

Developing Instructional Multimedia Module Incorporating Gagne's Nine Events of Instruction

Ms. Rasna Solanki*

*Assistant Professor, Sunrise College of Education, Maharishi Dayanand University, Rohtak.

Abstract

In recent years, many institutions of school education system in India especially metropolitans are incorporating multimedia technology into the classroom to enhance the teaching and learning process. In this paper, the researcher focus on the process in which an Instructional Multimedia Module (IMM) was created. It is integrated with multimedia elements such as graphics, audio and video to make it more attractive to be used by students in their learning process. This learning module was based on Gagne's nine events of instruction for the topic 'Reproduction' chosen after having Focus Group Discussion with X & XI class students.

Key words:- Multimedia, Instruction, ICT, Module

1. Introduction

In the face of rapid technology advancement, educators in this age of digital information and technology not only have to be proficiently knowledgeable in the field(s) that they are teaching, but must also be skilled in the technologies that are being used to convey the educational content. As a result, in the educational arena today, there is an emerging breed of technologically proficient educators who are using the Information and Communication Technology (ICT) to create a better teaching and learning environment. It is fast gaining popularity as a powerful instructional tool for disseminating knowledge and information to the learners. Multimedia allows the incorporation of animation, moving pictures, and sound into lessons, which extends our abilities to present materials that encourage student interaction with the subject matter. Pictures and animations help bring to life scientific facts and processes, and multimedia allows students to take a more active role in learning: they can watch experiments in action, see microorganisms up close, and use a mouse

or keyboard to navigate images, simulations and interactive material. Ideally, what teacher's needs is a single system that integrates text, images, simulations, video, audio and other multimedia material into a single, coherent environment that is available from school or home. The solution is multimedia modules. These modules make it possible for you to reach out to students and allow them to view engaging presentations repeatedly. These modules also offer original photographs, scientific illustrations, animations, educational videos, audio recordings, interactive quizzes, and ask-a-question areas through a series of external hyperlinks.

Presentations that incorporate sound and graphics allow all students, especially those with learning difficulties, to better understand concepts even before reading the text of a lesson. Since it is difficult to create an entire separate curriculum that incorporates images and sounds in addition to text as is often recommended for learning disabled students, multimedia helps teachers to incorporate sounds, graphics and videos into an existing presentation without a

large time investment. Students can repeatedly view the modules at home, which reinforce the information presented in class (Dimitriadi, 2001). The classroom is no more a static physical set-up, but a rather dynamic existence. Teachers should be able to integrate technology in their process of teaching and learning. It will enable teachers to pursue traditional goals with new fervor and success. This impact of technology will give a new dimension to the quality of our education system.

In this paper, researcher focus on integrating multimedia technology into the teaching and learning process by creating an instructional multimedia module (IMM) with a media-rich environment which can be deployed through CD-ROMs. In this respect, the researcher assumes the role of a multimedia developer and creates his/her own multimedia learning module using Gagne's nine events of instruction as basis for module development.

2. Integrating Multimedia in Education

Incorporating multimedia technology into the classroom has become a global trend, and in recent years, institutions world over are incorporating multimedia into their educational curricula to enhance the teaching and learning process (Johns, 1999; Kachian & Wieser, 1999, Kamsah, Mokhtar, Ahmad, & Yaakob, 2000). Multimedia is changing the way we communicate with each other. The way we send and receive messages is more effectively done and better comprehended. The inclusion of media elements reinforces the message and the delivery, which leads to a better learning and teaching environment. The power of multimedia lies in the fact that it is multi-sensory, stimulating the many senses of the audience, which consequently leads to better attention and retention rates. In other words, multimedia provides "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" (Agnew, Kellerman and Meyer, 1996). However, multimedia is now penetrating the education field and changing the way teachers teach and students learn. With the advent of multimedia and technology in the classrooms, teachers can equip themselves with these technological skills and become better communicators of their content materials, and thus enabling the students to learn in a more productive way. As stated by Lindstrom (1994), "Multimedia provides a means to supplement a presenter's efforts to garner attention, increase retention, improve comprehension, and to bring an audience into agreement." In light of this, educators can thus take advantage of the multi-sensory environment created by the multiple digital media elements to create multimedia education materials that would not only stimulate a variety of senses from the audience, but also elicit high attention and retention rates from them.

3. Multimedia Authoring Tools

An authoring tool is a software package that allows the author to develop interactive multimedia applications. There are many different types of authoring tool in the market today. They range from the simple slide-based tools to sophisticated software packages. Software packages that are classified under slide-based authoring tools include software packages such as Microsoft PowerPoint, Gold Disk's Astound, Macromedia Action and Lotus Freelance, just to mention a few.

In this paper, Microsoft power point with adobe was chosen as the primary authoring tool to create the IMM module. One of the reasons why this Authorware was picked is because the software is most suited to converting educational materials into interactive content. When creating a learning application, an important aspect is its interactive features as the level of interactivity included will enhance the user's knowledge in

the subject matter. In this context, this Authorware provides many functions for creating such interactive features. Microsoft PowerPoint is a powerful and ubiquitous tool for presenting visual information. The features of PowerPoint that make it an ideal tool for presentations also make it well suited for the development of multimedia learning objects. The ability to add text, images, and multimedia assets combined with built-in narration are sufficient enough features to author high-quality learning objects. Adding narration to PowerPoint is a great way to enhance a presentation. The addition of audio narration to a presentation benefits both the students and the instructor. Students benefit by having immediate access to expanded explanations of slides allowing them to review material at their own pace, such as for pre and post session review. The narrated resource can also be distributed, reused and even submitted to online repositories for peer review. (as cited in Rapid Development of Multimedia Learning Objects Amy Allcock, Lewis Tomalty, Benjamin Chen School of Medicine - Queen's University)

4. Interactivity in IMM

Interactivity allows the user to navigate and explore the application at his or her own pace. With navigational controls such as buttons, hot spots, and others, the user is able to hyperlink to different parts of the application very easily and at his or her own choice. Studies have shown

that interactivity raised the comprehension and retention rates of the audience to about 75%, compared to the 40% rate from what they see and hear, and the 20% rate from what they see only (Lindstrom, 1994). In IMM, the student can navigate through the content of the application in a non-linear fashion, accessing glossaries and jumping to different pages at any time, and not losing his or her place in the application.

