Technology - Boon for an Effective Education and Skilling

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ABSTRACT
Why is it that some Education institutes are effectively using technology for teaching and learning? This question is often asked as educators and technology supporters seek ways to enhance educational opportunities for students by technology The current research and best practice to show how to integrate technology into teaching in higher education . This resource discusses the relationship between knowledge, learning, teaching, and the nature of media, and shows how this information should inform the use of technology in a teaching environment. . In this paper, we focus on using multimedia technology as an innovative teaching and learning strategy in a problem-based learning environment by giving the students a multimedia project to train them in this skill set.
Keyword: - Education, Technology, Multimedia, Teaching, Learning.

I INTRODUCTION

One of the major concerns of many countries today is that there is a mismatch between graduates' skills, acquired from higher education institutions and the skill sets needed in industry. Many of the current graduates are found to be lacking in creativity, communications skills, analytical and critical thinking, and problem-solving skills (Teo & Wong, 2000; Tan, 2000). As such, there is much need for institutions of higher education to focus on training future graduates to be more adaptable to the needs of the industry.

Currently, many institutions are moving towards problem-based learning as a solution to producing graduates who are creative and can think critically, analytically, and solve problems. Since knowledge is no longer an end but a means to creating better problem solvers and encourage lifelong learning, problem-based learning is becoming increasingly popular in educational institutions as a tool to address the inadequacies of traditional teaching. Since these traditional approaches "do not encourage students to question what they have learnt or to associate with previously acquired knowledge" (Teo & Wong, 2000), problem-based learning is seen as an innovative measure to encourage students to "learn how to learn" via "real-life" problems (Boud & Feletti, 1999).

(a) Multimedia in education
The use of multimedia in industries has been extensive, as it has been effective in increasing productivity and retention rates, where research has shown that people remember 20% of what they see, 40% of what they see and hear, but about 75% of what they see and hear and do simultaneously .It is now permeating the educational system as a tool for effective teaching and learning. With multimedia, the communication of the information can be done in a more effective manner and it can be an effective instructional medium for delivering information. A multi-sensory experience can be created for the audience, which, in turn, elicits positive attitudes toward the application. Multimedia has also been shown to elicit the highest rate of information retention and result in shorter learning time). On the part of the creator, designing a multimedia application that is interactive and multi-sensory can be both a challenge and a thrill. Multimedia application design offers new insights into the learning process of the designer and forces him or her to represent information and knowledge in a new and innovative way.

Multimedia, defined, is the combination of various digital media types such as text, images, sound and video, into an integrated multi-sensory interactive application or presentation to convey a message or information to an audience. In other words, multimedia means "an individual or a small group using a computer to interact with information that is represented in several media, by repeatedly selecting what to see and hear next" .

(b) Problem-solving: The multimedia project in the classroom
The move towards using problem-based learning in many educational institutions has resulted in a shift in the curriculum model. The focus is moving from content towards problems to provide a more realistic approach to learning and to create an educational methodology which "emphasises real world challenges, higher order thinking skills, multi-disciplinary learning, independent learning, teamwork and communication skills" via a problem-based learning environment (Tan, 2000). However, this model can be further strengthened with the inclusion of multimedia technology into this problem-based learning environment to enhance the students' learning experience. This reinforced model is illustrated in Figure 1.

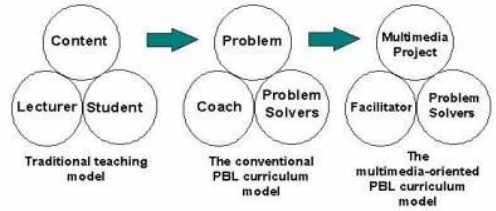

Figure 1. The multimedia-oriented Problem-Based Learning curriculum model

With the use of multimedia projects, students can utilise the knowledge presented to them by the teacher, and represent them in a more meaningful way, using different media elements. These media elements can be converted into digital form and modified and customised for the final project. By incorporating digital media elements into the project, the students are able to learn better since they use multiple sensory modalities, which would make them more motivated to pay more attention to the information presented and better retain the information.

Creating multimedia projects is both challenging and exciting. Fortunately, there are many multimedia technologies that are available for developers to create these innovative and interactive multimedia applications (Vaughan, 1998). These techologies include Adobe Photoshop and Premier to create and edit graphics and video files respectively, SoundForge and 3D Studio Max to create or edit sound and animation files, respectively. They can also use an authoring tool such as Macromedia Director or Authorware to integrate and synchronise all these media elements into one final application, add interactive features, and package the application into a distributable format for the end-user. Another advantage of creating multimedia projects in the classroom setting is that when students create multimedia projects, they tend to do this in a group environment. By working in a group, the students will have to learn to work cooperatively and collaboratively, using their group skills and a variety of activities to accomplish the project's overall objectives.

