USING MULTIMEDIA TO ENGAGE STUDENTS AS PROBLEM SOLVERS IN A STUDENT-CENTRED LEARNING ENVIRONMENT – A LIFELONG LEARNING EXPERIENCE IN THE MALAYSIAN CLASSROOM

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ABSTRACT

A multimedia project was incorporated into a problem-based learning environment where students used the multimedia design process (MDP) to design the multimedia application. Results were positive and encouraging for the further development and use of problem-oriented learning models as a means of instilling in students a process for lifelong learning.

INTRODUCTION

In the context of our present technological and educational development, lifelong learning has become very important. Hence, it is essential to encourage students in colleges to acquire some skills in learning how to learn via the solving of real-life problems.

The inclusion of multimedia technologies in the classroom has changed the educational landscape in many ways. Multimedia is changing the way we communicate with each other. It has also introduced important changes in our educational system and impacted on the way we communicate information to learners (Neo and Neo, 2000). With multimedia in the classroom, users have the flexibility to use the technology in numerous ways. Because of its multi-sensory ability, multimedia can be used as an instructional tool to represent and present concepts and ideas using the various media types such as text, images, sound, animation, and video (Luther, 1994). Thus, the traditional chalk-and-talk method of teaching can be enhanced by using multimedia-based instructional strategies.

As such, 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 (Agnew, Kellerman, and Meyer, 1996). The evolution of multimedia has made it possible for learners to become involved in their work. With multimedia technologies, they can create multimedia applications as part of their project activities. This would make them active participants in their own learning process, instead of just being passive learners of the educational content.

With a problem-based learning approach, the focus moves away from content learning and towards solving problems. As a result, this approach provides a more realistic and real-world environment to the learners (Keppell, 2005). In conventional problem-based learning (PBL), the role of the lecturer changes into that of a coach, and the students become problem-solvers, while the environment's emphasis is on solving real-world problems. In this PBL environment, the emphasis is on real-world challenges, and on creating higher order thinking skills, multi-disciplinary learning, independent learning, and teamwork and communication skills (Tan, 2000). However, this conventional PBL model can be further strengthened into a multimedia-rich, problem-based learning environment to enhance the students' learning experience (Keppell, 2005). In this model the students become the multimedia project designers, and the teacher assumes the role of a facilitator of student learning. With the use of multimedia projects, students are able to construct, in a multi-sensory manner, the knowledge that is presented to them by their teacher. This makes the knowledge more meaningful to the students. As stated by Agnew, Kellerman, and Meyer (1996), "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" (p. 9).

Multimedia-oriented projects allow students to achieve a higher self-esteem, increased ability to function as self-directed learners, the ability to learn to think effectively, and the aptitude to practise problem-solving and decision-making (Agnew et al., 1996).

In this paper, the authors will describe a multimedia project that was used to form the core of a problem-based learning environment within a group- and project-based setting. In this environment, students in a second-year course in the Faculty of Creative Multimedia (FCM) were given the problem of designing and developing an interactive multimedia application. Students worked in groups, solving the problem using the multimedia design process (MDP) to design the multimedia application. In this learning mode, students participated actively in their own learning process, instead of just being passive learners of the educational content. They were involved actively in solving their problems and in determining their own learning paths, as well as their learning outcomes, thus focussing on their learning processes.

THE PROBLEM-SOLVING LEARNING APPROACH

The problem-based method in teaching and learning was developed in response to the weaknesses in traditional, directed instruction, which is generally teacher-centred (Boud and Feletti, 1999). This teacher-centred mode does not encourage active engagement of students in their learning processes. It does not foster students in becoming active, independent, and autonomous learners. The problem-based approach to teaching and learning, however, involves students actively in learning while solving a problem, focuses on the learners, and offers more flexibility for learners to enhance creative and critical thinking skills and problem-solving abilities (Watson, 2002). As stated by Bates (2000),

> Modern learning theory…[is moving] beyond the recall of facts, principles, or correct procedures and into the areas of creativity, problem-solving, analysis, or evaluation (the very skills needed in the workplace in a knowledge-based economy, not to mention in life in general),[where] learners need the opportunity to communicate with one another as well as with their teachers. This of course includes the opportunity to question, challenge and discuss issues. Learning is as much a social as an individual activity. (p. 13)

Currently, many institutions are moving towards problem-based learning as a solution to producing graduates who are creative and can think critically and analytically, and solve problems (McAlpine and Clements, 2001; Teo and Wong, 2000, McAlpine and Stothard, 2005). Since acquiring knowledge is no longer an end in itself but a means of creating better problem solvers and of encouraging lifelong learning, problem-based learning is becoming increasingly popular in educational institutions as a tool to address the inadequacies of traditional teaching. Traditional approaches such as face-to-face methods are teacher-directed and, therefore, do not promote any questioning of the material or the making of associations with previously acquired knowledge on the part of the student (Teo and Wong, 2000). The concept of problem-based learning, on the other hand, is seen as an innovative measure to encourage students to learn how to learn via real-life problems (Boud and Feletti, 1999; Herrington, Oliver, and Reeves, 2003). Since this learning mode is broadly constructivist in its approach, the students participate actively in their own learning process and construct their own knowledge and are responsible for determining their own learning outcomes (Savery and Duffy, 1995; Jonassen, Peck and Wilson, 1999).

