Interactive multimedia education: Using Authorware as an instructional tool to enhance teaching and learning in the Malaysian classroom

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Abstract

The infusion of multimedia technology into the teaching and learning process is changing the way teachers teach and students learn. It is providing powerful tools for accessing, storing and disseminating information and re-shaping the delivery methodology of our educational content. This paper discusses the use of multimedia as an enabler for educators to become developers of their educational content, focussing on the creation of an interactive multimedia learning (IML) module using Authorware. A survey was carried out to assess students' response toward the module. Results showed a favourable trend towards using authoring technology in the classroom.

Keywords

Authorware, interactive multimedia, education technology

Introduction

As educators in this digital age, our boundaries for teaching have been expanded and blurred to the point that we not only have to be proficiently knowledgeable in the field(s) we are teaching, but also need to be skilled in the technologies that are being used to convey the educational information and content. The permeation of media elements into the teaching and learning environments has motivated educators to becoming more technology-oriented. The teacher, in other words, not only has to be a content expert, but also a multimedia developer. This infusion of technology into the teaching and learning process is changing the way teachers teach and students learn. It is indeed re-shaping the development of educational content and changing the fundamental concept of learning.

The issue that surrounds many educators is the need to use multimedia in their lesson plans and curricula. There is a need to adjust the educator's approach to teaching, preparing contents and

delivering materials. The more technologically innovative we can deliver the information to students, the better their retention and attention levels will be. As the next generation becomes familiar with computers and the Internet, they are going to expect information in the classrooms to follow the same pattern (Tapscott 1998).

The biggest advantage of using authoring packages to create multimedia educational content is that interactivity can be incorporated into the content. Interactivity, in fact, is the heart and soul of multimedia and allows the user to interact with the computer. A key feature in interactivity is that " it empowers the end-users of the application by letting them control the content and flow of information"(Vaughan, 1998). In other words, interactivity permits the user to navigate and explore the application at his or her own pace. This is an important feature especially in a learning courseware in which a learner can view and study at his or her own speed and skill level and control the pace of learning.

This paper discusses the use of multimedia as an enabler for educators to become developers of their educational content which can be translated into interactive electronic form through the use of an authoring tool. Here, we focus on the creation of an interactive multimedia learning (IML) module using Macromedia Authorware. Multimedia technology is gradually becoming a new emerging trend in the communication of educational information and increasingly altering the landscape in tertiary education. It is gaining popularity as an effective platform for enhancing the teaching and learning process and changing the fundamental concept of learning.

Using multimedia in teaching and learning

With interactive multimedia becoming integral in many industries, the education field is also evolving to create electronic multimedia materials, as "multimedia offers an excellent alternative to traditional teaching. By allowing students to explore and learn at different paces, every student has the opportunity to learn at his or her full potential." (Tway 1994).   Thus, by integrating the digital PC and multimedia technologies into the teaching and learning process, a new paradigm is created, and this has a great impact on our traditional method of delivering educational content today. New modes in teaching and learning are generated, thus giving rise to innovative ways to deliver instructional materials to the learners. Furthermore, the advent of the Internet and the World Wide Web (WWW), which is a global network, in the mid-90s, will extensively widen our scope of learning into a global perspective and connect our learners to educational resources and

information worldwide, which were hitherto not accessible by them.

Figure 1   The traditional ICP

In the traditional teaching and learning process, a single media (text) is used as the instructional media and the presentation of the educational content or the instructional communication process (ICP) is in a linear fashion (see Figure 1). This model is based on the communication of

information from the source (or sender) to the receiver via a delivery or transmission medium to deliver the information.

In the pre-technology education context, the teacher is the sender or the source, his or her educational material is the information or message, and the student is the receiver of the information. In terms of the delivery medium, the educator can deliver the message via the "chalk and talk" method and overhead projector (OHP) and transparencies.