As stated by Agnew et. al (1996, p9), "Student-created multimedia projects are beneficial, in addition, because they often involve substantial work, open-ended assignments, theme-based activities, and knowledge and experiences that the students draw from a wide variety of sources." Multimedia-oriented projects are "a way for students to achieve high self-esteem, to increase their ability to function as self-directed learners, to learn to think effectively, and to practice problem-solving and decision-making" (Agnew et. al, 1996). Therefore, using multimedia in the teaching and learning environment enables students to become critical thinkers, problem-solvers, more apt to seek information, and more motivated in their learning processes. Multimedia is slowly gaining ground as a way for students to represent the knowledge that they acquire in class and to construct their own interpretation of the information acquired. It also fosters collaborative and cooperative learning between and among students, thus better preparing them with a skill set for real-life work situations (Roblyer & Edwards, 2000; Jonassen et. al, 1999).

II COURSE STRUCTURE OF THE INTERACTIVE MULTIMEDIA CLASS

The class was structured toward creating a problem-based learning environment for the students in a multimedia design context in order to harness their abilities to use and appreciate media effectively when representing various pieces of information to convey a message to the audience. This problem-based learning environment is employed to develop the students' capabilities to solve real-life problems and to exercise analytical, critical and creative thinking in their work (Boud & Feletti, 1999; Newby, Stepich, Lehman & Russell, 2000). Thus, by designing a multimedia application that is multi-sensory and interactive, the students are challenged to learn more about their chosen subject material and to develop their abilities to analyse and draw conclusions from it. Some of the goals for a multimedia project that were adapted from Agnew et.al (1996) for use in this class included the following:

(a) **Higher-order thinking skills**. Here the students were required to present their information appropriately and effectively. They were also required to select the appropriate media and to use them effectively in conveying their project's message, theme, drama and impact.
(b) **Group and interpersonal skills**. This goal requires that the students to work successfully in a group and with members of their groups in class and interacting with people outside of the classroom environment. This is especially true when the students have to interview and do research.
(c) **Content and discipline**. This requirement enables the student to learn significant facts and concepts in the multimedia discipline as well as interdisciplinary topics. The students can also familiarise themselves with the vocabulary of multimedia, its terms and interpretations.
(d) **Technical skills**. No multimedia project is complete without the use of multimedia software technology. Here the students will learn about project planning and acquire execution skills. More importantly, the students learn how to use a multimedia authoring tool to complete their project and incorporate interactive features into their presentations. These interactive links will work alongside the display of information in multimedia form, using text, graphics, sound, video and animations, in an effective manner. The combination of all these elements will bring about a successful final interactive multimedia application.

The Interactive Multimedia course is a course taken by second-year students of the Multimedia University who are taking their Bachelor of Multimedia (BMM) degree. In this course, the students were given interactive lectures on multimedia concepts and multimedia project development. They were also given interactive tutorials and lab sessions on Macromedia Director, which would be the main authoring tool for them to use to create their final multimedia project. Their task was to propose a

multimedia topic of their choice and to design and create an interactive CD-ROM application using multimedia technology.

Part of the class consisted of lectures that dealt with multimedia and the creation of multimedia presentations. It involved providing students with the fundamental concepts of the multimedia process (see Figure 2). This included deciding on the multimedia hardware and software, what was involved in creating a multimedia project, how media elements were gathered and modified, the creation of the presentation interface, and the use of interactivity in a multimedia presentation. These students have already been exposed to multimedia and using some multimedia software packages. However, they have had no exposure to working with a multimedia authoring tool, and in creating and managing multimedia project in a group setting.

