 members. **b. Authentic setting:** The groups were given a theme-based project to develop using multimedia and to regard themselves as multimedia developers for a real-world client
2. Interpretation and problem identification Group Leaders were appointed and groups engaged in brainstorming activities, group meetings, delegation of tasks. Multiples solutions of the problem were created and discussed among the groups members.
3. Project conceptualisation to understand the problem Storyboarding activities, interface design and media acquisition activities were carried out to help teams conceptualise and crystallise their ideas. Discussions among the group were also carried out to solve problems arising in the planning of the project.
4. Cognitive tools used for development **Project authoring:** Authoring tools such as Director allowed students to translate their creative ideas into a digital application. Third-party applications, such as Adobe Photoshop, Premier, Illustrator, SoundForge, 3D Studio Max and Swish, were also used to provide editing and media creation activities to the media elements to prepare them for use in Director.
5. Conversation and collaboration tools for peer collaborations and communication **Collaboration, Presentation & Reflection** **a. Collaboration**: Throughout the development process, students were given ample opportunities to converse and collaborate within and outside of the classroom walls. Aside from the face-to-face meetings, students utilised various methods of communication and collaboration tools, especially Yahoo!'s Instant Messenging service, emails and even telephone SMS (Short Messaging Service) to exchange ideas and files, collaborate, hold meetings and discussions, and keep in touch with each other. **b. Presentation**: Student groups gave 2 presentations of their work to solicit feedback and comments from their peers and used tools such as MS PowerPoint and Flash to organize and develop their presentations. These presentations allowed them to develop their presentation skills and to acquire critiques from colleagues for improvement. **c. Reflection**: Students reflected on their individual and team progress throughout the development of the project through their reports and their journal entries, using MS Word files or Dreamweaver HTML files. Some created blogs online to document their progress and submitted the URLs with their reports.

This learning environment resulted in a student learning process that reflected the course of action that required them to exercise critical and creative thinking, collaboration with members of their team, solve problems (design- and group-based), and to be responsible for their decisions in developing their chosen application from the ground up. They were able to perform in an authentic learning setting with meaningful tasks, build on their existing knowledge and skills, and required to take ownership for their learning process, all of which were very learner-centred and constructivist in approach.

The student learning outcomes

Winnips & McLoughlin (2001) have posited that proof of student learning can be found in their learning outcomes. The learning outcomes of the study were in the form of the students' final interactive multimedia CD

applications. At the end of 14 weeks, each group had to present their completed final applications. When it



came to these presentations, the applications that were presented ranged from edutainment to marketing to corporate applications, centred around the theme, "*Malaysian Culture*", which showed students' ability to have multiple solutions and perspective of the problem. An example of these applications is shown in Figure 1 which is an application on the Malay wedding ceremony.

Figure 1. An interactive multimedia application on Malaysian traditional weddings

As can be seen in Figure 1, the application begins with a Main Menu screen with 4 sections, "Introduction", "The Wedding Planner", "The Wedding" and "Gallery". Clicking on "The Wedding", for example, will lead the user to the section on the wedding ceremony. Here the user can explore the wedding ceremony process in detail, such as the "Akad Nikah" (or the religious solemnisation of the marriage) process. As can be seen here, students were responsible for the design of the interface of the application, the layout and structure of the screen, the placement of the media elements, the navigational panel, and the interactive features of the application. Results of the presentation of these applications showed that students were able to demonstrate multiple perspectives and solutions to their design problem, which was in line with the constructivist pedagogy Jonassen (1999) and Herrington et. al (2004). By being able to complete and apply the multimedia concepts learnt in class, and through their collaborations with their peers, students were able to construct new knowledge on their own, resulting in an improved learning experience, as can be seen from these applications. Furthermore, the overall performance of the groups was also good, as all groups were able to complete their CDs and achieving As and Bs in their course grades.

RESULTS OF THE STUDY

In order to measure students' attitudes and perceptions towards developing a multimedia project, a survey questionnaire was administered to the students at the end of the course. The items were measured on a 5-point Likert scale, and with 1 = Strongly Disagree, 2 = Disagree, 3 = Undecided, 4 =Agree and 5 = Strongly Agree. In

particular, the objective of the survey was to gauge students' perceptions in working on a group-based multimedia development project. The items of the survey were further reduced using a factorial analysis in SPSS 11.0 with a Cronbach Alpha coefficient of 0.9106, which is considered a good internal consistency and reliability value (Lim, Khine, Hew, Wong, Shanti & Lim, 2003). A factor analysis was performed and yielded 5 significant factors with means of over 3.5 (Table 2), indicating that students "Agreed" or "Strongly Agreed" with the items on the survey. These factors were also significantly correlated with multimedia development (Table 3). These 5 factors were classified as the following:

1. **Teamwork and collaboration**. This factor contained items that measured students' perceptions towards working together in a group and their collaborative effort in completing their multimedia project.
2. **Motivation towards the project.** This factor contained items that measured students' motivation, satisfaction and enjoyment attitudes towards their project.
3. **Increased and enhanced learning skills.** This factor contained items that measured students' perceptions towards the skills they acquired during the development of the project.
4. **The learning environment.** This factor contained items that measured students' perception toward this multimedia-mediated constructivist-based learning environment as a whole.
5. **Application of skills acquired.** This factor contained items that measured students' attitudes toward applying their acquired skills to the real-world.