With the introduction of technology, specifically multimedia technology, into the classroom environment, the delivery of the information becomes a new phenomenon. The use of technology and multimedia will clearly reinforce and strengthen the traditional ICP and change the roles of the instructors and students. Now, the teacher becomes the director of the knowledge-access process and will make a difference in the integration of the media into this process. The ICP now involves the selection of the information, the arrangement and the delivery of it in an appropriate environment. This process would also cultivate some interaction between the student and the information itself, making the learning process more effective for the student. The educational content is still the information or message to be delivered by the teacher (the sender) to the student (receiver), but now, the type of instructional media or educational content used would be computer-based interactive multimedia. These instructional materials can be delivered in a multimodal environment using the multimedia elements and interactivity. Navigational links can be added to the instructional content to enable the student to interact and to move around the content with ease in the way he/she likes best. Thus the student can control the pace of learning suitable to his/her skill level. The presentation can take place in a non-linear fashion, thus enabling the student to foster a two-way communications between the user and the computer. The teacher can now use the various combinations of media elements to create interactive educational content. The result is a stimulating environment for learning and retaining the information (Roblyer and Edwards, 2000).

The interactive multimedia materials that are created can then be delivered to the students in various methods. Some of these methods range from demonstrations and presentations, drills and practices, and tutorials, which are more teacher-centred methods of teaching and learning, to cooperative and collaborative learning, problem-solving and Web-based learning, which are more student-centred methods of teaching and learning (Newby, Stepich, Lehman, and Russell, 2000). Figure 2 illustrates the reinforced ICP and the various teaching and learning methods.

**Figure 2 The enhanced ICP and content delivery methods**

Teacher-centred learning

As we are all familiar, the traditional way of teaching and learning is the chalk-and-talk or the OHP (Overhead Projector) and transparencies method and the instructional media used is textual (printed books). This method of teaching is the directed instruction model which has its foundations embedded in the behavioural learning perspective (Skinner, 1938) and it is a popular technique, which has been used for decades as an educational strategy in our institutions of learning. Basically, the teacher controls the instructional process, the content is delivered to the entire class and the teacher tends to emphasize factual knowledge. In other words, the teacher delivers the lecture content and the students obediently listen to the lecture.

Thus, the teacher is the one in control of the information that is received by the students and is responsible for how much information or content to be disseminated to them. Consequently, the learning mode tends to be passive and the learners play little part in their learning process (Orlich, Harder, Callahan and Gibson, 1998). These teacher-centred methods include presentations, demonstrations, drills and practices and tutorials to process the information. Multimedia courseware can be packaged on the CD-ROM and delivered in a networked classroom leading to a teacher-centric mode where the courseware is opened on their PCs and the students follow the teacher's lecture on their PCs.

Student-centred learning mode

In the student-centred methods, students must play an active part in their learning and must construct their own knowledge and bring their authentic experiences into the learning process with the teacher as the facilitator (Jonassen, Peck and Wilson, 1999; Jonassen 1994; Duffy & Jonassen 1991). In this case, the multimedia material can be used to foster team processing and active learning as with collaborative and cooperative methods, encourage higher-level learning skills and increase comprehension and retention rates, as in the case of using problem-solving
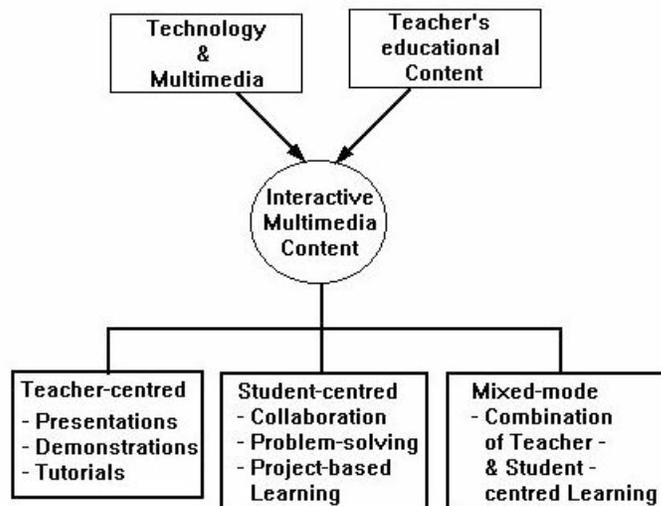
methodologies (Neo & Neo, 2001).In the process, learners determine how to reach the desired learning outcomes themselves. This learning mode is embedded in the constructivist learning