USING MULTIMEDIA IN A PROBLEM-SOLVING LEARNING ENVIRONMENT

It is a requirement of effective problem-based learning environments that the problem is not only authentic and relevant, but it must also have multiple perspectives, i.e., many solutions to the problem, and encourage the representation of information in multiple modes such as graphics, audio or video (Jonassen et al., 1999). As a consequence of technology, there is a move toward more project-based work and problem-based learning. Student-created multimedia projects and assignments are also encouraged, where students are given more choice in their learning and in the curriculum.

A multimedia-mediated, problem-based project such as the one considered in this study suitably fulfills the abovementioned requirements, as students can make use of the different media elements to represent information in their projects. The incorporation of a multimedia project as the core problem in such a problem-oriented environment would pose a design and development problem to these students. They would need to decide on the best combination of media elements to represent their solution and to achieve their group goals. Through the creative use of multimedia in their projects, students would become more motivated and this would enhance their learning processes. Students would be able to harness several learning skills while working with multimedia-based projects, and these include higher-order thinking skills, group and interpersonal skills, content skills,

and technical skills (Agnew et al., 1996), which will enhance and contribute significantly to their problem-solving skills.

METHODOLOGY: THE CLASS STRUCTURE

To study such a problem-based learning environment, this investigation was conducted with 75 students (*N*=75) taking a course called Interactive Multimedia, a course taken by second-year students of the Multimedia University who are studying for their Bachelor of Multimedia (BMM) degree. This course was designed to teach students about multimedia concepts and multimedia project development. Since the class was structured to be a problem-oriented learning course, an ill-structured problem was posed early on to the students to do during this 14-week course. This problem had unstated goals and constraints, multiple solutions and criteria for evaluation, uncertainty about concepts, no general rules for describing or predicting outcomes, and required learners to make judgments about the problem as well as defend these judgements. Students were told to form small groups whereby they were able to pick their own group members. In these groups, students were faced with solving a problem. The problem was for them to create a multimedia application based on their knowledge, experiences, and research on a particular topic. Specifically, students were required to create an interactive multimedia application on a consumer product of their choice. The students, in their respective groups, had to discuss and decide on the topic they wanted to explore. Once they had decided on the topic, they had to develop a multimedia application based on that topic, and present the application to the class.

THE STUDENT LEARNING PROCESS: THE MULTIMEDIA DESIGN PROCESS (MDP)

While engaging in the creation of this multimedia project, students followed a 6-step multimedia design process (MDP), which was adapted from Luther (1994) and Neo and Neo (2004), and modified for this study. The MDP highlights the student learning process of solving a problem via a multimedia project and involved the following:

- Student cooperation and collaboration

As this problem-based learning environment is set in a group situation, students had to collaborate and cooperate with each other in order to find solutions to their problem. Here, brainstorming activities were developed to help groups carry out their decision-making processes and come to a commonly agreed goal. Students conducted group meetings, selected a group leader to help plan and organize and take charge of the group's learning path, and cultivated teamwork activities. Peer-to-peer interactions, discourse and dialogue, and cohesion among team members became essential tools in their learning process.

- Identifying the problem/project

An ill-structured problem was given, which required the students to apply their creative and critical-thinking skills to solving the problem using digital media, and in working in a group environment. Students met to discuss the problem, identify issues and hypotheses, and select possible directions to solving that problem (Stepien, Senn and Stepien, 2000).

- Planning and organizing the project

In this phase, a project proposal was made which defined the scope of the final multimedia application. The proposal identified the aspect of the project that the group wished to explore, the overall concept of their project or solution, and the target audience.

- Designing the application

In this phase, the groups designed storyboards that expressed the overall solution embodied by their projects, created the specific interfaces of each screen, and decided on 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 the application's navigational structure. Each screen of the application was sketched and the entire storyboard was submitted on paper.

- Authoring the application

In this phase, the groups authored their applications using a professional authoring tool, Macromedia Director. Here, they integrated and synchronised their chosen media elements, incorporated interactivity, and packaged the final application into a standalone presentation on a CD-ROM.

