DEVELOPMENT OF A MULTIMEDIA ENHANCED WEB PROTOTYPE FOR TECHNICAL LEARNING INSTRUMENT

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A thesis submitted in fulfillment of the requirements for the award of the Degree of Master of Vocational and Technical Education

Kolej Universiti Teknologi Tun Hussein Onn

OCTOBER 2003

Dedicated to my beloved FAMILY…

Thanks for all the support and prayers

ACKNOWLEDGEMENT

In the name of Allah, Most Gracious, Most Merciful, thanks to Allah for the accomplished research. My first thanks go to Mr Razali Hassan for his guidance and supervision along with the implementation of this study. It was a great pleasure to conduct this thesis under his supervision.

My highest gratitude is dedicated to my love, Syarifah Nur Aqida Syed Ahmad for the unlimited assistance and tolerance during the entire progress.

Finally, I wish to acknowledge all my colleagues and the undergraduate students participated in this study. Without your help, support, interest and valuable hints, it would be difficult for me to fulfill the questionnaire.

ABSTRACT

Inconveniences in apparatus preparation, increased number of students and time constraints had caused the development of alternative learning instrument. Thus, a research on development and evaluation of multimedia enhanced web site as a learning instrument for metallogaphy subject was conducted. A website namely Visual Metallography (*VM*) was designed and enhanced with multimedia as the information transmission medium. Video clips were used to elaborate the specimen preparation process in laboratory whereas; animation was included to enhance the interactive circumstance. *VM* was evaluated using questionnaire with a group of respondent. Reliability level of instrument used was determined through a pilot test. Cronbach's alpha for section 2, 3 and 4 were 0.942, 0.839 and 0.813 respectively. The research sample comprised 50 engineering students of KUiTTHO enrolling for Metallography subject. Research findings were analysed descriptively using SPSS 11.0 software. Referring to the analysed data, 55 items were highly rated except for item 23, which rated at medium level. In conclusion, the interface (GUI) design, multimedia provided and learning style presented in *VM* web were fulfilling the users' needs. *VM* is indeed suitable as a multimedia-enhanced web based learning instrument purposely for lecturers and students.

ABSTRAK

Kesukaran penyediaan peralatan, peningkatan bilangan pelajar, dan kekangan masa merupakan masalah yang membawa kepada perlunya alternatif yang baru. Justeru, kajian rekabentuk dan penilaian web bermultimedia sebagai instrumen pengajaran dan pembelajaran bagi subjek metalografi di bentuk. Laman web yang dibangunkan ini dinamakan sebagai *Visual Metallography* (VM) sempena dengan keupayaannya menyampaikan maklumat secara visual melalui multimedia. Klip video digunakan untuk menerangkan proses penyediaan spesimen di makmal. Selain dari video, animasi di sertakan untuk meningkatkan kesan interaktiviti di dalam sistem. VM dinilai menggunakan borang soal selidik yang dijawab oleh sekumpulan responden sebanyak 50 orang. Aras reliability instrumen adalah pada nilai alpha sebanyak 0.942, 0.839, dan 0.813 bagi setiap bahagian soal selidik 2, 3, dan 4. Sampel kajian dipilih dari kalangan populasi pelajar KUiTTHO yang sedang mempelajari ilmu pengetahuan metallografi. Dapatan kajian yang dianalisis secara deskriptif menggunakan perisian SPSS menunjukkan, 55 item soalan diaraskan oleh responden pada kelas yang tinggi kecuali bagi item 23 yang diaraskan pada kelas sederhana. Secara keseluruhannya, rekabentuk antaramuka (GUI), multimedia, dan kaedah pengajaran yang disampaikan di dalam VM adalah memenuhi kehendak pengguna. Justeru, VM adalah sesuai untuk dijadikan sebagai bahan pembelajaran dan pengajaran berasaskan teknologi web bermultimedia bagi kegunaan pensyarah dan pelajar.

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CHAPTER I

INTRODUCTION

It was noted that most technical educational material were spread via multimedia within the internet. They were applied for distance learning program, and also used as teaching and learning instrumentation. Educational web page is also call 'Instructional Web-Base Software'.