philosophy (Piaget, 1952; Bruner, 1985) which has evolved over the last half of the 20th century and has its foundations in cognitive learning psychology. In this constructivist model, learners must construct their own meaning of what they learn, and learning builds on what learners have already constructed in other contexts. The teacher, in this case, is no longer perceived as the sole authority of learning, but rather, as the person to facilitate learning, guiding and supporting learners' own construction of knowledge (Orlich et al,1998).

The multimedia courseware content can also be packaged as a Web file and delivered on the Internet in a Web browser as online courses where the students access the courseware from a browser on their PCs. The student is then free to engage in learning on his or her own time, and consequently, the learning mode is student-centric. This multimedia material can be used to foster team-processing and active learning as with collaborative and cooperative methods, encourage higher-level learning and increase comprehension and retention rates, and focus on the total development of the student and self-accessed and self-directed learning.

Hybrid -mode learning environment

Another approach is the hybrid mode which combines the two previous approaches and posits that the teacher can use a variety of methods in the instructional situation (Newby et al, 2000). In fact, the teacher has the flexibility to incorporate the two teaching and learning approaches and use whichever method he or she deems useful to increase and enhance the students' learning processes. In this case, the same multimedia courseware content can also be packaged and delivered over satellite and broadband technologies for distance learning. Here, the student learns the materials on his or her own time, and interacts with the teacher via video-conferencing in real-time.

Designing an interactive multimedia learning (IML) module using Authorware

In creating the multimedia learning module, the teacher must (a) select the authoring tool and (b) use the interactive multimedia learning (IML) module development process.

(a) Selecting the authoring tool - Macromedia Authorware

Prior to constructing the learning application, the developer or the teacher, who will be designing the application, will have to decide what type of authoring tool to use. In this paper, Authorware is chosen as the authoring tool to develop the learning application. Macromedia Authorware is a very popular tool for creating interactive content. It has now become a tool for educators and trainers to create electronic learning applications deployed through the Web or on CD-ROMs (Johns, 1999; Kachian & Wieser, 1999). "Authorware is rooted in some pretty powerful technology. Its sophisticated judging, sequencing and instructional management facility builds upon two decades of work by Authorware founder Mike Allen on a computer-assisted instruction system called PLATO" (Hofstetter, 1995). Authorware provides a very flexible and versatile feature whereby applications created in other popular authoring software packages such as Director and Flash, can be imported directly into the Authorware application and thus embedded

as part of the Authorware application. In addition, Authorware applications can also be made web-enabled for those wanting to put interactive modules on the Internet or Intranet.

 Authorware has adapted and applied the flowchart method of the traditional presentation method as its philosophy, and can be used by developers with no computer programming skills. Authorware allows the author to integrate the various multimedia elements into a seamless application. It can be used effectively to create a digital multimedia lecture, which is interactive and has navigational features that empower the users with the control of the content and flow of information. It provides a two-way communication or interaction between the user and the computer and a two-way communication or interaction with the application itself thus enabling the user to explore and learn at his/her own pace.

Authorware is an icon-based authoring tool as it uses various icons to represent the different media elements. These icons can be sequenced and synchronised on a flowline according to the creator's needs to effectively convey information to the user. In addition, these icons can be used to create highly interactive content used for teaching and learning purposes. A very important aspect of a learning application is its interactivity characteristic.   When creating learning applications, the level of interactivity included will enhance the user's knowledge in the subject matter. In that context, Authorware's interactive features are housed in the Interaction icon, which is the icon that provides the interactive functions in the final multimedia application.

(b) The interactive multimedia learning (IML) module development process

The IML module content showcased in this paper utilised Authorware's multimedia and interactive features. The content was based on a class lecture entitled, "Digital sound: A multimedia building block". Table 3 describes the principal procedures used in the IML module creating (Neo & Neo, 1999).