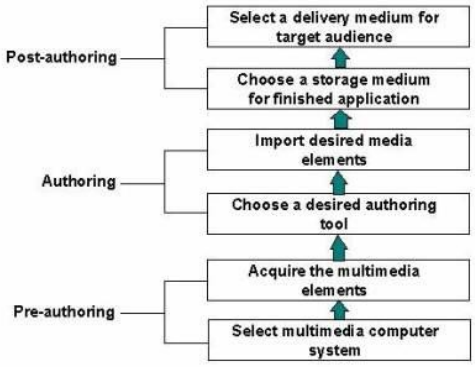

Figure 2. The multimedia process (Source: Neo & Neo, 1999)

The final project for the class involved breaking up the students into groups of 4 to 6 persons. Each group had to create and design an interactive multimedia application of their choice on a CD-ROM. The students had the option of choosing their own team members and the topic, and were given the entire 14-week semester to develop the project. The purpose of this project was to access the students' skills in framing and solving problems using multimedia technologies. As a group, the students had to decide on the concept of the presentation, the design of the presentation interface and navigation, and the appropriate digital multimedia elements and interactive features to use to best convey their topic of interest.

III PLANNING THE APPLICATION PROJECT PROPOSAL

The first stage in a multimedia development process is to come up with a project plan. This project plan will define the scope of the final multimedia application, the targeted market and the treatment of the presentation. After introducing the general theme to the class, the students had to submit a project proposal outlining their topic of choice and the team members and their specific functions. They had to identify the target audience and concept of their final project. Upon proposal approval, the team then had to create a storyboard. In their storyboard, the group had to outline the specific interfaces of each screen, the media elements to be used and the information that was to accompany the screen design. They also had to outline the type of interactivity that they were going to use in each screen and their navigational structure. Each screen of the application was sketched and the entire storyboard was submitted on paper.

It is also at this stage that the groups elected their group leader. The group leader would be responsible for providing the direction and objectives for the final project and to moderate any disagreements that may arise from the group's discussions. The groups were to meet and discuss their proposal outside of class times. After the groups had been formed and the area of interest was identified, each group gave a short presentation and a brief summary of their project in class.

IV PROJECT EXECUTION

(a) **Research: Acquiring the resources**
At this stage of the multimedia project development, materials had to be gathered from the application's sources to be used as information in the final project. To be able to assemble the various media elements for the final multimedia projects, the groups had to collect materials from the various sources of their topics. These materials range from brochures to product information, to photographs taken at the respective sites, to video footage shot at the sites themselves. The media materials assembled were usually in analogue format. This meant that they were collected in their raw state and not yet ready to be processed in the PC. The collection of materials at this stage is critical because the groups had to make sure that they had enough material for use in their multimedia presentations. Therefore, their brainstorming and planning stage prior to this provided them with their direction and objectives for the project. The acquisition of the materials thus required the groups to visit the sites of their topics, interview the necessary people and collect data on the topic.

(b) **Converting the media elements to digital**
After all the materials have been collected and assemble in their raw analogue state, they have to be converted into a standard digital format in order for the PC to be able to process them. This would entail using scanners to convert images and graphics, and digitising any analogue video footage into digital movie clips. These files were then saved as appropriate media formats and stored in the PC's hard drive. For example, images were scanned and stored as JPEG (Joint Photography Experts Group), GIF (Graphic Interchange Format), or BMP (Windows Bitmap) files, and digital movie clips were

stored as AVI (Audio Video Interleave) or MOV (Quicktime Movie) files.

(c) **Editing or creating media**
Once the media elements have been digitised and stored in the PC, they can then be edited or modified in software packages. In these packages, the media elements are modified to include special effects and filters to further enhance its look and perspective. The group members who were designated as graphic designers had the responsibility to edit images in image-editing packages. Many chose to use Adobe Photoshop for this purpose. Adobe Photoshop is a sophisticated image-editing tool that is popularly used to modify and edit digital images. Other media elements like animations were digitally created in animation software like Macromedia Flash and 3D packages like Kinetix 3D Studio Max.

(d) **Multimedia authoring: Macromedia Director**
Authoring is the stage where all the media elements that have been created or modified and stored digitally in the PC are brought together into one final application and integrated into a cohesive presentation for the purpose of conveying a specific message to the audience. It is also at this stage that elements of interactivity and navigation are incorporated to involve the user in the application and to create a multi-sensory experience.

Macromedia Director was chosen to be the primary authoring tool for this course. Director is currently the de facto authoring tool for creating interactive multimedia applications such as kiosks, product brochures, interactive advertising applications, and multimedia presentations. It is also very popularly used in the Multimedia University for multimedia application development and interactive presentations. Director follows a movie metaphor and has many elements of movie-making incorporated in its authoring scheme (see Figure 3). These include a Cast Window to house media elements, a Stage to showcase the production, a Score to synchronise the entire presentation, and Scripts to control each Castmember (Neo & Neo, 1999).

