



Faculty of Creative Multimedia

**Problem-solving on the Internet using web-based authoring tools:
A Malaysian Experience**

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ABSTRACT

In recent years, the Internet has become a special focus in the education arena. This paper focuses on a multimedia course in which students learned web-based authoring tools and then applied them to solve a problem on the web. Here, students will find an existing website of their choice, make a critical analysis of its weaknesses, and improve the website by making it media-rich and interactive. This mode of learning is Constructivist in approach. The results of this study showed that it can be used to inculcate higher-order thinking skills such as problem-solving, analytical and critical skills into the students.

Introduction

In this new age of digitalism, information and the transmission of information are becoming important components in our communication strategies. The way we send and receive information has received a tremendous boost from the advancements in technology. This revolution in the Information and Communication Technology (ICT) has produced a techno-savvy and media-hungry generation that uses digital media as a way to learn and communicate with each other.

In recent years, the permeation of multimedia technologies into the educational arena is transforming the teaching and learning environments in our institutions of higher learning. In the context of modern educational theory, learning is moving from the traditional behaviourist perspective where students are rote-learners to the modern Constructivist-based paradigm, where students are active learners and involved in their own learning process. This shift in focus on learning has empowered educators to widen their scope and flexibility in delivering educational content to the learners and has led to the evolution of new concepts and innovative teaching techniques in the instruction-learning process. As such, multimedia or the use of multiple digital media elements in an interactive learning application is becoming an emerging trend in the communication of educational information. In this new environment, the teacher will make a difference in the integration of the media into the student's learning process.

Today, many institutions of higher learning, including those in Malaysia, are rapidly moving towards integrating technology particularly the ICT into the classroom. The Internet, in particular, has become a special focus in this area. It is affecting the communication strategies in the education environment and influencing the way educators teach and students learn. The problem-solving strategy considered in this paper is anchored in the Constructivist approach in

teaching and learning and will promote a media-rich and challenging learning environment on the Net for students in the University.

Problem-solving - the learning perspective

This problem-solving project is underpinned theoretically by the Constructivist learning framework in which learning is regarded as an active process whereby learners construct new ideas, concepts and knowledge based on their previous knowledge, experiences and social environments (Marcincovich, 2000; Orlich, Harder, Callahan & Gibson, 1998; Segumpan, 2000). In this context, learners build their own knowledge by constructing mental models or schemas based on their current experiences, and these schemas can then be developed, modified and made sophisticated over time. This constructivist learning approach was developed during the last 50 years of the 20th century. It has its foundations in cognitive learning psychology which is rooted in the theories by Dewey, Piaget, Bruner and Vygotsky (Roblyer and Edwards, 2000).

This problem-based method was developed in response to the weaknesses in the traditional directed instruction, which is generally teacher-centred. In this teacher-centric learning mode, the teacher or lecturer uses rote and fact-based learning and assumes the role of being the sole content-provider in the classroom. The teacher is in total control of the classroom and decides on how much information is to be delivered to the learners. The main focus is on delivering content during lectures and tutorials. Students rely on lecturers to feed them with information, and are generally passive recipients of knowledge and thereby lacking ownership of their learning. Individual subjects are learned in an encapsulated manner. Students' main task is on memorisation and absorption of facts delivered to them by the sole authority, the teacher, who is regarded as the 'sage on the stage'. The students then regurgitate what they have memorised in a test or examination which is used as the measurement of successful learning. This teacher-centred mode does not encourage active engagement of students in their learning process. It does not foster students to become independent and autonomous learners (Orlich, Harder, Callahan & Gibson, 1998). On the other hand, problem-solving involves students actively in learning and solving a problem, focuses on the learners and offers more flexibility for learners to enhance creative and critical thinking skills and problem-solving ability (Tan, 2000).