Table 3 The procedures used in creating the IML module

Steps	Description
1: Assemble the content	Gather and organise media for content
2: Digitising media	Convert analogue materials to digital form
3: Editing the media files	Modify and edit media files using helper applications
4: Author the application	Import, organise and synchronise media, and add interactive features
5: Incorporating interactivity	Create user-friendly navigational controls and interactive functions
6: Delivering the application	Packaging the final application into a standalone or web application to be viewed by user

Step 1 - Assembling Content

In Step 1, once the authoring tool has been selected, the educational content and media for the module are then assembled. Here, the content is the lecture material. The lecturer decides on the types of media that are deemed suitable to convey his or her objectives in the learning

application. When these various media elements are gathered and organized properly, the lecturer can proceed to develop the module.

Step 2 - Digitisation process

The media files that have been assembled are usually in two different formats, analogue and digital. For those that are already in digital format, no conversion is necessary as they can be read and processed by the PC directly. However, for those media that are still in the analogue format, a digitising process must take place first before they can be input and processed by the computer. This applies to all multimedia files. The higher the quality the author selects the media files particularly the audio and video files, the larger the storage size of the file will be. However, normally, when authoring interactive multimedia applications for the PC, it is necessary to ensure that the various file sizes are manageable or else it may make the learning module difficult to play back later.

Step 3 - Editing process

Step 3 involves the editing or modification of the digital media files. In this phase, various third-party helper applications are used, which are geared towards the editing process. For example, Adobe Photoshop is used to edit images or digital photos. For drawing and creating customised graphics, Corel Draw, Macromedia Freehand and Adobe Illustrator can be used. To edit sound files, popular sound editing tools such as Sonic Foundry's Sound Forge can be used to cut out or add part of an audio sequence. Sound effects can be created by using a small portion of a larger sound file, different sounds can be merged, background music can be created, sound effects can be added and so on as part of the process of editing sound. Video editing tools are also needed if customised video is to be used in an application. The advantage of using video editing software is that video can be edited non-linearly. A popular non-linear editing package is Adobe Premiere. As for animation, Authorware provides simple animation features. For more complex sequences, third party animation software need to be used. Popular animation software packages include tools like Macromedia Director and Flash, which are also authoring tools in their own right.

Step 4 - Authoring process

Step 4 involves the authoring process. The authoring stage is the most important stage in the development process, and is influenced by the choice of authoring tool made earlier. Once all these media have been assembled, digitised and edited, it is ready to be sequenced and integrated together which will result in a seamless multimedia application. To integrate the different media types, the author will have to use the different icons provided by Authorware and sequence them appropriately, according to the author's discretion. Authorware uses a flow line as its method of sequencing the different media. Therefore, all the user needs to do is to select the appropriate icon from the package's icon palette and drag and drop the icon onto the flow line. These icons can then be arranged in whatever order the author decides. In addition, the author can add interactivity.

Step 5- Adding interactivity

Adding interactivity is the core function of the authoring process and is the crux of the success of the multimedia application. The ability to incorporate interactive features into the final application is of utmost importance in an authoring tool. Interactivity has also been found to increase retention and comprehension rates among users. "People only remember 15% of what they hear and 25% of what they see but they remember over 60% of what they interact with"

(Wolfgram, 1994). Therefore, if the information is to be presented in a multimedia environment, where the aural and visual senses are stimulated, then involving the user in the application's experience will only enhance their retention of the information displayed.