Figure 3. Director's interface

The students were taught the basics of Director and given tutorials in creating interactive applications using Director's tools and features, and packaging techniques to save multimedia applications as standalone presentations for CD-ROM delivery. In particular, they were introduced to Director's interface and working areas and taught how to create animations, incorporate interactivity using Behaviors, writing simple Lingo scripts and creating projectors to package Director movies for CD-ROMs or "shocking" the application for the Web (Neo & Neo, 1999). Students also had to incorporate design principles acquired from any of their previous classes into their interface design to be able to create screen interfaces for their final applications.

(e) **Packaging for delivery**
Multimedia applications inevitably have large file sizes. Therefore, they cannot be accommodated by floppy disks, but by multimedia-capable optical storage devices. Packaging involves the physical packaging of the application and saving it onto an optical storage device. Thus, as the final step in their multimedia project development, students had to create a standalone application and"burn" their application onto a CD-ROM. A standalone application is a self-executing file that, when clicked, can be played back on an end-user's PC without a helper software programme (i.e., the authoring tool, or Director, in this case). They also had to design a CD-ROM cover for their applications. The CD cover would be a conceptual representation of their final multimedia application and would have their "production company" listed. This was to give them authentic experiences in packaging applications for market distribution.

V ASSESSMENT CRITERIA

At the end of the semester, the groups submitted their final projects on CD-ROM together with a copy of their storyboard and project proposal. They were assessed on the following criteria:

(a) **Originality**: How original or creative was their concept?
(b) **Critical thinking**: How well were they able to convert their concept of their topic on the storyboard into the final CD application? Was it well thought out?
(c) **Use of media**: How successful were they in their use of media elements to represent their ideas?
(d) **Director:** How well were they able to use the Director tools taught to them in their tutorials and lab sessions?
(e) **Difficulty**: How complex were their navigational scheme and interactivity (linear vs. non-linear) and how was this accomplished?
(f) **Presentation**: How well was the material presented?
(g) **Cohesion of application**: How consistent were the digital materials used with the message to be conveyed.

(h) **Team work**: How did the team work together to produce the application? Did everyone perform their specific functions?

(a) Student evaluations

The groups or respondents (N=46) were also given a survey on their project and interviewed individually. The survey consisted of questions to assess their interest in group project work and whether or not they were motivated in their project development. The survey also tried to gauge their level of understanding and their critical thinking skills, as well as how they worked as a team. The survey was measured using a 5-point Likert scale, with 1 for Strongly Disagree (SDA), 2 for Agree, 3 for Undecided, 4 for Disagree and 5 for Strongly Agree (SA). These questions made up several constructs to measure the students' problem-solving skills, collaborative efforts and team work. The results of the survey were tabulated and their corresponding means are illustrated in

TABLE 4
MEANS AND PERCENTAGES OF STUDENTS (RANKED)

Questions asked	**Mean score**	**%**
1. I found the project challenging	4.17	91
2. The project allowed me to be creative in my thinking	4.15	91
3. We were better able to present the concept using digital multimedia	4.11	91
4. I was able to have creative input in the project	4.02	83
5. This project allowed me to think critically about the topic	3.98	83
6. The project enhanced my understanding of the subject	3.98	83
7. I felt very motivated doing the project	3.98	76
8. I understood the subject matter better after the project development	3.98	89
9. I was able to learn more working with my teammates	3.91	78
10. The team was able to create the project with the existing software	3.85	76
11. The group was able to achieve its goals	3.83	76
N = 46		

On the whole, the students in the Interactive Multimedia class responded very well to the course structure and were able to have a positive attitude toward this problem-solving learning environment. Based on the results of the survey, we found three areas that were significant in shaping these students' attitudes towards the project. The first is that they were very motivated, enjoyed being challenged and able to have creative input and use multimedia technology and software. This was represented by Questions 1, 2, 3, 4 and 7 with means of 4.17, 4.15, 4.11, 4.02 and 3.98, respectively. The second area is in their ability to think critically about the topic and develop a deeper understanding of the subject via the project, represented by Questions 5, 6 and 8, each with means of 3.98. The third area is the student's ability to function well as a team, represented by Questions 9, 10 and 11, with means of 3.91, 3.85 and 3.83, respectively.