- Student presentation and reflection

Once the project was completed, each group gave a final presentation in front of the class. This allowed other students to see what their coursemates had done and to provide feedback to them where necessary. Once all the presentations were completed, the final

applications were submitted on CD-ROMs to the lecturer. The multimedia design process is illustrated in Figure 1.
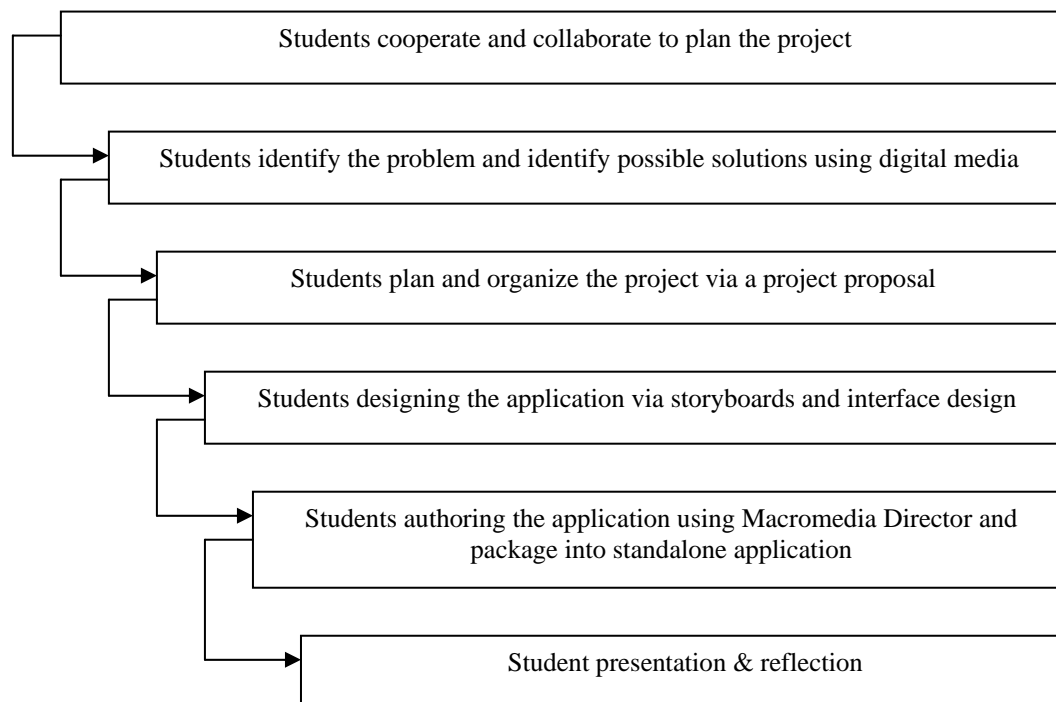

Figure 1. The Multimedia Design Process (MDP).

SHOWCASE OF STUDENT WORK

The final applications that were submitted by the students on CD-ROMs were on various topics, ranging from kiosks to electronic brochures to product marketing to edutainment to games. Figure 2 showcases two still-image examples of one group's project, an interactive CD-ROM about women's products.
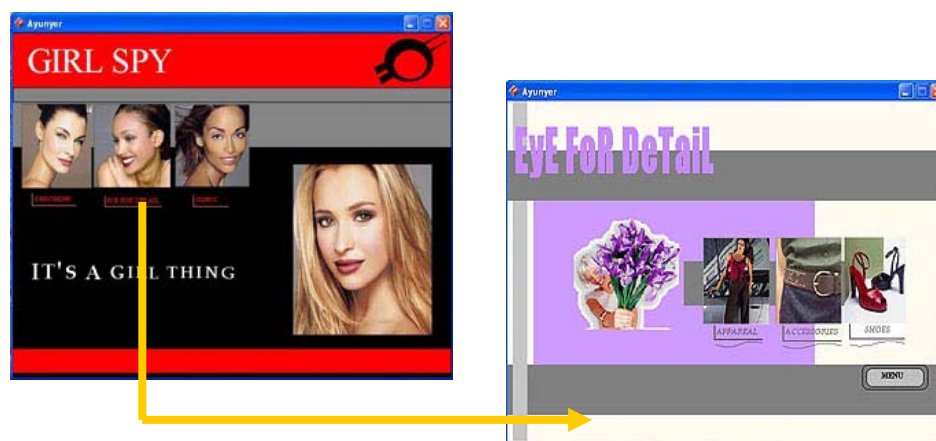
Figure 2. Images from an interactive CD-ROM on women's products.