User interactivity comes in the form of using navigational controls. Thus, it takes the form of buttons or hot spots or hypertext or hypermedia links.   The most important goal for adding interactivity is to provide the user with the choice to decide where to explore first within the application at his or her own pace. Adding interactivity that is too complex and complicated may not necessarily be a good thing. The reason is because any interactivity that is added into the
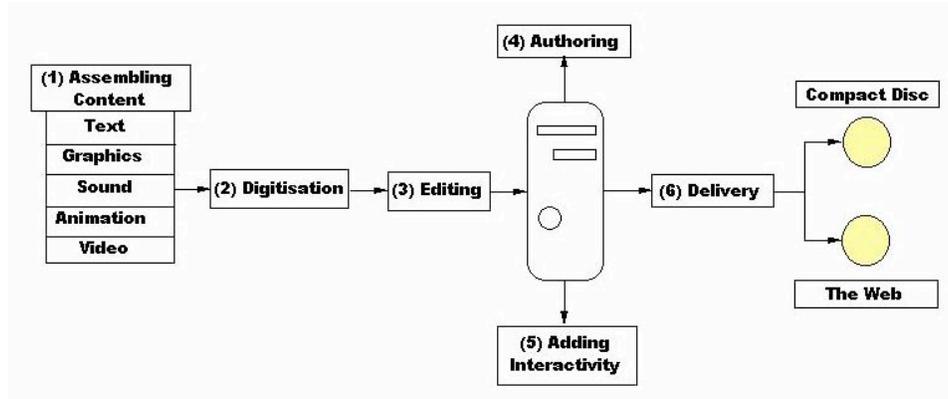
application should enhance the communication of the content and the user should not be bogged down with multiple levels of interactivity. If it takes too long or there are too many layers before the user can get to the wanted information, the user will lose interest in the topic. In other words, allow the user to go direct to the content if necessary.
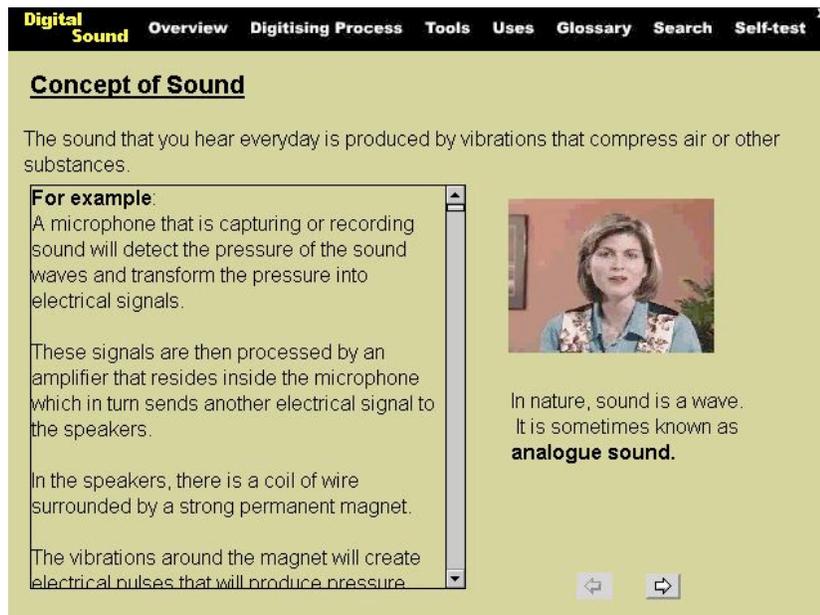
Step 6 - Delivery

Step 6 involves delivering the final application in a standalone format to the end-user or the student. Packaging of the application will very much depend on the delivery system of the application.   The most common is on a CD. This type of delivery system can store up to 650 MBs.The CD-ROM can be used as a lecture module in a directed instruction mode or by students as a self-paced, student-centric learning module to revise his or her work and further strengthen his or her understanding of the subject matter. Another way is to package the learning application as a Web-enabled module, or "shocked" for the Web, to be delivered and viewed in the Web environment for a more asynchronous, student-centric learning mode. Both the EXE and the "shocked" module can also be delivered over a synchronous learning networked environment for a more teacher-centric mode of teaching and learning. The choice of the teaching and learning mode will depend on the instructor, as the final IML module can be delivered in different learning environments (see Figure 4).

Figure 4A schematic diagram of the IML module development process and delivery

The learning module

The following diagrams (Figures 5 (a), (b), and (c)) depict some screenshots of the multimedia learning module entitled, "Digital sound: A multimedia building block." This module was delivered to second year students in a multimedia course in the Faculty of Creative Multimedia in the various teaching modes, i.e., teacher-centric, student-centric and mixed mode.