Figures 5 (a), (b) and (c) illustrate some of the percentages of students who answered in the "Agree" and "Strongly Agree" category (numbers 4 and 5 on the Likert scale). As shown below, 91% of the students found the project challenging (see Figure 5 (a)), 89% felt that the project allowed them to have a better understanding of their topic (see Figure 5 (b)), and 78% were able to learn from their teammates (see Figure 5 (c)).

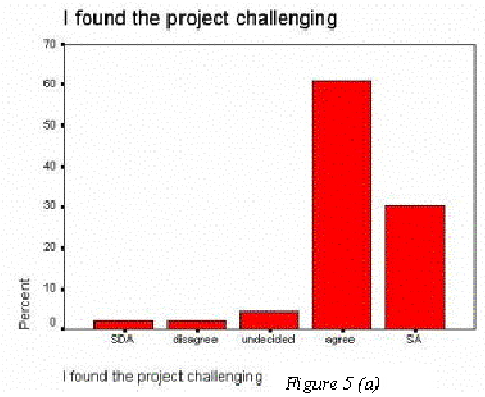

Figure 5 (a)

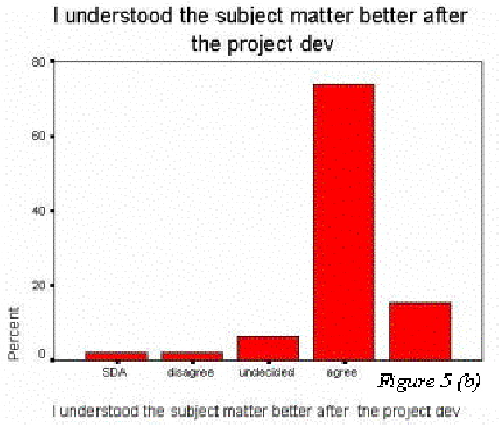

Figure 5 (b)

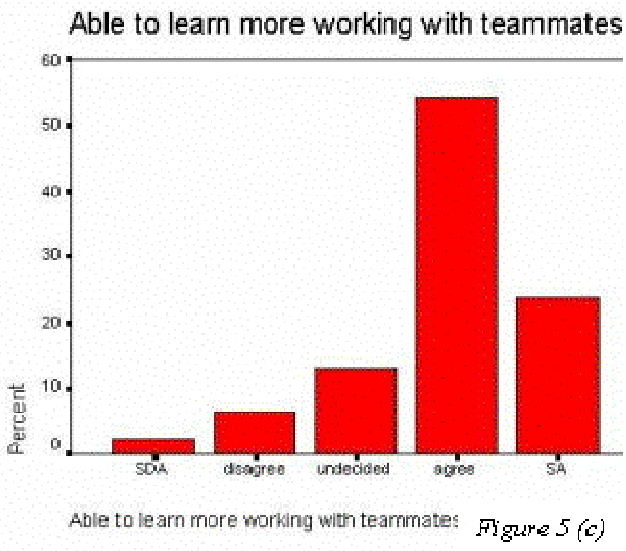

Figure 5 (c).

Figures 5 (a), (b) and (c). Percentages of responses

(b) Student interviews

We also conducted interviews with the groups to find out more about their problem-solving skills and team efforts. We found that the groups that did very well in their projects had very good group leaders and worked well together. Interviews showed that these groups collaborated well in their collective efforts. Many of these groups divided themselves into the general categories of Graphic Designers, Multimedia Author/Programmer (using Director), Resource Manager, and Researcher.

rom the interviews we did with the students as well as the surveys that we conducted, we found that the majority of these students were very motivated and found working on their multimedia project very inspiring and challenging. Many of them enjoyed exercising their creativity and multimedia skills in visually representing their content material. Some even said that they liked doing the project because it allowed them to fully understand what it takes to create a multimedia application from the beginning to end and how to work as a team. They were able to learn more about their topic as well as creating multimedia presentations, and able to design an interactive multimedia application with active links, thus supporting the propositions made by Agnew et. al (1996) and illustrated by

TABLE 8
GROUP RESPONSES FROM INTERVIEWS

	Question: What did you learn from this project?
Group 1	"We learnt more about the topic as well as the software. We also developed a positive group attitude."
Group 2	"We learnt more about multimedia, developing a CD-ROM, software, navigation and interactivity."
Group 3	"Teamwork is not so easy, but I learnt how to be a good leader. We learnt more about our topic. Fun to know everyone on the team and had fun shooting video, never done it before."
Group 4	"Learnt more about group members."
Group 5	"Learnt more about software and hardware in multimedia."
Group 6	"I can use Director for my other projects now. It was very challenging"

For most of the semester, the groups would work either during class times to discuss their projects, or schedule meetings outside of class times. The lecturer also met with the various groups each week to discuss their progress and to act as a consultant and a guide to these groups.