5. Building IMM Module: The Development Process

The interactive multimedia content showcased in this paper utilised Authorware's multimedia and interactive features. The content design for the module is based on Gagne's nine events of instruction. The task was undertaken by using the multimedia authoring process (MAP) (Neo & Neo, 1998) which is a 3-stage procedure used in developing a multimedia application. The three stages are:

1. Pre-authoring
2. Authoring process, and
3. Post-authoring

5.1 The Pre-Authoring Stage

As depicted in Figure 1, the pre-authoring stage consists of creating a storyboard or plan of action for the creation of the final application and involves the assembly of media elements needed for the application. These elements can be in

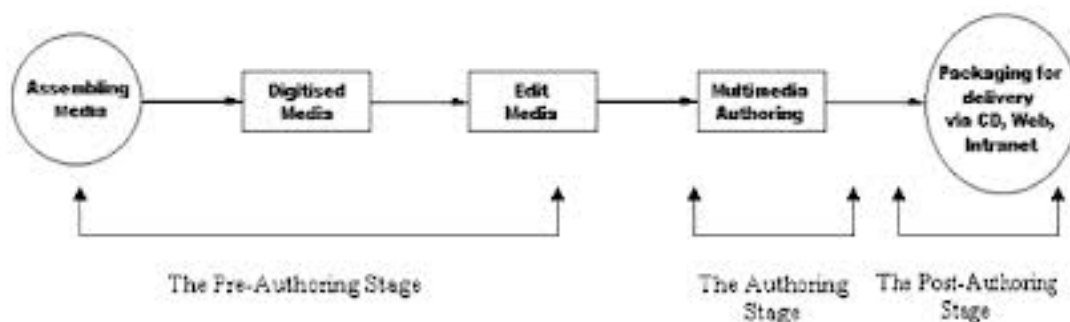


Fig. 1 : Stages of IMM Module

(Source: ascillite.org.au)

analogue or digital format at this stage. The objective in this stage is to acquire as many media elements as possible for the authoring stage. Once the media has been selected and assembled, they can then be edited. Analogue materials will be converted into digital files accordingly. Third-party software such as Adobe Photoshop, Macromedia FreeHand, Adobe Premier, Macromedia Sound Forge and Macromedia Flash can be used to further edit and modify these digital files to customize them for the final application.

5.2 The Authoring Stage

This is the stage where all the media are integrated and synchronized according to the application's storyboard. Here is where the developer would make a decision on the choice of authoring tool to use. Once the tool has been chosen, all the media are imported into the programme and arranged accordingly. This stage is important because it not only involved the

integration of all the media elements acquired earlier, but also now, the developer can add interactivity and navigation into the final application. The addition of the interactive features and a navigational structure will allow two-way communication between the user and the application and enhance its effectiveness in the retention and recall of information. Author ware uses a flow line as its method of sequencing the different media. Once the final application is completed, it can then be packaged as either a standalone application or as a Web-enabled application.

5.3 The Post-Authoring Stage

These packaged files can then be appropriately distributed to the end-user. Currently, the two most popular ways to distribute multimedia applications is via the CD-ROMs or the Web. Either way, the authoring tool of choice, should have the features to package the final interactive multimedia application as an exe file for the CD-

Table 5.1: Gagne's Nine Events & Related Cognitive Process

Instructional Event	Relation to Learning Process
Gaining attention	<i>Reception</i> of patterns of neural impulses
Informing the learner of the objective	Activating a process of <i>executive control</i>
Stimulating recall of prerequisite learned capabilities	<i>Retrieval</i> of prior learning to working memory
Presenting the stimulus material	Emphasizing features for <i>selective perception</i>
Providing learning guidance	<i>Semantic encoding</i> ; cues for retrieval
Eliciting performance	Activating response <i>organization</i>
Providing feedback about performance correctness	Establishing <i>reinforcement</i>
Assessing the performance	Activating <i>retrieval</i> ; making reinforcement possible
Enhancing retention and transfer	Providing cues and strategies for <i>retrieval</i>

(Source: Gagne et al., 2005, p. 195)

ROM or, as in Author ware's case, a Shockwave file for Internet and Intranet distribution.

During pre-authoring stage, when instructor wants to design a storyboard for the topic one should be very much particular for maximizing the effectiveness, efficiency and appeal of instruction and other learning experiences. For this, one should follow Instructional System Design, the process consisting broadly of determining the current status and needs of learner, defining end goals of instruction, creating some interventions to assist in the transition. Various instructional strategies should also be used to reduce extraneous cognitive load and promote germane cognitive load.

In this study, researcher has used Gagne's nine events of instruction to design storyboard for the chosen topic. Gagne described nine specific internal processes that occur when a person is engaged in learning and how you can support these processes through steps called the *events*

of instruction. The instructional events do not produce or guarantee learning but instead support the internal process of the student within the learning environment.. The following table outlines Gagne's Nine Events and the corresponding cognitive process it fuels.

The Conditions of Learning theory includes the Gagné Assumption, the idea that different types of learning exist, and each requires a different type of instruction or instructional condition to promote the various desired learning outcomes. Gagné identified five types of learning, with each requiring a different type of instruction:

1. Verbal information
2. Intellectual skills
3. Cognitive strategies
4. Motor skills
5. Attitude

Different internal and external conditions are necessary for each type of learning.

Table 2: Taxonomy of Human Learning Capabilities

Types of Human Capabilities	Conditions	Principles for Instructional Events
Verbal Information	Retrieving stored information: the internal conditions to support this learning include <ul style="list-style-type: none"> • Preexisting of organized knowledge • Strategies for processing the new information 	<ul style="list-style-type: none"> • Provide meaningful context of information for encoding • Provide elaborations, imagery, or other encoding cues • Organize information so that it can be learned in chunks
Intellectual Skills	Mental operations that permits individuals to respond to conceptualizations of the environment: <ul style="list-style-type: none"> • Discrimination • Concrete and defined concepts • Rule using • Problem solving: combining subordinate rules in order to solve a problem 	<ul style="list-style-type: none"> • Provide varied concrete examples and rules • Provide opportunities for interacting with examples in different ways • Assess learners in new situations

contd...