Siaw (2000) reported that a survey conducted by the Hong Kong Education Commission found that employers rated the problem-solving and analytical skills of university graduates as the least satisfactory of their skills, and that generally graduates are deficient in personal and interpersonal skills. Teo and Wong (2000) stated that a national survey conducted in Australia found that more than three-quarters of the graduates from Australian universities and technical schools are not suited to the jobs they applied for and that these new graduates lack creativity and flair, oral business communications skills, problem-solving ability and interpersonal skills. Though no comparative studies have been done in Malaysia, it is likely that Malaysian graduates in

tertiary education face a similar situation. Many institutions of higher learning, including those in Malaysia, have now recognised these weaknesses in their curricula and have taken steps to improve them. Problem-based teaching and learning has been used by some universities and polytechnics, including those in Malaysia, as a solution to these weaknesses (Tan, 2000; Siaw, 2000; Marincovich, 2000; Segumpan, 2000).

This problem-solving approach involves the restructuring of the traditional teacher-centric curriculum and uses problem-solving as the stimulus and focus for student learning activity. This shift in emphasis in teaching and learning has moved students from being the passive recipients of knowledge and information, as in the traditional directed instruction mode, towards the acquisition of knowledge and skills through a process of solving a complex task in a way which develops higher level cognitive processes such as defining and understanding, analysing, investigating, and solving a problem and presenting the solution. This has the effect of inculcating high levels of skills into the students.

Basically, this learning environment is student-centric whereby students are active and autonomous learners, immersed in their own learning process and construction of knowledge instead of being passive receivers of information and knowledge as in the traditional teacher-led instruction. In this way, the emphasis on learning is placed on the students who are encouraged to find their own solutions to the problems based on their prior knowledge, experiences and attitudes. This learning mode also emphasizes that the problems must be authentic, meaningful and relevant to the students' learning. The teacher, in this case, is no longer regarded as 'the sage on the stage' but acts as a facilitator or guide to help and support the students' own construction of knowledge and problem resolution.

Another important aspect of this constructivist perspective is that it places great emphasis on the social context of the learning environment. In this learning mode, social interactions enable students to learn with and from one another and this can lead to increased development of cognitive and intellectual skills, knowledge and understanding (Vygotsky, 1978). In other words, students learn best when placed in an environment where they can work collaboratively with their peers and interact socially among themselves to discuss and exchange concepts and ideas to solve a realistic problem. This learning mode then becomes a social activity where students learn by social negotiation with their peers and teacher as members of a learning community to construct solutions to the problems collectively.

In the constructivist learning mode, it is essential 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, Peck & Wilson, 1999). A multimedia-mediated problem-solving project such as the one considered in this paper, where students make use of the different media elements to represent information in their projects, suitably fulfills there requirements.

The multimedia-based Internet project

Today, Malaysia has taken on a firm step towards establishing an Information-rich society. With the setting up of the Multimedia SuperCorridor or the MSC, Malaysia will be linked electronically to the world. At the heart of the Multimedia SuperCorridor is the Multimedia University which was established in 1997 to provide multimedia and related courses of education with the setting up of the Faculty of Creative Multimedia (FCM).

The Internet is now a popular educational and informational medium for this Net generation (Tapscott, 1998). The course here is an Internet application course in the FCM in which students are taught to use specific web authoring tools, in this case, Macromedia Flash and Dreamweaver and then to make use of these tools to solve a problem related to the Web. Macromedia Flash is a very popular tool to create web animation. With Flash, web-sites that just contain text and graphics can be transformed into more dynamic and multimedia-capable web-sites (Franklin and Patton, 2000). Macromedia Dreamweaver is also an industry standard for creating web pages. It has a user-friendly interface and the user need not be an HTML expert to create exciting and dynamic web pages. (Crowder and Crowder, 2000).

One way to highlight this problem-solving experience is to introduce the building of a multimedia project in the curriculum. With such a project, students are encouraged to make use of the knowledge presented to them by the teacher, and represent them in a more meaningful way, using different media elements, harness their own abilities, use and appreciate media effectively, and properly represent the various pieces of information to convey a message to the audience. With multimedia technologies, they can create multimedia applications as part of their project requirements. This would make them active participants in their own learning process, instead of just being passive learners of the educational content. Courses that use multimedia for students' projects will inevitably give these students hands-on experience with the design of an application. They decide 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. The advantage of creating multimedia projects in the classroom environment is that when students create multimedia projects, they tend to do this in a group environment. By working in a group situation, the students will have to tap into their group skills and use a variety of activities to accomplish the project's overall objectives. They also have to use a suite of multimedia tools to develop the application.