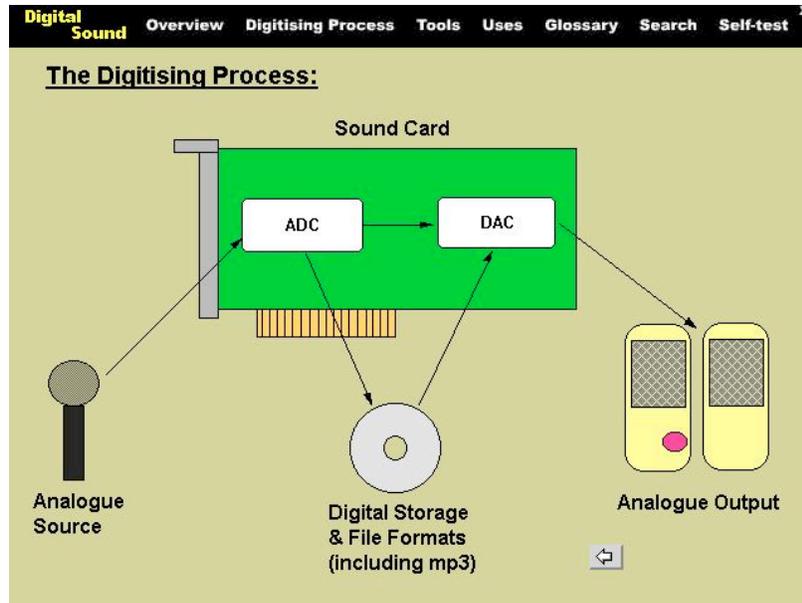**Figure 5 (a) : Students will study the concept of sound and see a digital video clip explaining the topic in detail**

Figure 5 (b): A diagram of the digitisation process is displayed to give the students a visual idea of the concept

Figure 5 (c): Students can experiment with different sound fidelities by clicking on the different interactive option buttons in each box. After choosing their sampling rate, sample size and number of channels, they can click the PLAY button to hear an example of the sound with the options they had chosen. This allows them to experience first-hand the various fidelities of sound.

Students' repsonses

A survey was also carried out among the students (N=53) to assess their attitudes and reactions to these methods. The survey was measured in a 5-point Likert scale (1= Strongly Disagree, 5= Strongly Agree). In particular, the students were asked to respond to questions that included 1) what they thought of the use of technology in teaching, 2) how appropriate was the use of media in explaining concepts, 3) whether they found the lecture module stimulating, 4) whether the information presented was clear and concise, 5) whether the interface of the module was easy to understand, and 6) whether they were satisfied with the amount of information received.

Results showed that 88.6% of the students were very favourable towards the use of technology in teaching (mean = 4.42), 88.7% found the use of media appropriate in explaining concepts (mean = 4.3), 84.9% found the lecture module very stimulating (mean = 4.11), 88.7% found the information presented clear and concise (mean = 4.19), 90.6% found the module's interface easy to understand (mean = 4.23), and 83.1% were satisfied with the amount of information received in the module (mean = 4.02). Table 6 illustrates these results.

Table 6 Mean and percentages of survey results (N=53)

	Mean	% students
1. Prefer technology-based teaching	4.42	88.6
2. Use of media appropriate	4.3	88.7
3. Found lecture very stimulating	4.11	84.9
4. Information presented was clear and concise	4.19	88.7
5. Interface of the module easy to understand	4.23	90.6
6. Satisfied with the amount of information received	4.02	83.1