In the current study, the tools facilitating Web-Base Instructional Software consisted of media, synchronous and asynchronous communication tools, web browser, search engines, plug-ins, computers, connections, internet or intranet service provider, and Web servers. A discussion of these tools was deemed necessary since inadequate design or setup of these tools may cause confusion and frustration for students. Additionally, it may affect their perceptions about the content of a Web site or provoke feelings of being lost in cyberspace (Borges et al., 1998; Nielsen, 2000; Ratner, 1998). This, in turn, can negatively affect effective learning and information retention (e.g., Darke, 1988a; Darke, 1988b; Jonassen & Grabowski, 1993; Kruse & Keil, 2000; Ratner, 1998; Reber, 1985; Sheets, 1992; Wiebe & Howe, 1998).

This study involved a part from the problems mention above which concerning the multimedia application. Normally, technical education web page covering the use of graphical, text, and image followed by a tutorial that dragging the user to understand the content of knowledge provided. Only few of them, used the video clip as additional media for supporting the web presentation.

1.1 Research Background

The research encompassed the development of web base learning and teaching instrument engaging a video clips as additional media for a subject of Metallography. Generally, this study concerned to design, develop, and evaluate the product. It initiated with determining the optimum design criteria of the product from literature review. Then a product of web instruments for Metallography was developed with the applications of decided characteristic.

Subsequently, the instrument for product evaluation was created. Besides, from evaluations, the answers for research questions were produced. The respondents were a group of user sample which comprised the second year students of mechanical engineering department at 'Kolej Universiti Teknologi Tun Hussein Onn'. The data from questionnaire was analysed statistically to seek out the rating for users' satisfactory, multimedia attraction, multimedia criteria, and the pedagogical concept in the web.

1.2 Problem Statement

Generally, there were inconveniences in apparatus preparation in technical subject which was typically conveying various types of information to the students. Besides, the increasing number of students enrolling for the technical subjects plus the syllabus constraints which stressed on theoretical concept and calculations made the condition worse. Individuals do not all process information the same way; some learn better by reading, some by watching, some by experimenting, and of course sometimes a difficult concept only becomes clear when looking at it in a variety of ways. (Mehringer, 2002). Thus, many researchers recommended for digital

instrument application to overcome this problem and the established internet was discovered potential as a platform to develop the instrument.

Technical subject such as Material Science and Technology is largely based on applied engineering. However, the effectiveness of conveying applied engineering learning material through the internet was rather low without engaging the entire multimedia concept. A multimedia object incorporates multimedia instructional material, such as text, image, voice, and video (Fuji and Tanigawa, 2002). Previously, our online materials covering use of graphical tools would use text and screen stills followed by a tutorial that walked the reader through the steps of a simple use of the tool. This is very tedious, error-prone, and frustrating. Video clips were intended to improve the online educational materials by making the content more engaging and easier to understand. (Mehringer, 2002). Moreover, Aragon (2002) found that graphic images, photographs, and videos had been successful to enhance student motivation. Videos also helped some students feel that the case was real (Valaitis et al., 2002).

According to the research done by Centre of Applied Research in Education Technology (CARET), to create an optimal digital teaching and learning media, the content should be accurate, up-to-date, relevant to the subject objectives and to the needs of the learners, align with state content standards, and be presented in ways that make optimal use of the technology. The major problem, which drags to this research, is how to present the video clip on the web with an optimum design in perceptive of need of user. One of the criteria indicated in a course website developed by Cradler & Cradler (2000) was the online environment should follow a good web design criteria, be easy to navigate, conserve bandwidth, and follow copyright principles. Moreover, the reliability of the technology delivery system should be as failsafe as possible, and the effectiveness of a website should be assessed through an evaluation process (Distance Learning Policy Laboratory, 2001).

1.3 Research Objective

To develop a prototype web for the technical learning instrument for Metallography subject with application of multimedia.