By project completion, these students would have progressed into becoming more critical of their work, more creative with their ideas, and more active in achieving their learning goals. 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, thus supporting the Constructivist perspective of student learning.

In this paper, the core problem that the students need to address was to re-design a badly designed web-site on the Internet. Since most web-sites are becoming more multimedia-oriented, the students had to incorporate more than text and graphics into their web-sites to enhance them. This problem-solving project requires interdisciplinary skills involving multimedia technology and Internet design knowledge. In this project, the lecturer's main role was to provide lectures and tutorials on the understanding of the Internet and multimedia technology and on the basic skills in using the software packages as well as web-design. These lectures and tutorials are necessary to provide the students with pre-requisite knowledge that they have to use to complete their problem-based project. Once these lessons were completed, the project was assigned to them immediately in order to provide them with enough time to organise themselves and to motivate them to relate what was taught in class to what they would need to complete their final project.

The students were divided into groups of five by self-selection and had to collaborate with one another to complete this task. Each group also had to create a report that lists down the reasons for choosing a particular site as well as to design solutions or suggest improvements that they thought would greatly enhance the site without changing the content of the site. Then the group had to delegate the different areas of the project to each member according to what they saw as component tasks and to implement their suggestions. To complete the project, they had to use the prior knowledge that was taught to them about multimedia and Internet technology, design principles as well as the authoring techniques that were shown to them during their tutorials.

During the course of the project, students were allowed and even encouraged to go to the lecturer to ask for pointers on how to go about doing their projects. They could either make an appointment personally or as a group to see the lecturer or they could use the Internet to chat with the lecturer. Students also used the Internet to discuss the project among their group members. In this whole process, the teacher acted as the facilitator or guide to support the students' learning process and help them in their technical problems.

After completing the project, each group was required to give a brief presentation on their project to the entire class and to answer questions posed to them by the lecturer or the students themselves. By having them present their work, the students can authenticate their performances and their understanding of the project because they will have to provide explanation for their actions. Once the presentation was completed, each group had to turn in their work either on CD or Zip disks to the lecturer on time. Figure 1 shows a conceptual framework of the student problem-solving process.

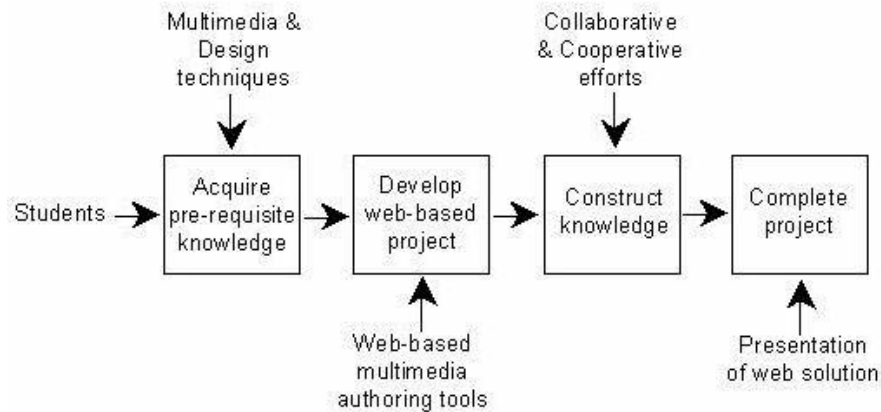


Figure 1 The student problem-solving process

The project was assessed based mainly on such criteria as the students' ability to identify the shortcomings of the web-site, their suggested improvements, their ability to work collaboratively and the creative and innovative uses of Dreamweaver and Flash. On the whole, the students' performance was of a credible standard having obtained mostly B grades and above in their projects. The results were satisfactory, although there were a few problems associated with meeting schedules, shifting of groupings and PC problems but the groups managed to complete their projects.

Students' showcase project

Figures 2 and 3 showcase one team of students' final project of the website (<http://www.automarket-place.com>).