Table 2: Means of the survey factors

Factor	Mean	Std. Dev.
Teamwork	3.71	0.770
Motivation	4.09	0.486
Skills	3.94	0.532
Environment	3.91	0.519
Application of skills	4.15	0.601

Table 3: Correlations results between independent and dependent variables

		Correlations				
		Teamwork	Motivation	Skills	Environment	Application of skills
Multimedia Development	Pearson Correlation	**0.271***	**0.582****	**0.440****	**0.423****	**0.374****
	Sig. (2-tailed)	0.049	0.000	0.001	0.002	0.006
	N	53	53	53	53	53
**. Correlation is significant at the 0.01 level (2-tailed).						
*. Correlation is significant at the 0.05 level (2-tailed).						

In other words, students' positive attitudes towards developing a multimedia project was related to the students' teamwork and collaborative effort, their motivation towards their projects, the skills that they acquired from doing the project, their perceptions towards the learning environment and their perceptions about applying their skills in the real-world.

In addition, a multiple regression analysis was performed to determine how much influence teamwork, motivation, attitude towards the learning environment, acquired skills and ability to apply these skills had on the students' perceptions of developing a multimedia project within a constructive learning environment.

These results are explained in Table 4, Table 5, and Tables 6(a) and (b). Results of the model summary of the performed (R Squared) of the students' perceptions towards the learning multiple regression analysis (Table 4) showed that 45% environment was explained by their teamwork, motivation, skills, the learning environment and their ability to apply these skills. Furthermore, the results of the ANOVA analysis in Table 5 were very significant (F=7.572, p=0.000), at a 95% confidence level, indicating a good fit, since these factors were able to explain the outcome. These findings were considered important as they partially explained that student's positive attitudes and perceptions in developing a multimedia project in this learning environment were due to their ability to work in teams, were motivated, acquired technical and presentation skills and were able to apply

them in future projects. In Table 6(a), the results showed that the Motivation factor (t=3.219, p=0.002) played the most significant role in this learning environment.

Students were very motivated to develop a multimedia project where they were able to control every decision-making level and this resulted in their positive perception of the study. Teamwork, Skills, Application, and Environment, although important factors, did not play a significant role as Motivation to influence students' attitude towards this learning environment. The results in Table 6I(b) show that there was no significant multi-collinearity, as the Variance Inflation Factor or VIF is below 10, indicating that multi-collinearity was not serious (Cooper & Schindler, 2006).

Table 4: Results of the multiple regression analysis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.668(a)	**.446**	.387	.48236	1.606

a Predictors: (Constant), Apply, Team, Environment, Motivation, Skills
b Dependent Variable: MMDEV (Multimedia Development)

Table 5: Results of the ANOVA[b] analysis

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.809	5	1.762	**7.572**	**.000(a)**
	Residual	10.936	47	.233		
	Total	19.744	52			

a Predictors: (Constant), Apply, Team, Environment, Motivation, Skills
b Dependent Variable: MMDEV (Multimedia Development)

Table 6(a): Coefficients[a] from the Regression Analysis

Model		Unstandardized Coefficients		Standardized Coefficients		Sig.
		B	Std. Error	Beta	t	
1	(Constant)	-0.407	0.726		-0.560	0.578
	Teamwork	0.054	0.093	0.067	0.575	0.568
	Motivation	**0.520**	**0.162**	**0.411**	**3.219**	**0.002**
	Skills	0.142	0.155	0.123	0.913	0.366
	Environmt	0.281	0.141	0.237	1.993	0.052
	Apply	0.095	0.130	0.093	0.733	0.467

a Dependent Variable: MMDEV (Multimedia Development)

Table 6(b): Coefficients[a] from the Regression Analysis (cont'd)

Model		Correlations			Collinearity Statistics	
		Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)					
	CONTRI	0.271	0.084	0.062	0.866	1.154
	MOTI	0.582	0.425	0.349	0.724	1.381
	ESKILLS	0.440	0.132	0.099	0.653	1.531
	LECTLEAR	0.423	0.279	0.216	0.833	1.200
	APPLY2	0.374	0.106	0.080	0.733	1.365

a Dependent Variable: MMDEV (Multimedia Development)

When administering the survey, students' comments and feedback were also solicited to further support these results. As shown in Table 7, students' feedback and comments (verbatim) on the survey revealed that they were very positive towards the multimedia development project in this study, and in these 5 factors.