1.4 Research Questions

In accomplishing the research, there were four questions concerned which obviously focusing to the needs of this study. The questions are:

a. How far does the graphical user interface developed reached users' satisfactory?
b. How far the multimedia created on Visual Metallography captivates the learners?
c. How do the multimedia criteria range in the visual metallography?
d. How far the teaching style of Visual Metallography website meets the engineering students need?

1.5 Theoretical Framework

This research originated from development of a prototype web with application of multimedia. Referring to the research questions, a survey need to be conducted to a group of user. In this survey, questionnaire was developed to measure the parameter indicating the problems. The instrument was developed structurally

and consists of four sections. The first section seeks to find out the respondent demographic data. Second section asked the 'users satisfactory' about the graphical user interface (GUI). Third section concerned multimedia criteria and there attraction to the learners'. Meanwhile, the last section was related to find out the relationship between web pedagogical concept and the learners' need. The adapted questions from previous reviews were merged to fulfil research requirements. A pilot study was conducted to evaluate the validity and reliability due to the research factors. Consequently, the instrument was improved to the required quality. Finally, the result of the survey was analyzed statistically using SPSS software.

1.6 Importance of Research

This research project is a response to the urgent need to conduct research on assisting Metallography subject necessities which was obviously required expensive equipments, spacious learning site, and large number of students. A web was developed with video clips application in order to deal with the problems.

A definition from Huss (1999) indicated web multimedia as the application of text, images, animations, sounds and video on the Web, supported by Hypertext Markup Language (HTML). Video clips were the most often used to enhance a portion of a topic such as to introduce the topic, or explain an important or difficult concept. The video clips were intended to improve the online educational materials by making the content more engaging and easier to understand.

1.7 Scope of Study

Initially, literature reviews on video based web designs were studied to attain the properties of designing a web. The web was designed based on the particular properties by means of Macromedia Dreamweaver MX software and supported by Macromedia Flash MX, and Adobe Premiere 6.5. Learning content included was specifically on Metallography which is a subtopic of Material Science subject taught in technical education institutes.

In the mean time, an evaluation instrument for assessing the product was developed to solve the research questions. There were three different aspects to be considered in assessing the product which comprise questionnaire for user interface satisfaction, multimedia content, functionality and attractive assessment and the web pedagogical concept evaluation. The reliability of the instrument was determined using the 'Cronbach's Apha' value obtained from series of pilot study.

Respondents for the questionnaire were randomly selected from first year technical students of Kolej Universiti Teknologi Tun Hussein Onn (KUiTTHO). The questionnaire sessions were hold in a computer laboratory. Data obtained from the questionnaire were statistically analysed using SPSS software to reach the research questions. The analysis comprised mean and percentage analysis, and developing a number of graphics representing the research findings.

CHAPTER II

LITERATURE REVIEW

2.1 Multimedia Enhanced Web Sites for Technical Education

There is no doubt to decline the power of internet. According to AOL, Americans with online access has increased from 45 million users in 1998 to 105 million users in 2001. Of these online users, those with home broadband access had grown from 6% in December, 1999 to 19% as of September, 2001 (Mallory et. al., 2001). An application of IT was proved to increase student comprehension and their interest. Butzin (2001) found out, third-year PC students scored higher on all test comparisons than the non-PC group. Significant differences were obtained in mathematics applications (Grade 2), reading comprehension (Grade 5), mathematics computation (Grade 5), and mathematics application (Grade 5).

One of the best known Internet systems is the multimedia information system called the World Wide Web (WWW). WWW technology enables easy navigation on the Internet and is a tool by which students can apply their investigative and research skills to construct understanding of scientific knowledge. Students were motivated by technology being able to assist with their learning, and hence their ability to take control of their own learning (Ng and Gunstone, 2002).

Due to the problem of cost, time constrains, and number of students, there must be an alternative to apply. E-Learning should be the answer because of its features of e-learning itself, which explained by Vesper et al. (2002), consistency of content and delivery; Availability 24/7; Availability from any location with a suitable inter/intra-net access; completing the program at the learner's own pace; inclusion of text, audio, graphical, and video elements; and rapid updates. Video was needed for the visual learners and such presentations can be done with streaming video from the web site (Combs, 2002).