Some weaknesses in the website:

1. The background colour distracts the viewer's eye.
2. The background is too simple
3. The typeface used is very boring and dull.
4. The font color used is not suitable for the background
5. The images are not inserted properly.
6. The images' links were broken.
7. The links didn't work.
8. Information for the link is not clear. It confuses the viewer.

Figure 2 The original website (Arrows denote web-pages from 2 links, "Collectables" and "Special Events", accessed from the site's homepage) and the weaknesses identified by the students



- Changes to be done to the website:**
1. Since it's about a car company, the background should be dynamic with various FORD car images manipulated in Adobe Photoshop.
 2. Different kinds of fonts should be used to differentiate the main title and the sub-title.
 3. Less bright colors should be used to prevent irritation to the eyes.
 4. The main title should be enlarged compared to the other titles.
 5. The links should be linked properly to specific pages.
 6. The image should be inserted properly into the space given.

Figure 3 The re-designed website with the same links and the students' suggested changes

Student evaluation

A survey questionnaire was given out to the students (N=102) to assess three constructs: Teamwork, problem-solving and critical thinking skills and their personal attitudes towards the project. The survey was measured using a 5-point Likert scale, with 1 for Strongly Disagree (SDA), 2 for Disagree, 3 for Undecided, 4 for Agree and 5 for Strongly Agree (SA). Overall, the students rated the project favourably with over 65% agreeing or strongly agreeing with many of the items on the survey. Table 4 illustrates the results obtained for the teamwork construct.

Table 4 Means and percentages of students for Teamwork items

Teamwork Items	Mean	%
1. I knew exactly what my part was in the team	3.91	83.2
2. Team better able to present using digital media	3.86	74.3
3. Able to work as a team	3.65	67.6
4. Able to learn more working with teammates	3.71	73.5
N = 102		

In terms of teamwork, the survey showed that students were able to work together as a group and learn from each other. Being able to identify their exact part on the team ranked the highest among the Teamwork items, with a mean of 3.91 and a response rate of 83.2%. Being able to use digital media for their presentation was important to them, with 74.3% of the students

responding with a mean of 3.86. They also enjoyed working together as a team and learning from each other, with 67.6% of them yielding a mean of 3.65 and 73.5% of them yielding a mean of 3.71, respectively. Figure 5 shows the histogram for the item "I knew exactly what my part was in the team."



Figure 5 Histogram shows percentage of students who rated favourably on a Teamwork item

In terms of harnessing their problem-solving and critical-thinking skills (see Table 6), students responded that the project encouraged their creativity (mean = 3.89, response rate = 82.4%), was challenging to them (mean = 3.79, response rate = 73.3%) and allowed them to have creative input in their collective work (mean = 3.79, response rate = 71.6%). The project also allowed them to develop critical thinking skills (mean = 3.77, response rate = 75.5), increased their understanding of the subject matter (means = 3.77 and 3.66, response rates = 75.5% and 65.4%). Figure 7 shows a histogram for one of their problem-solving responses.

Table 6 Results for Problem-solving and Critical-thinking items

Problem-solving & Critical-thinking items	Mean	%
1. Project allowed me to be creative in my thinking	3.89	82.4
2. I found the project challenging	3.79	73.3
3. I was able to have creative input	3.79	71.6
4. Project allowed me to think critically	3.77	75.5
5. Project enhanced understanding of the subject	3.77	75.5
6. I understood the subject matter better after the project dev	3.66	65.4
N = 102		