	<p>The internal conditions to facilitate this type of learning include:</p> <ul style="list-style-type: none"> • Recalling prerequisite skills <p>Interacting in a variety of ways with the new learning</p> <p>Applying the new skills to range and variety of different situations and contexts</p>	
Cognitive Strategies	<p>An internal process by which the learners plans, controls, and monitors his/her own ways of thinking and learning, including</p> <ul style="list-style-type: none"> • Task specific • General • Executive 	<ul style="list-style-type: none"> • If task-specific, describe the strategy; if task general, demonstrate the strategy. • Provide opportunities for strategy specific practice with support and feedback
Attitude	<p>An internal state, i.e. predisposition that affects an individual choice of action</p>	<ul style="list-style-type: none"> • Provide respected models who enact positive behavior and reinforce the model • When learner enacts the behavior, provide reinforcement
Motor Skills	<p>Capability to perform a sequence of physical movements. It involves three stages: Learning the sequence of the movement</p> <ul style="list-style-type: none"> • Practicing the movement • Refining the movement from the feedback from the environment 	<ul style="list-style-type: none"> • Establish executive subroutine and provide for mental rehearsal. • Arrange several repetitions of skills with correct feedback

Source: *Gredler's (1997) descriptions of Gagne's condition of learning.*

Above events can be translated into specific instructional tactics that can be implemented in any teaching learning environment in order to efficiently and effectively achieve the desired performance or learning outcome..

Before developing the module, pedagogic framework of IMM was prepared mentioning

target audience, context and purpose of developing IMM.

Purpose of developing IMM was explained in terms of teaching intentions, five learning abilities and nine instructional events mentioned by Gagne in coherence with slide number explaining the respective instructional event.

Table 5.3: Pedagogic Framework / Design of Screenwriting of IMM

By whom	Target audience	<p>Class - X</p> <p>Age-14-16 years</p> <p>Subject-science</p> <p>Language-english</p> <p>Facilities-computers with internet facilities</p>
In what context	Learning context	<p>Reproduction</p> <ul style="list-style-type: none"> • Existence of life • Asexual reproduction • Sexual reproduction

Table 5.4: Purpose of Developing IMM

S. No	Teaching Intentions	Dimensions	Supports Learning Ability	Slide No.	Instru ctional Event
1.	Developing critical thinking: Higher order thinking skill which mainly consists of evaluating arguments. It is a composite of attitudes, knowledge and skills, in relation to inquiry, nature of evidence and application to the situation.	A) Inference- Discriminating degree of truth & falsity of inference drawn from given data.	(1) Intellectual skill: Stimulate recall of subordinate concepts and rules.	17, 118	IE-3 IE-6
		B) Recognition of assumptions: Recognizing unstated assumptions or presuppositions in given statements.	(2) Cognitive strategy: Learner originates a novel solution. (3) Verbal information: Learner restates information in paraphrased form.	43, 57, 59, 89, 92	IE-8
		C) Deduction: Determining whether conclusions necessarily follow from given data.	(1) Intellectual skills: Ask learner to apply rule or concept to new examples. (5) Motor skills: Ask for execution of performance (5) Motor skills: Learner execute performance of total skills	25, 55, 61, 69, 126	IE-6 IE-8
		D) Interpretation: Weighing evidences and deciding if generalizations or conclusions based on given data are warranted.	(1) Intellectual skill: Provide spaced reviews including variety of examples Cognitive strategies: Provide occasion for a variety of novel problem solutions.	26, 27, 44, 56, 97, 119	IE-9
		e) Evaluation of arguments: In making decisions for important questions, it is desirable to distinguish between arguments as strong and weak. Argument is strong when it is directly related to question. It is weak when it is not directly related to question.	(4) Attitude: Ask learner to indicate choices of action in real or simulated situations. Intellectual skill: Ask learner to apply rule or concept to new examples. (4) Attitude: Learner make desired choices of personal action in real or simulated situation. (1) Intellectual skill: Learner demonstrates application of concept or rule.	53, 69, 92, 93, 94, 95, 116, 120, 127	IE-6 IE-8

contd...

2.	Problem solving: It involves being presented with a situation that requires resolution . it is ability to recognize and define problems, invent & implement solutions, track and evaluate results.				
		A) Domain knowledge: Content of a particular field of knowledge. It is the sum or range of what has been perceived, discovered or learned.	(1) Intellectual skill : Introduce stimulus change; variations in sensory mode Presenting examples of concept or rule-intellectual skill	7, 44, 54, 58, 62, 89, 91, 96, 98, 111, 122, 123, 124	IE-3
		b) Reasoning skill: Production of publically verified argument, so strong that everyone accepts the same solution, valid. It is an explicit communication that proves to others that your conclusion is correct & sufficient.	(3) Verbal information: Ask for information in paraphrase ,or in learner's own words. (5)Motor skills: Ask for execution of performance (1) Intellectual skills: Provide spaced reviews including variety of examples Cognitive strategy: Provide occasions for a variety of novel problem solutions	11, 15, 44, 55, 61, 90, 115, 117, 119	IE-6 IE-9

Table 5.5: Basic Pedagogic Screenwriting Structure for Each Chapter

I	Make them want to know	Gain attention: Using music sensitization Elucidate through uncluttered graphics Texture the story with varying moods	IE-1
II	Tell them what you will do	Inform learner of objectives	IE-2
III	Stimulating them	Through previously learnt concepts	IE-3
IV	Do it pedagogically	• Facilitate attention viewing of information • Provide learning guidance through examples	IE-4 IE-5
V	Asking them to play rapid fire round	Elicit performance using practice questions	IE-6
VI	Tell them ,what you have done	Provide feedback	IE-7
VII	Assessment of what has been done	Provide them with questions to assess the level of achievement of objectives	IE-8
VIII	Encountering them with real life problems	Enhance retention & transfer	IE-9
IX	Connect it	Link each chapter to the next one	

In whole, pedagogic screenwriting for each chapter was also framed before developing a concrete storyboard. As per the number of sub-

topics three chapters were configured and their screenwriting was done incoherence with nine instructional events of Gagne.

In all, the multimedia contents and activities, styles of presentation are planned according to Gagne's (2000) nine instructional events with the incorporation of multimedia learning content and student-centered approach to produce an interactive learning module. This learning module focuses on the course syllabus with the topic "Reproduction". All students were

arranged to learn through an interactive learning module and allows students to access from the computer. The learning process is flexible as they can determine their own learning preference and interact with the learning contents and receive minimal guidance from the human instructor. The figures below show the screenshots taken from this learning module.