Figures 7 (a) and (b) illustrate the percentage responses of students to two of the items on the survey.
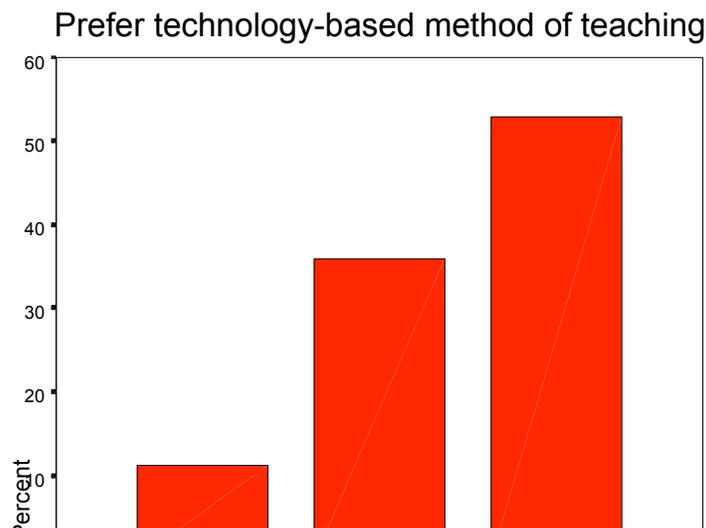
(a)

Prefer technology-based method of teaching

Figure 7 (a) and (b): Percentage responses on two items on the survey

Discussion

Five significant factors have emerged with the integration of multimedia into the teaching and learning process:

1) It has changed the fundamental concept of learning. The students are no longer passive learners, i.e., passively absorbing the information from the teachers, but can actively participate in their own learning process.

2) With multimedia, the teachers now have more options to represent their educational content using a combination of media rather than just text only. That means that their content can now be interactive and media-rich.

3) In the survey, 88.7% of the students (with a mean of 4.3) liked the use of media in explaining concepts. This is in conjunction with Tapscott's (1998) position that the new generation looks to using digital media in their learning process.

4) The teachers can now strengthen their instructional strategies and methods of communicating content to the learners, thus enhancing the teaching and learning environment.

5) The learners preferred technology-based teaching (88.6% with a mean of 4.42). This could be due to the innovativeness of the method of teaching coupled with the fact that these students belong to the PC generation and find using computers and technology-based instruction a more effective and innovative way to learn.

In effect, this infusion of multimedia technology into the teaching and learning process has generated a new paradigm in education and changing the way teachers teach and students learn. And its impact on learning is far-reaching.

The education challenge

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 also presents a serious challenge to all educators, particularly in tertiary education.

The use of ICT and multimedia is garnering tremendous support from the Government in Malaysia. As stated by Mat (2000), the Secretary- General of the Malaysian Ministry of Education, " Technology supports learning. It will enable teachers to pursue traditional goals with new fervour and success. 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." There is already a move to create multimedia courseware in Malaysian 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. It is vital therefore for students and teachers alike to exploit the full potential of multimedia so that the learning environment becomes more productive and efficient.

Thus, with multimedia and multimedia technologies permeating the educational arena with such fervour, it is posing a tremendous challenge to educators in the higher institutions of learning to integrate these multimedia technologies into the classroom to enhance the teaching and learning environments.

To face this challenge effectively, there must be three requirements. 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 or a technology centre should be instituted to provide the technological resources and support as required. 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 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.

Conclusion

In summary, we see that learning with multimedia technology has introduced an important paradigm shift in education that will have a very important impact on our educational system and the way teachers teach and students learn. The trends strongly indicate that digital teaching and learning will gain ground in the Malaysian institutions of higher learning and multimedia will emerge as an effective platform for teaching and learning in the classroom.
The changing role of teaching and learning is inevitable with the introduction of multimedia technologies in the educational field and the spawning of a technological savvy generation of youths. Information is being exchanged in a digital mode, and the educational curriculum is evolving to incorporate multimedia elements and interactive features that create a better teaching and learning environment for the students as well as the teachers. The future trend in educational methodology and strategy is towards integrating technology into the classroom.

The interactive module presented here displayed several characteristics that would make it a more effective way to teach and learn, such as the following:

It is a visually-based module which allows the user to see the concepts presented in a more graphical manner

It contains materials that allow students to view them at their own pace

It contains features that allow the students to control and be responsible for the information acquired

In this context, multimedia can be used as the strategic instructional medium for teaching and learning in our education system. Incorporating multimedia into the classroom has become a global trend, and in recent years, many institutions of higher learning in Malaysia are incorporating multimedia into their educational curricula.

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