In an e-learning system for teaching hydraulics and pneumatics (technical subject) created by Vassileva and Bojkov, the features available from the instrument were:

a. Video clips illustrating the basic application of the system;
b. Many animated pictures showing components' mode of operation;
c. Virtual 3D play models of the basic components;
d. Interactive assembly unit, for system assembly from predefined set of components;
e. Interactive system simulator demonstrating different modes of operation;
f. Intelligent "virtual tutor" guided experiments
g. Self -tests.

2.2 Advantages and Disadvantages of Multimedia in Web Sites

Referring to Holstrom (2002), recently, educators recognize the advantages of video: It pulls learners together around a visual prompt (Stigler 2002; Finn 2002); because video utilizes more senses, learners retain more knowledge (Osciak & Milheim 2001; Lewis 1997); and adults enjoy learning in an environment that

appeals to multiple intelligences (Brougher 1997). The Internet action wraps around the video because educators realize the old paper-and-pencil exercises are insufficient. "Unless the videos are followed by discussion and practice, they turn into a 'one-shot deal' and lose their effectiveness" (Lauro 1995, p. 65). Moreover, the Internet has become the vehicle through which discussions were facilitated; particularly for distance learning, these e-discussions can promote a sense of community that is often a void in the e-learner's experience.

Besides, Mehringer (2002) reported that, individuals do not all process information the same way; some learn better by reading, some by watching, some by experimenting, and of course sometimes a difficult concept only becomes clear when looking at it in a variety of ways. Our materials consist of text, pictures, animations, etc. Supplementing words and pictures with an expert speaker might provide additional help for difficult points. Some lectures will never be transformed into web materials unless they are captured as live lectures and put online simply and easily. It is faster to videotape a live lecture and pair it with the speaker's slides than to develop web pages from the materials.

Furthermore, multimedia instructional environments were widely recognized to hold great potential for improving the way that people learn (Mayer and Moreno, 2002). Learners were exposed to material in verbal (such as on-screen text or narration) as well as pictorial form (including static materials such as photos or illustrations, and dynamic materials such as video or animation). Although verbal forms of presentation had long dominated education, there was encouraging evidence that student understanding can be enhanced by the addition of visual forms of presentation.

Lai and So (2002) work on the advantages of video clips in web pages indicate that although hands-on demonstrations provide authentic experience to the students and should not be substituted completely, video cases can be used to alleviate some of the problems practical classes (Stephen and Leavell, 1999).

Furthermore, videos open up other dimensions of learning in which conventional demonstrations cannot provide. Besides, a video clip capable of showing practical application of the considered component or system in industry or real life as shown in Figure 2.1 (Vassileva et al., 2002).

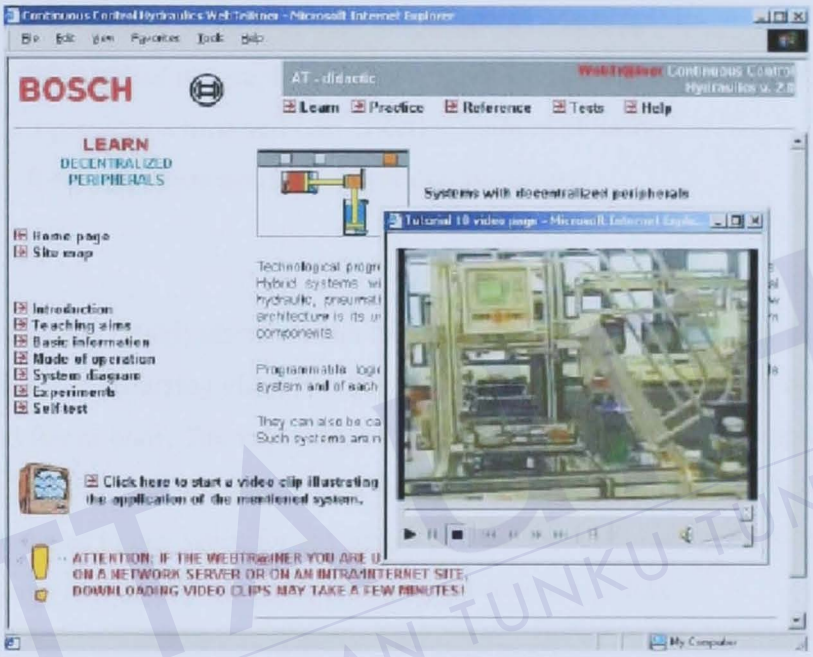

Figure 2.1: Basic information page of the *WebTr@iner* (Vassileva and Bojkov, 2002)