Table 7: Students' comments on the survey in developing a multimedia project

Students' feedback and comments on the survey
Teamwork 1. *"Working on the project has made me want to make on another project. It was definitely a great experience…. I am looking forward to work with team in future to come."* 2. *"Great! My group member is really good as we came from different faculty….we really work as a team especially when I face problems, my group member will always give me a hand."* 3. *"Can't be denying that, sometimes we do have argument on certain idea, but we will find a positive manner to settle it."*
Motivation towards the development of the project *1. "…my motivational level in the project has always been high."* *2. "Very motivated. This subject is very fun. I get the chance to come out with my own ideas and creation on an application."* *3. "I'm so happy and motivated when do this project."*
Acquired skills 1. *"Before this, I also wasn't able to tell people what this subject, Interactive Multimedia is all about. Through this project, I learnt not only the technical part of designing an application but also the rules-of-thumb of a good application."* 2. *"Before doing this project, I do not know much about Silat…but after working on this topic for past four months, I learnt Silat in detail. Now I am able to explain about Silat to my other friends".* 3. *"I found that from this project…. The more I'm involved in this project, the more I found that I can understand this subject better than before and enhance my skills in development."*
Learning environment *1. I've learnt how to work in a group, improve myself in working with someone new, improve knowledge in interactive multimedia, understanding more about the real-world workplace and situations…all difficulties we can solve by asking experts, our tutor and/lecturer and outsiders.* *2. Many things that I have learnt from doing this project and what it is like in a real working environment, which includes the bad and good.* *3. This project is a learning experience…I learnt how to be a leader…how to work as a team, accept and make critical decisions of other group member's idea…my understanding of the topic and also of interactive multimedia is much clearer.*
Application of skills 1. *"By having this project. We learnt so many things on how to manage the members in a group and how to finish the works on time…Time management is very important while doing this project to meet the deadline".* 2. *"…from the experience of working with my group members, I am prepared to face different people I might meet in the near future."* 3. *"I get to know more about how to develop a good project in the future as if I have the chances to take on the multimedia task."*

DISCUSSION

From this study, it can be seen that there was strong support for using a multimedia project in a constructivist learning environment. Results of the factor and multiple regression analyses showed that the factors that influenced students' perceptions towards multimedia development were Teamwork, Motivation, Acquired Skills, the Learning Environment, and the Application of their skills. Consequently, the development of this learning environment showed that:

1. Motivation was a big factor in influencing students' attitude and perceptions in this learning environment. Students were very motivated in their attitude towards developing the multimedia project and this was due to the fact that the project was relevant to them and their future. Many reported being able to see the relevance of doing this project and the skills acquired as necessary to perform better in the real-world.
2. Students showed increased understanding of the topic and were able to see the relevance of the project to real-life situations. The authentic setting for this learning environment allowed students to experience real-life working conditions supporting Herrington et. al's (2004) position that constructivist learning environments should be set in an authentic learning context.
3. Students' feedback and comments showed that they enjoyed working in a team to complete their projects, enjoyed being able to be creative and critical in their decision-making process, were able to acquire relevant skills for their future careers, increased their understanding of the subject matter, were

satisfied with their contributions to their projects. These experiences showed strong support for developing a constructivist learning environment as suggested by Jonassen (1999).

4. The incorporation of a multimedia project into this constructivist learning environment enabled students to use multimedia technology to apply their creativity and to enable them to solve their design problems. Students became the designers of their multimedia applications and were able to experience critical-thinking, presentation and communication skills, and be creative in their thinking, with the teacher becoming the facilitator and guide in the class. This experience only served to increase their motivation and confidence levels throughout the project duration. By being able to create a multimedia project that was challenging yet fun to do, active learning was present in the environment, as students remained engaged in their learning process, and were able to construct and build upon their knowledge and understanding of the subject domain. Therefore, by being able to complete their projects, students were able to engage in knowledge construction using multimedia technology, which served to enhance their learning (Yildirim, 2006). Multimedia technology thus became an enabler for them to successfully complete their projects, and solve their problems, which further enhanced their engagement in the learning process.

CONCLUSION

A study was designed to investigate students' perceptions and attitudes towards a multimedia-mediated constructivist learning environment via developing a multimedia project. A constructivist learning environment that incorporated Jonassen's (1999) model was extended to include Herrington et. al's (2004) suggestion of setting constructivist learning environment within an authentic setting. A multimedia project with real-world implications were given to students, who worked in groups, to complete. Results showed that students were very motivated and active in their learning process, and reported positive perceptions and attitudes towards this learning environment. Therefore, this research study was successful in showing that incorporating multimedia technology into a constructivist learning environment can result in an innovative teaching and learning environment for students to acquire key learning outcomes that would better prepare them for their future in the workplace.

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