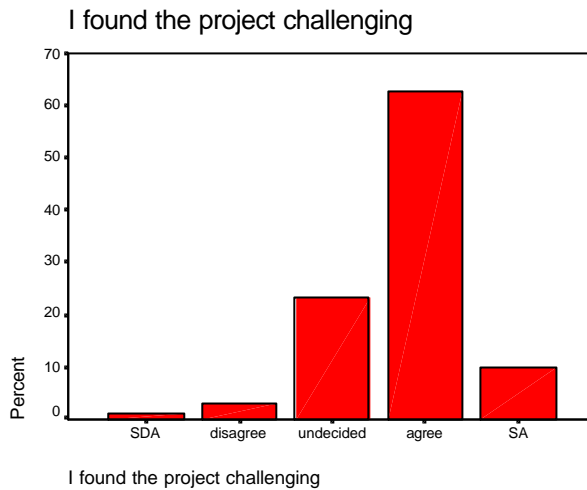


Figure 7 Histogram for students' problem-solving skills

And finally, the survey tried to gauge the students' personal attitudes towards working on the project (see Table 8). We found that 66.7% of the students looked forward to working on the project (mean = 3.71), 66.7% of them were motivated to do their project (mean = 3.65) and 64.7% of them were satisfied with their own contribution in the project (mean = 3.64). Figure 9 shows a histogram for students' response to an item measuring personal attitudes.

Table 8 Results for students' personal attitudes to project items

Personal Attitudes Items	Mean	%
1. Look forward to working on the project	3.71	66.7
2. Motivated doing project	3.65	66.7
3. Satisfied with own contribution in the project	3.64	64.7
N = 102		

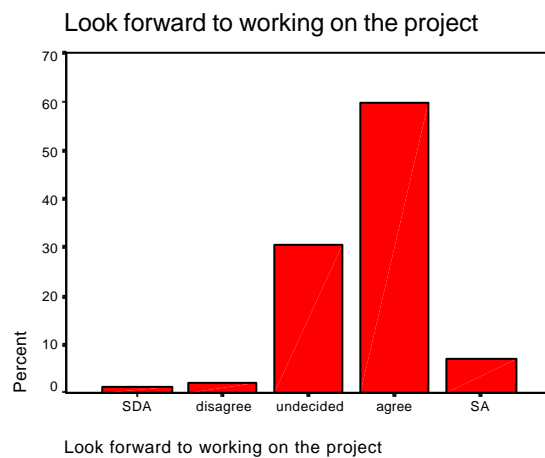


Figure 9 Histogram for students' personal attitudes towards the project

On-line interview and students' responses

The students were interviewed on-line on their reactions towards the project using the chat-room on the Internet. In general, the interview was positive and encouraging. The following are some of the comments presented by the students on the on-line survey (see Table 10).

Table 10 Students' comments

	Students' comments
1.	<i>"We were very enthusiastic about the project and found it very challenging working in a group environment in which we have to learn to share ideas and work collaboratively on a strategy, and cooperate with each other to successfully complete the project".</i>
2.	<i>"Not one man show", some commented. "Like playing basketball, all must work together", others said.</i>
3.	<i>" We have sufficient guidance and time to finish the assignment although we experienced some problems in scheduling meetings for discussions and difficulty in agreeing to the desired solution".</i>
4.	<i>" I found that in a project like this, a good and efficient group leader made life much easier, especially in distributing individual tasks to the members of a group".</i>
5.	<i>" I think the tasks should be given to the members according to each member's ability".</i>
6.	<i>" I think the tasks should be distributed equally".</i>
7.	<i>" I have learned a lot from the project. It was an authentic project very much related to real life experience".</i>
8.	<i>" We were able to understand the problem, work collaboratively and construct our own solutions to the problem".</i>
9.	<i>" This kind of project trains us to think critically and improve our problem-solving skills".</i>
10	<i>"We should have more of this kind of problem-solving training in the next semester", some commented.</i>

In general, the interview was well responded.

Discussion

From this study, we can observe the following student reactions:

1. Students found this method of learning challenging and interesting as evidenced by their enthusiasm in the project.
2. The students in general liked the problem-based project as in doing the project, students performed critical thinking by defining the problems of the site and to come up creatively with solutions to enhance the site on their own.

3. They enjoyed the problem-solving environment because it was an authentic problem and related to real-life experiences. They also learnt to work in a group and share ideas with their teammates and worked collaboratively to make the project a success. In other words, students learned to compromise in order to reach a consensus view in carrying out the project to a successful completion and, in the process, learnt from one another. However, they were some problems associated with teamwork, scheduling and cooperation among the group. Notwithstanding these problems, all the groups were able to complete their projects on time and, the overall performance was satisfactory.
4. Since the problem was authentic, students were able to draw from real-life experiences to complete the task.
5. By dividing them into groups, they learned to work together as a team and to learn from one another. Through this collaborative learning, they helped motivate one another and worked as team players to share ideas through inquiry and dialogue to improve their thinking and social skills. This experience will help them in their career later.
6. The teacher helped, guided and supported students' learning but did not direct instruction and became a member of the learning community.