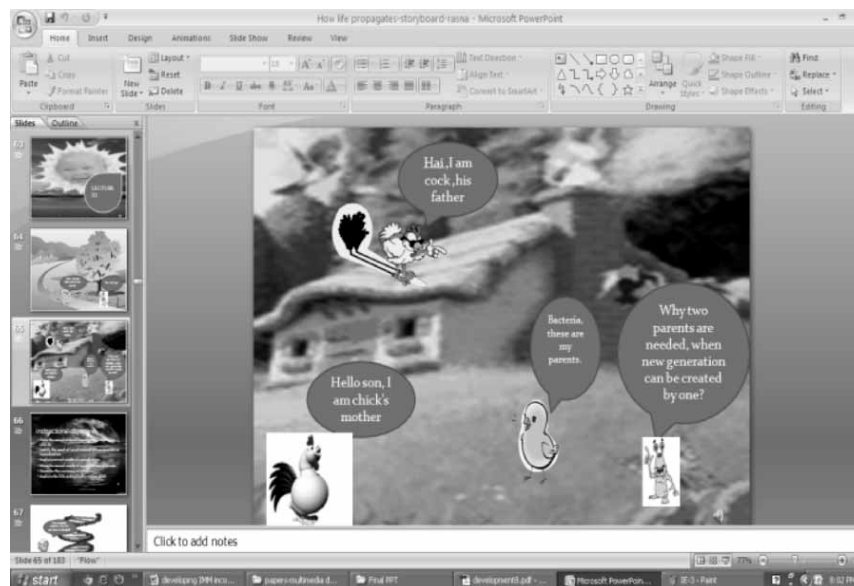


Fig. 2: Gain Attention

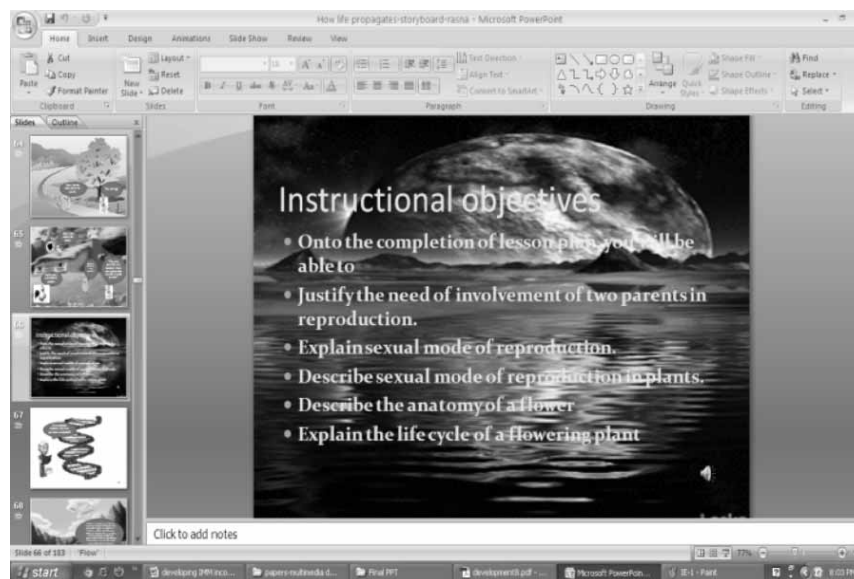


Fig. 3: Inform learner of Learning Objectives

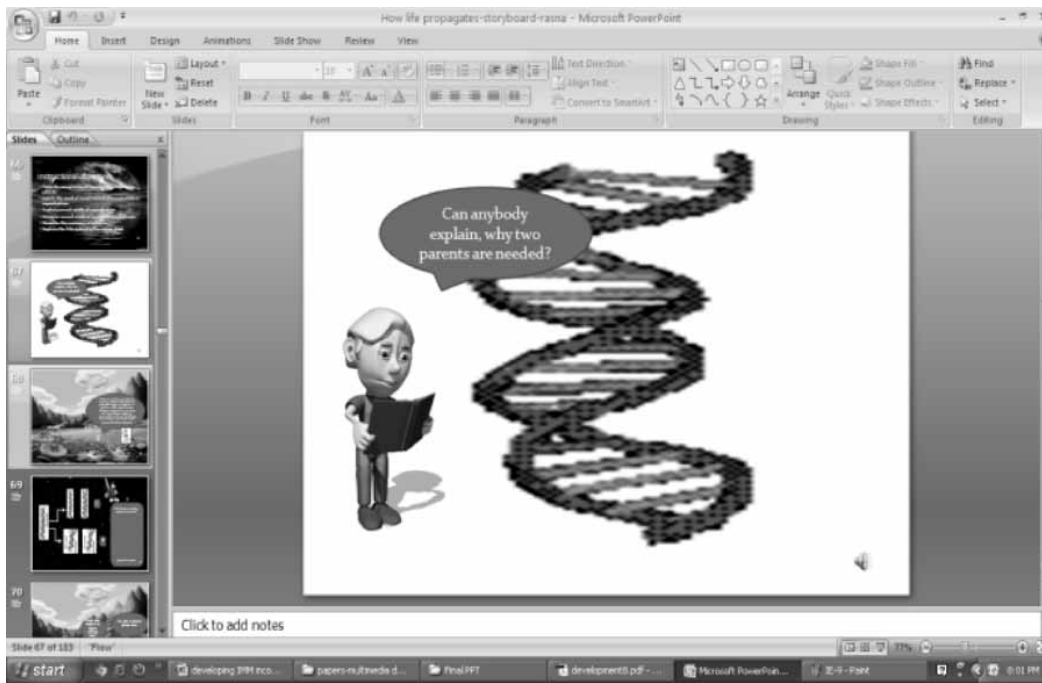


Fig. 4: Recall of Pre-Requisite Learning

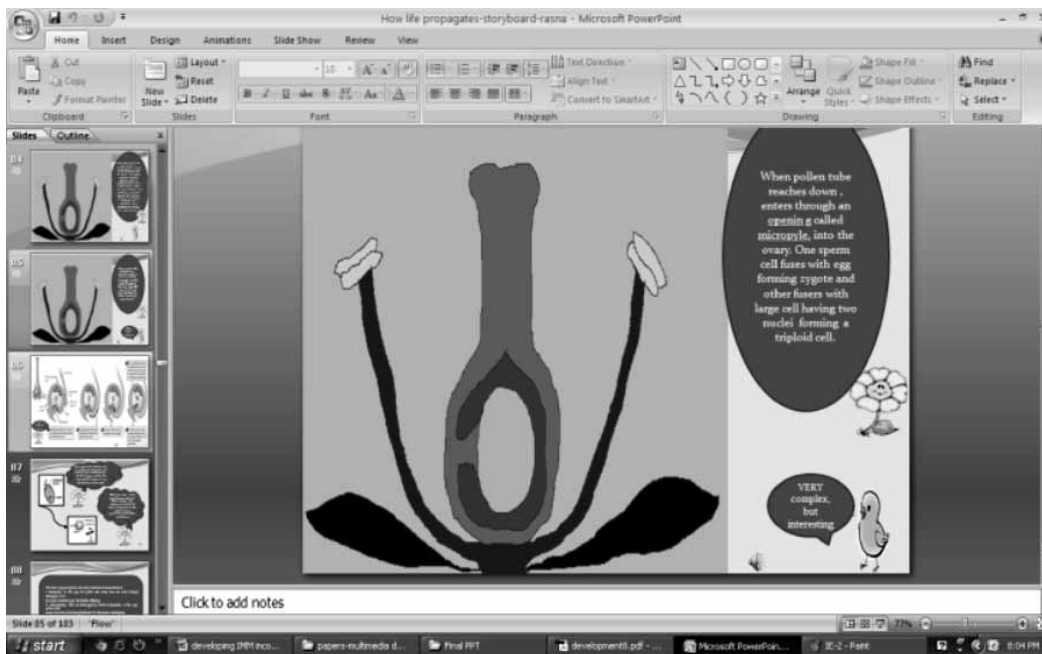


Fig. 5: Presenting Stimulus Material

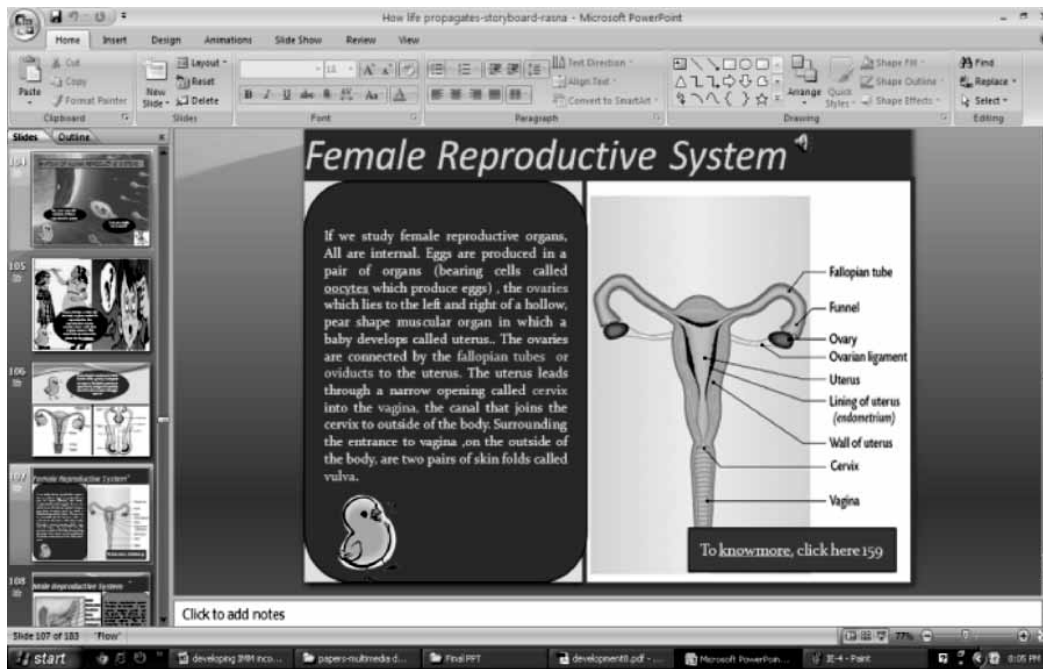


Fig. 6: Providing Learning Guidance

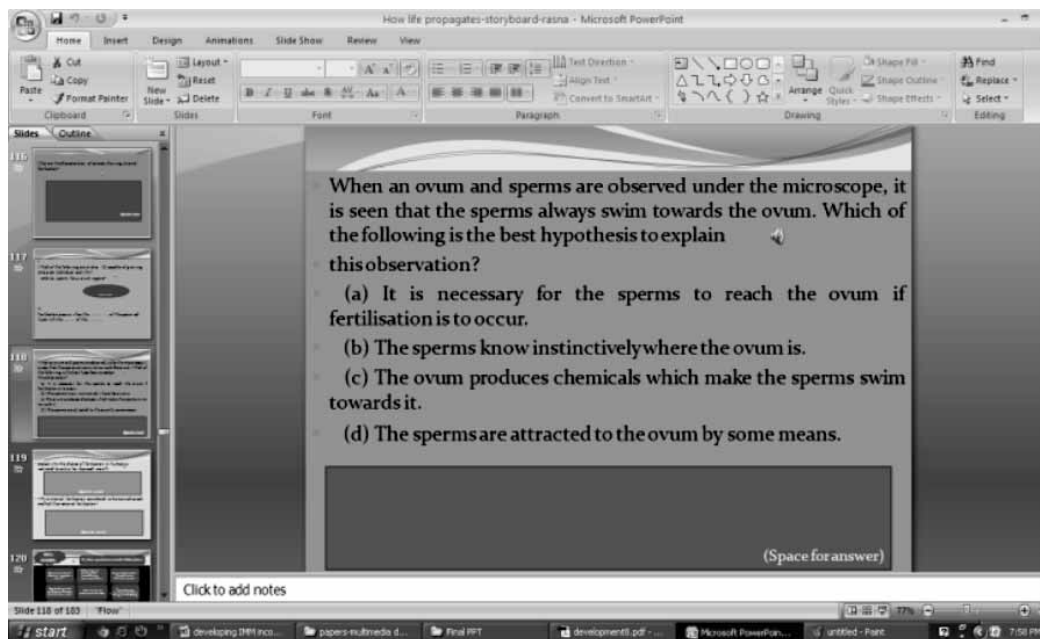


Fig. 7: Eliciting Performance

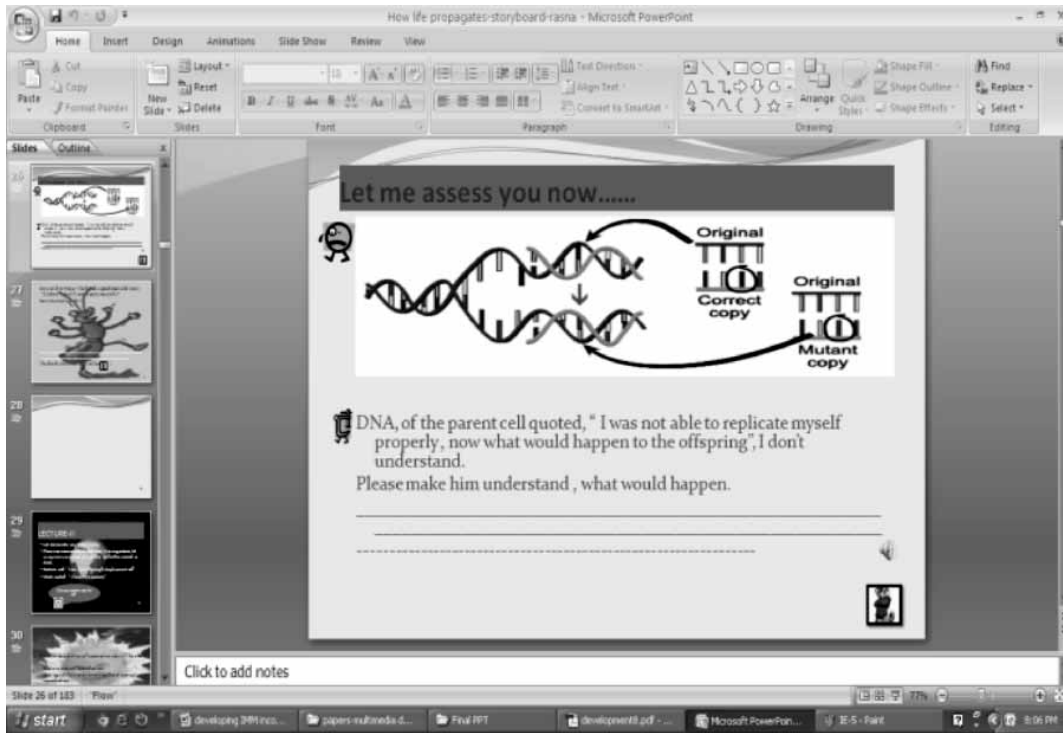