SURVEY RESULTS

A survey via questionnaire was conducted among the students. The 5-point Likert scale ranged from 1, Strongly Disagree; to 5, Strongly Agree; and measured students' attitudes towards the project. Results obtained were positive and encouraging. The students – in general – liked the multimedia-mediated, problem-based project because in doing the project, they learnt to think critically and provide solutions to the problem. Table 1 illustrates the results of the

survey by displaying the means (*M*), and the percentage of students who responded favourably (4 or 5 on the scale), for each item.

ITEMS ON SURVEY	Mean (*M*)	% (P)
1. The group was able to achieve its goals	4.01	85.3
2. I was able to learn more working with my teammates	4.08	82.7
3. Motivated to do project	4.08	86.7
4. I was able to work as a team	4.11	82.7
5. We were able to present our project well using multimedia	4.13	93.3
6. This project allowed to think critically about the topic	4.17	93.3
7. The project allowed me to be creative in my thinking	4.19	92.0
8. I saw the relevance between the project and real world situations	4.20	88.0
9. I found the project to be challenging	4.27	94.7
10. The project enhanced my understanding of the subject	4.33	94.7
N=75		

Table 1. Mean scores (M), and the percentage (P) of favourable responses in the survey.

As can be seen from Table 1, 94.7% of the students found that the multimedia project enhanced their understanding of the subject matter (*M*=4.33) and, although challenging to them (*M*=4.27, P=94.7%), was motivating for them to do (*M*=4.08, P=86.7%). They were also able to cultivate problem-solving skills in that they reported being able to think critically about their topic (*M*=4.17, P=93.3%), and apply creative thinking skills to the project (*M*=4.19, P=92%). Multimedia was also an integral factor to their favourable attitude as 93.3% reported being able to present their project well using multimedia technology (*M*=4.13). Teamwork was also cultivated as 82.7% of the students reported being able to learn more from working in a team (*M*=4.08), 82.7% were able to work as a team (*M*=4.11) and the groups were able to achieve their group's goals (*M*=4.01, P=85.3%). Eighty-eight percent of the students also reported that working on this multimedia project allowed them to see its relevance to real-life situations (*M*=4.20). The findings indicate that increased understanding of the subject matter was an important factor that contributed to the students' favourable attitudes towards the project, making it the highest ranking mean in the survey. The project challenged their abilities to organize their projects and allowed them to cultivate problem-solving and critical-thinking skills. The findings are further supported by the students' ability to demonstrate solid understandings of interactive multimedia, evidenced by the successful completion of their projects using the MDP. Team effort was also an important element in each group's success and for each member's own learning process. Students found that interaction with team members not only helped them achieve their group goals, but also enabled them learn more from their team members. Students found that working in a team helped to foster an interactive social environment that improved their learning process. Students were also able to relate their project development experiences to real-world situations, making it the third highest ranking item in the survey. In addition, self-esteem and motivation items were highly rated in the survey, indicating that students enjoyed doing the project and found it to be very exciting and satisfying.

DISCUSSION AND CONCLUSION

By being provided with control in the decision-making process, and the technical ability to author and create, students learned the skills that enabled them to construct their own solutions to the problem at hand. This process enabled them to research, plan, and organize the content of the project, and to structure solutions to the problems. As such, students were actively

engaged in seeking their own information and knowledge and in finding their own solutions to the problem, thus giving the students ownership and voice in the learning process.

The findings in the survey further supported this. Students reported favourably on many of the survey items that sought to measure their teamwork, critical-thinking and problem-solving skills, and motivation levels. This learning environment also encouraged and supported collaborative peer learning where the teacher acted as a facilitator and consultant, guiding students in solving their problems. And by being able to see the relevance between their project and a real-life situation, students not only viewed the project simply as a classroom exercise, but rather as an experience acquired for help in real-life situations. This showed that the project was successful in bridging the gap between students' theoretical understanding of interactive multimedia and its practical uses in the real world, and has important implications for the students' futures.

The use of multimedia technology in this problem-based learning environment, and the use of a challenging project, allowed students the flexibility to solve their design project, which contributed to their motivation levels – as reported in the survey. The results positively supported this study's objective to create a more learner-centered environment, where the locus of control lay with the students themselves, enhancing their involvement by giving them decision-making opportunities in the project. This multimedia design project was anchored in the problem-solving context and served as the core of the problem in a problem-based learning environment. The design problem was a realistic and authentic task and the MDP was used to design the multimedia project. The study showed that by actively engaging students in their own learning processes, and have them work together in collaboration with their peers to solve authentic problems, students learned to cultivate their higher-order thinking and teamwork skills. The project also enhanced their problem-solving, interpersonal, and lifelong learning skills; all of which are highly valued and needed in today's workplace.

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