Referring to Mehringer (2002), the video clips will be used to enhance existing online materials by making the content more engaging and easier to understand. Valaitis et al. (2002) and Lawless (2002) stressed more on video application where video clips also helped some students feel that the case was real. As multimedia environment invite the inclusion of video, users are able to see "themselves" in the educational materials. Vassileva and Bojkov (2002) work on an intelligent web page, *WebTr@iner*, point out the advantages of the instrument as follows:

a. The teaching method used illustrates complex processes in an easy, clear and attractive manner;
b. It takes into account the different levels of knowledge of students starting the course;
c. As an Intelligent Tutorial System it reacts to the students' capabilities and mistakes;
d. It is quickly accessible, easy to update and distribute;
e. Widespread geographical areas will not cause a logistical problem.
f. It provides a time and cost effective training of users;
g. *WebTr@iner* is available in various languages;

Kähkönen (2002) elaborated on the problems of video clips in web pages where skills in transferring video into the net and video editing were most often considered fair or poor. The video clip too was still quite little used and appreciated, due to technical limitations and lacking expertise. Besides, it can be both boring and difficult to listen to one voice for any length of time, especially when there are few visual cues to accompany the audio (Aragon and Johnson, 2002).

2.3 Development and Evaluation of Multimedia Enhanced Web Sites

In designing multimedia presentations involving animations and video clips, instructional designers base their decisions on a theory of how students learn. The first principle was that students learn more deeply from animation and narration than from narration alone. Students were better able to build mental connections between corresponding words and pictures when both were presented (i.e. animation and narration) than when only one was presented (i.e., narration) and the learner must mentally created the other (Mayer and Moreno, 2002).

Reeves and Nass (1996) identified a number of factors that can influence the perception of multimedia material. The following are particularly relevant to authoring video-based multimedia:

a. Image size

Larger images are evaluated more positively than smaller ones and better capture the viewer's attention. Additionally, content on larger images are better remembered than those on smaller ones.

b. Fidelity

Sound quality was found to have more impact on the viewer's perception of the quality of the material being shown. More importantly, audio fidelity was found to affect attention to media and the viewer's memory for audio information.

c. Synchrony

Viewers of videos containing audio-video asynchrony commented that people in the video were "less interesting, less pleasant, less influential, more agitated, and less successful in their delivery" than those in synchronized video. This is very significant, as educational materials should not have any of the attributes that have just been mentioned.

d. Scene Changes

Scene changes can be used to provide structural cues to direct the viewer's attention as well as serving as markers in the viewer's memory. In order to create appropriate cuts and scene changes without using cameramen, it will be necessary to use more than one camera to capture the discussion.

REFERENCES

Amaral, T., & Colwell, C. (2002). Accessibility in Complex Web Based Learning Applications: Lessons from the Pearl Project. *Proceedings of E-Learn 2002* (pp. 1358-1361). Montréal, Canada: Association for the Advancement of Computing in Education (AACE).

Aragon, S.R., & Johnson, S.D. (2002). An Instructional Strategy Framework for Online Learning Environments. *Proceedings of E-Learn 2002* (pp. 529-536). Montréal, Canada: Association for the Advancement of Computing in Education (AACE).

Barron, A. (2002). *A Teacher's Guide to Distance Learning*. Retrieved December 18, 2002, from University of South Florida, The Florida Center for Instructional Technology Web site: http://fcit.coedu.usf.edu/DISTANCE/

Brougher, J.Z. (1997). Creating a nourishing learning environment for adults using multiple intelligence theory. *Adult Learning*, 8 (4), 28-29.