Fig. 8: Providing Feedback

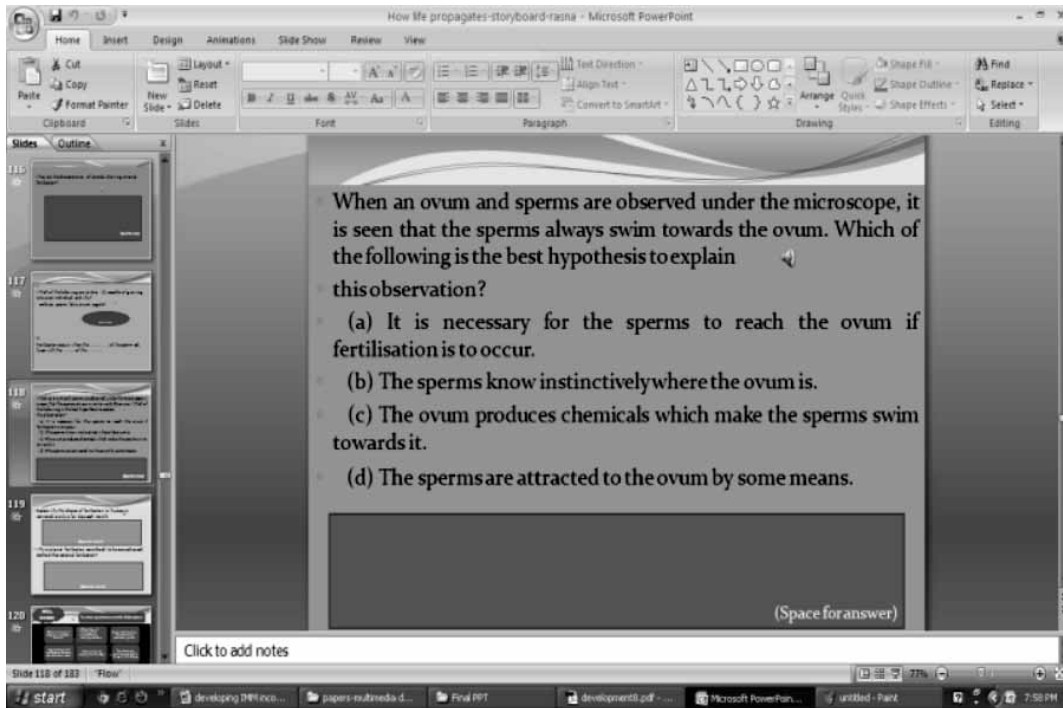


Fig. 9: Assessing Performance

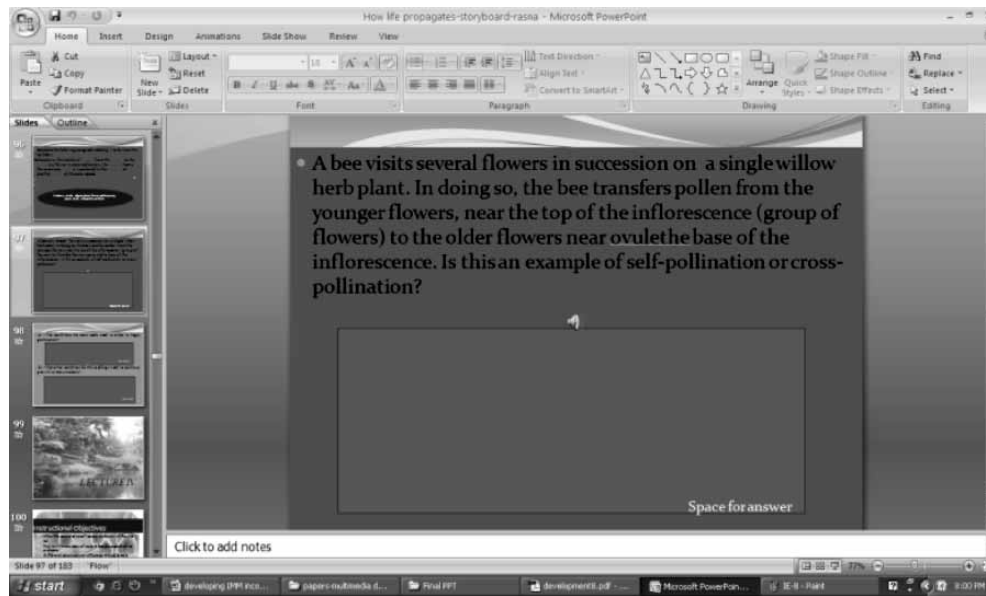


Fig. 10: Enhance Retention & Transfer

6. Lab Environment

In order to provide the required conducive environment for IMM, a computer lab was used. The lab contained close to 40 fully functional networked PCs. Since there were 30 students, the whole class was accommodated in one time. Each student was given a PC of their own to understand the concept with their own pace. Before the module starts, instructions were given to the students on how to access the module. No additional software or hardware was installed for this and the computers ran on

Windows operating system. The teacher was in the room to act as a facilitator. Since this was the first time the class or the students were exposed to such module where they had their own accessibility and self pacing, it was quite appreciable that they all found it very interesting, interactive and informative.