Some groups did encounter scheduling problems with conflicting class schedules and problems with deciding on which theme and topic to concentrate on during the initial stages of the project development, but they were able to resolve them as the weeks progressed. They encountered some more problems when researching the site of their topic of interest as not all groups received cooperation from their chosen topic. Therefore, they had to work around that problem by either using information publicly available or by highlighting that topic indirectly. By doing so, they exercised their creative and critical thinking toward these problems.

Groups that had good leaders and good teamwork were able to finish their projects early. Their applications had little or no problems. The translations of their storyboards into electronic presentations showed minimal changes and they made good use of many media elements. The navigational links and interactive features were also intact and the presentation ran smoothly from beginning to end. Some even went beyond what was taught in class to include a difficult component like scripting.

Some groups had good leaders but were weaker in their application of multimedia knowledge. However, they were still able to make a multimedia presentation of their topic, although the representations of their information by the media elements were simpler than the stronger groups. Groups that did not have a strong leader or were unable to cooperate did demonstrate a weakness in their overall presentations. This was due to the fact that the dynamics within the group were not colloborative or cooperative at all. Statements elicited from them include, *"Don't take friends when doing*

groupwork," and *"I will be more careful when choosing my group members next time,"* and *"I would work individually next time."* For these groups, they would schedule meetings with the lecturer to discuss their problems and present their solutions, with the lecturer acting as the facilitator in these meetings.

However, these groups were small in number and still managed to complete their project, indicating that although they were not able to fully cooperate with each other, they managed to stay as a group long enough to finish the project. Surveys taken by these individuals still indicated that they were very much motivated to doing their project but were unable to do their best because of their inability to get along as team members.

Overall, despite some problems in scheduling and personality conflicts, the students enjoyed working in teams to develop their project. As the means and percentages had shown in Table 4, over 75% of the students favourably rated team efforts (Questions 9,10, 11) and group participation as a factor in completing their project, indicating that they were able to learn from their teammates, collaborate to achieve the group's goals and collectively solve their multimedia design problems together. Specific questions on teamwork showed a lower percentage in student responses (76% and 78%) as compared to the rest of the questions. This is probably due to the fact that this is a new experience for these students who have little experience in working together to solve problems. This is also reflected in some of the statements given by the groups in Table 8. However, teamwork is still positively viewed by the students and should therefore be encouraged so that they will have the necessary problem-solving skills when they face real-life situations, particularly in the IT-oriented business environment of today.

VI CONCLUSION

This paper has presented and discussed the use of multimedia in a problem-based learning environment to equip students with high-order thinking and problem-solving skills and to enable them to experience an IT-oriented learning situation. From the results, we are able to conclude that by integrating multimedia into the teaching and learning process, the conventional PBL curriculum model is reinforced and strengthened and a multimedia-oriented PBL curriculum model can be instituted. The multimedia project in this course enabled the students to exercise their creative and critical thinking skills in solving their design and development problems, work collaboratively to gain team-based experience, and to face the real-life situation of problem-solving. This is a student-centered learning approach which allows them to construct their own framework of knowledge and understanding, and determine their own learning goals.

REFERENCES

[1] Agnew, P. W., Kellerman, A. S. & Meyer, J. (1996). *Multimedia in the Classroom*, Boston: Allyn and Bacon.

[2] Boud, D. & Feletti, G. (1999). *The Challenge of Problem-Based Learning*, (2nd Ed.), London: Kogan Page.

[3] Hofstetter, F. T. (1995). *Multimedia Literacy*, New York: McGraw-Hill.

[4] Jonassen, D. H., Peck, K. L., and Wilson, B. G. (1999). *Learning With Technology: A Constructivist Perspective*, New Jersey: Merrill/Prentice Hall.

[5] Lindstrom, R. (1994). *The Business Week Guide to Multimedia Presentations: Create Dynamic Presentations That Inspire*, New York: McGraw-Hill.

[6] Neo, M. & Neo T. K. (1999). *Director: The Multimedia Movie*, Subang Jaya, Malaysia: Meway Computec Sdn. Bhd.

[7] Neo, M & Neo, T. K. (2000). Multimedia Learning: Using multimedia as a platform for instruction and learning in higher education. *Paper presented at the Multimedia*