Borges, J.A., Morales, I.., & Rodriguez, N. J. (1998). Page design guidelines developed through usability testing. In C. Forsythe, E. Grose, & J. Ratner (Eds.), *Human factors and Web development* (pp. 137-152). Mahwah, NJ: Erlbaum Associates.

Butzin, S.M. (2001, Summer). Using Instructional Technology in Transformed Learning Environments: An Evaluation of Project CHILD. *Journal of Research on Computing in Education, 33* (4), pp. 367-374.

Burns, R.B. (2000). *Introduction to Research Methods* (4th ed.). Frenchs Forest, NSW, Australia: Longman

Cavanaugh, C. (2002). Distance Education Quality: The Resources Practices Results Cycle and the Standards. *Proceedings of E-Learn 2002* (pp. 168-173). Montréal, Canada: Association for the Advancement of Computing in Education (AACE).

Cradler, J., & Cradler, R. (2000). *Criteria for the review and design of web-based educational resources.* California, USA: Educational Support Systems.

Chang, Y. (2002). Assessing the Usability of MOA Interface Designs. *Proceedings of E-Learn 2002* (pp. 189-195). Montréal, Canada: Association for the Advancement of Computing in Education (AACE).

Chin, J.P., Diehl, V.A., & Norman, K.L. (1988) Development of an Instrument Measuring User Satisfaction of the Human-Computer Interface. *ACM CHI'88 Proceedings* (pp. 213-218). Boston: ACM Press.

Combs, L. (2002). Science Education in the Web Era. *Proceedings of E-Learn 2002* (pp. 204-209). Montréal, Canada: Association for the Advancement of Computing in Education (AACE).

Darke, S. (1988a). Anxiety and working memory capacity. *Cognition and Emotion, 2* (2), 145-154.

Darke, S. (1988b). Effects of anxiety on inferential reasoning task performance. *Journal of Personality and Social Psychology, 55* (3), 499-505.

Distance Learning Policy Laboratory. (2001). *Supporting faculty in the use of technology: A guide to principles, policies, and implementation strategies.* Retrieved October 11, 2002, from The Electronic Campus Web site: http://www.electroniccampus.org/ policylab/reports/supporting_faculty.pdf.

Finn, L.E. (2002). Using video to reflect on curriculum. *Educational Leadership.* 59 (6), 72-75.

Fuji, T. et al. (2002). The Methodology for Reuse of E-Learning Resources. *Proceedings of E-Learn 2002* (pp. 305-310). Montréal, Canada: Association for the Advancement of Computing in Education (AACE).

Grasha, A. F. (1996). *Teaching With Style*. Pittsburgh, USA: Alliance Publishers.

Holstrom, L. (2002). A Demonstration of Exemplary Pedagogies Designed for Low-Budget Producers and Low-Tech Learners. *Proceedings of E-Learn 2002* (pp. 2518-2519). Montréal, Canada: Association for the Advancement of Computing in Education (AACE).

Ibrahim et al. (2001).*Kejuruteraan Perisian.* Skudai, Malaysia: Penerbit Universiti Teknologi Malaysia.

Jonassen, D.H., & Grabowski, B.L. (1993). *Handbook of individual differences, learning, and instruction.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Kähkönen, E. (2002). Teaching or Producing? Orientation and Motivation of Virtual University Team in the Development of Web Courses. *Proceedings of E-Learn 2002* (pp. 1685-1688). Montréal, Canada: Association for the Advancement of Computing in Education (AACE).

Kawasaki, G. (1996). Four things to ask your Webmaster. Forbes, 128.

Kennedy, G. (1999). Defining the Dimensions of a Formative Evaluation Program: A Multi-Method, Multi-Perspective Approach to the Evaluation of Multimedia. *Proceedings of ED-MEDIA 99 World Conference on Educational Multimedia. Hypermedia & Telecommunications. 1999* (pp. 640-645). Charlottesville: Association for the Advancement of Computing in Education.

Kerka, S. (1996). Distance Learning, the Internet, and the World Wide Web. ERIC document ED395214. Retrieved December 09, 2002, from US Department of Education Web site: http://www.ed.gov/databases/ERIC_Digests/ed395214.html.