7. Results

The main finding of this research is multimedia courseware created that can be used by students and teachers in the process of teaching and

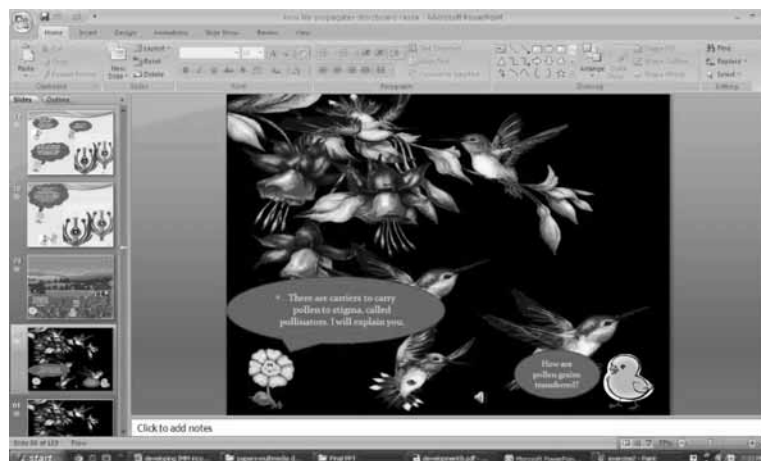


Fig. 11: Interface of the Courseware that uses Graphics, Text and Animation.

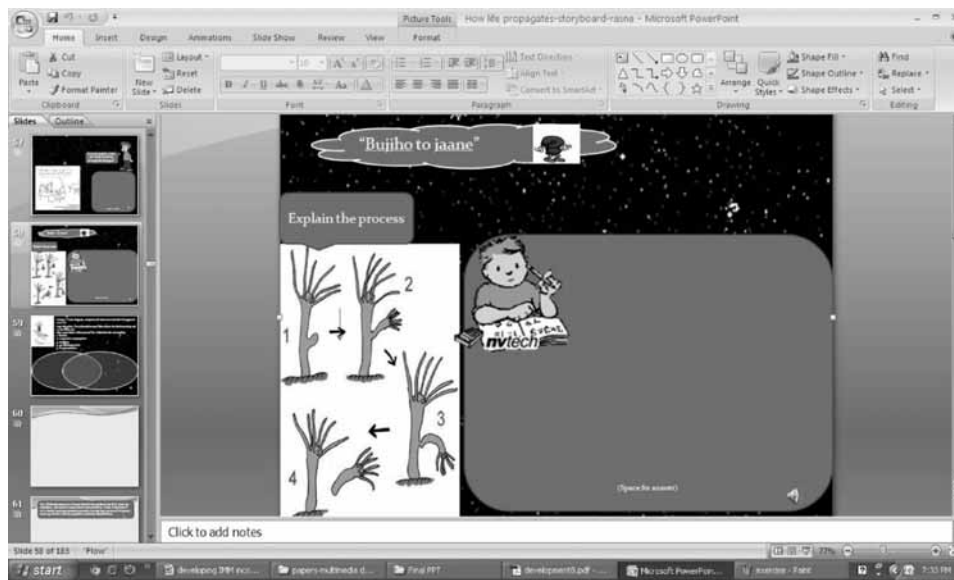


Fig. 12: Video Element

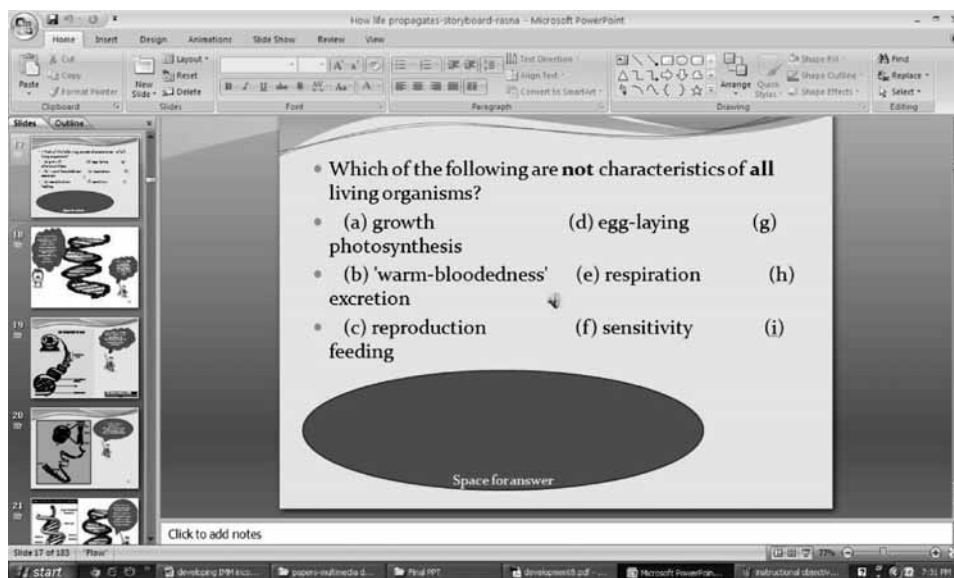


Fig. 13: Interface Showing an Example of Related Exercise.

learning of respective topic. The students can use the courseware based on their learning pace, according to their preferred learning styles.

As examples, Fig. 11, 12 and 13 show the interfaces of IMM

In Fig. 11, we can see that there are some buttons at the top of the page that could link to another page. Therefore, users can easily switch to other topic without having to complete the topic on a

particular page. Likewise, the user could click the stop button if he doesn't want the icon to read the content. Furthermore, colorful background GIF images are used in order to attract children to use this courseware.