The education challenge for Malaysian educators

The incorporation of ICT and multimedia into the instructional methodology and delivery systems in education will enhance the teaching and learning process and empower the educational institutions to meet rising expectations, but it will also present a serious challenge to all educators in Malaysia, particularly in higher education.

The use of ICT and multimedia is garnering tremendous support from the Government who believe that "technology supports learning. It will enable teachers to pursue traditional goals with new fervour and success" and that "the use of modern technology in beefing up the delivery of learning materials in our education system must reflect the changing times. Our students must be versatile to these challenges in technology, and our teachers must be proactive to the new requirements." There is a need to "devise curriculum so that the culture of 'learning to learn' and lifelong learning can be rapidly inculcated into the students. The learning contents must foster the skill to seek information, think critically, use the information and communicate effectively and work in a team." (Mat, 2000)

There is already a move to create multimedia courseware in educational institutions. In the smart schools, the curriculum is being revised to include multimedia materials to enhance the teaching and learning environments. These multimedia materials focus on the total development of the student and self-accessed and self-directed learning.

Thus, with multimedia and multimedia technologies permeating the educational arena with such fervour, it is no wonder that we as educators at higher institutions of learning are facing a great challenge: To integrate these multimedia technologies into the classroom to enhance the teaching and learning environments for both the teacher and the students.

However, this poses a serious challenge to the Malaysian educators: To be able to do this seamlessly, three requirements must be satisfied. The first is to make the hardware available to the educators. In other words, MPCs (multimedia PCs) must be made available to the teachers. The second is to make the software for multimedia application creation available to these educators for the development of their multimedia materials. The third requirement is to bridge the gap between technology and education, and empower the teachers with the skills to use the technology effectively to create their multimedia materials and applications.

In terms of the first two requirements, it is being addressed and implemented, with many of the higher learning institutions purchasing computers and multimedia authoring software for their computer labs and equipping the teachers with computers and software in their own offices. However, with regards to the third requirement, therein lies the biggest challenge. As educators, there must be some training provided or acquired for teachers to be able to equip themselves with the proper skills for interactive multimedia creation. With the authoring tools in the market being user-friendly and manufactured specifically for non-programmers, educators need only be trained to be able to effectively use these tools for their electronic content.

In short, we are seeing trends emerging which strongly indicate that digital teaching and learning will gain ground in our institutions of higher learning.

Conclusion

The evolution of multimedia has made it very possible for learners to become involved in their work. 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.

This multimedia web-based project was chosen because it allows the students to perform critical thinking by defining the problems of the site and to come up with creative solutions to enhance the site on their own. Also, since the problem is an authentic and Internet-related problem, the students are highly motivated and able to draw from real-life experiences to complete the task. This project is a self-directed learning experience in which the students participated actively in their own learning process and determine their own

learning outcomes rather than being passive receivers of knowledge or information imparted to them by the teachers. In the process, they learned to apply what they have learned previously to the project in a cooperative and collaborative manner, foster their critical thinking and problem-solving skill, an experience that enriches and enhances their learning process.

In summary, problem-solving project engages students actively in participating in their own learning, unlike the teacher-centred mode, where students are passively receiving knowledge from the teacher, They are responsible for their own learning, constructing new knowledge based on their experiences. In this problem-solving project, students examined and analysed the design problem, researched the project, proposed possible solutions, developed proposals and produced the final solution to the problem. Students became self-directed learners as they seek actively to achieve their own learning outcomes. This project is not only stimulating and challenging to the students, but also deepen students' understanding of the coursework since the students found the information themselves and then applied the information to solve the problems. Therefore, this project enables students to build their problem-solving and collaborative skills as well as creative and critical thinking abilities in order to meet the demands of the 21st century organisations.

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