In Fig. 12, video is used to replace text as a tool to explain the contents. The use of the video is useful for teachers since it can assist the teachers in explaining certain practical aspects of the

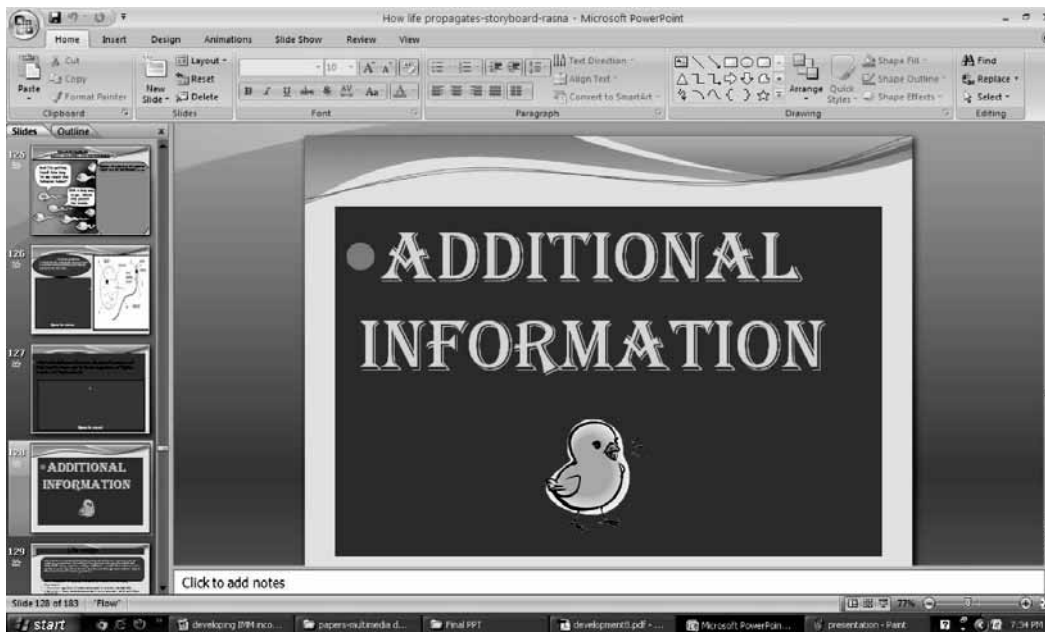


Fig. 14: Interface showing Title Slide of Additional Information Provided

topic. This innovative part of the courseware combines a few types of multimedia elements such as audio, video and image.

Fig. 13 shows an example of an exercise for a topic. At the end of each topic, this courseware provides exercises to test students' understanding of the subject materials.

Links were also provided to the selected materials to expose the users to various related issues in the effort to improve understanding and to fulfill the required learning outcomes. In addition, new technology in multimedia development such as storyboarding and scripting are used to improve visualization and presentation.

In order to ensure usability and effectiveness of the courseware, before releasing the product to end user, IMM went under alpha testing and beta testing mainly to review application concept, format, user interface, page layout and bug and content mistakes respectively.

8. Conclusion

Multimedia courseware offers many benefits over traditional methods of delivering

information. Information can be displayed in various formats that enable users/students to interact with the materials being presented as needed in their own time. Multimedia courseware has the potential to present information more effectively compared to the traditional teaching approach using textbook, classroom teaching, and practical exercises. Thus, teaching –learning process has to be assisted with interactive multimedia courseware to enhance learning and understanding without regard to time pace in terms of future work for this research, effectiveness of various components of IMM will be analyzed using questionnaire and the results will be analyzed statistically. In conclusion, 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. This 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 geared towards integrating multimedia technology into the classroom.

References

- Agnew, P. W., Kellerman, A. S., and Meyer, J. (1996). *Multimedia in the Classroom*. Allyn and Bacon, Boston.
- Fui Theng, L., Mai, N., Designing a Multimedia-mediated Student-centred Learning Environment (MMSLE) with Gagne's 9 Events: Students' Perceptions.
- Gagne, R.M., Wager, W.W., Goals, K.C., & Kelle, J.M. (2005). *Principle of Instructional Design*, (5th Edition), Belmont, CA: Thomson Learning, Inc.
- Hofstetter, F.T. (1995). *Multimedia Literacy*. McGraw-Hill, U.S.A. <http://imej.wfu.edu/articles/1999/1/01/index.asp>
- Johns, J.F. (1999). Web-based practice environments to teach mechanical skills. *Interactive Multimedia Electronic Journal of Computer-Enhanced Learning (IMEJ)*, Vol. 1, No. 1 (May). <http://imej.wfu.edu/articles/1999/1/01/index.asp>
- Kachian, C. & Wieser, P. (1999). You can almost feel the music: redesigning a course for new media delivery. *Interactive Multimedia Electronic Journal of Computer-Enhanced Learning (IMEJ)*, Vol. 1, No. 1 (May).
- Kamsah, M, Mokhtar, S., Ahmad, R, and Yaakob, M. (2000). Developing the concept of e-university for Malaysian public universities. *e-learning 2000: Accelerating e-Learning Towards Higher Education Value, Malaysian International Conference & Exhibition on Electronic Learning 2000*, Kuala Lumpur, Malaysia, May 25.
- Lindstrom, R. (1994). *The Business Week Guide to Multimedia Presentations: Create Dynamic Presentations That Inspire*. McGraw-Hill, New York.
- Mat, J. (2000). Technology in the Malaysian Education System. *e-learning 2000: Accelerating e-Learning towards Higher Education Value, Malaysian International Conference & Exhibition on Electronic Learning 2000*, Kuala Lumpur, Malaysia, pp. 1-9.
- Neo, M., & Neo, T.K (1998). *Authorware: The Multimedia Icon*, Subang Jaya: Meway Computec Sdn. Bhd., Malaysia.
- Neo, M & Neo, T. K. (2000). Multimedia learning: using multimedia as a platform for instruction and learning in higher education. *Proceedings of the Multimedia University International Symposium on Information and Communication Technologies 2000 (M2USIC'2000)*, Kuala Lumpur, Malaysia.
- Roblyer, M.D. and Edwards, J. (1998). *Integrating Educational Technology into Teaching* (2nd edition). Merrill/Prentice-Hall, New Jersey.
- Tapscott, D. (1998). *Growing Up Digital: The Rise of the Net Generation*. McGraw-Hill, New York.
- Tway, L. (1995). *Multimedia in Action*. AP Professional, MA.