Kruse, K., & Keil, J. (2000). *Technology-based training.* San Francisco, CA: Jossey-Bass Pfeiffer.

Lauro Jr., D.R. (1995). Five approaches to professional development compared. *THE Journal*, 22 (10), 61-66.

Lewis, C.S. (1997). Interactive multimedia brings new possibilities to adult learning. *Adult Learning,* 8 (5/6), 23-6.

Lewis, J.R. (1995). IBM Computer Usability Satisfaction Questionnaires: Psychometric Evaluation and Instructions for Use. *International Journal of Human-Computer Interaction*, 7(1), 57-78

Lynch, P.J., & Horton, S. (2002). *Web Style Guide* (2nd. Ed.). New Haven, USA: Yale University Press.

Mallory, J.R. et al. (2002). Synchronous, Remote, Internet Conferencing with Unique Populationsin Various Settings. *Proceedings of E-Learn 2002* (pp. 635-639). Montréal, Canada: Association for the Advancement of Computing in Education (AACE).

McLachlan, K. (2002). *Web Evaluation.* Retrieved February 10, 2003, from: http://www.cyberbee.com/guides.html

Mehringer, S. (2002). Enhancing Web-Based Materials with Video Clips. *Proceedings of E-Learn 2002* (pp. 676-681). Montréal, Canada: Association for the Advancement of Computing in Education (AACE).

Microsoft Encarta Reference Library 2004. (2003) *Encarta Reference Library 2004.* Redmond: Microsoft Corporation.

Miura, I.T. (1986). *Understanding gender differences in middle school computer interest and use.* Paper presented at the Annual Meating of the Amarican Education Research Association (67th, San Francisco, CA, April 16-20, 1986). ERIC: ED273248.

Monthienvichienchai, R., & Sasse, M.A. (2002). Computer Support for Vicarious Learning. *Proceedings of E-Learn 2002* (pp. 668-705). Montréal, Canada: Association for the Advancement of Computing in Education (AACE).

Mouty, G. (1999). Literature Review on User-Friendly Interface Design. *UNED-UK's Stakeholder Toolkit for Women Project.* London: UNED-UK

Nielsen, J. (2000). *Designing Web usability.* Indianapolis: New Riders Publishing.

Ng, R. (2000). The Effectiveness of Using Technology to Teach English as a Second Language. *Vocational Education and Training for Life Long Learning in the Information Era, 2000* (pp. 69-74). Hong Kong, China: IVETA Conference Proceedings

Norsuriani, N. (2000). *Penglibatan Pelajar dalam Kegiatan Kokurikulum Sukaneka: Satu Tinjauan di ITTHO.* (Master Case Study, Kolej Universiti Teknologi Tun Hussein Onn, 2000). Johor: KUiTTHO.

Osciak, S.Y., & Milheim, W.D. (2001). Multiple intelligences and the design of web-based instruction. *International Journal of Instructional Media.* 28 (4). 355-361.

Ratner, J. (1998). Easing the learning curve for novice Web users. In C. Forsythe, E. Grose, & J. Ratner (Eds.), *Human factors and Web development* (pp. 111-118). Mahwah, NJ: Erlbaum Associates.

Reber, A.S. (1985). *The Penguin dictionary of psychology.* London: Penguin Books.

Reeves, B., & Nass, C. (1996). *The Media Equation: how people treat computers, television, and new media like real people and places.* New York: CSLI Publications.

Ring, G. et al. (2002). Impact Evaluations of Corporate eLearning. *Proceedings of E-Learn 2002* (pp. 41-46). Montréal, Canada: Association for the Advancement of Computing in Education (AACE).

Sano, D. (1996). Designing large-scale websites: A visual design methodology. New York: Wiley.

Sheets, M. (1992, Spring). Characteristics of adult education students and factors which determine course completion: A review. *New Horizons in Adult Education, 6*(1), 3-18.

So, S., & Lai, T. (2002). Could We Smell the Cooking over the Internet? An Interactive E-Learning Solution for Home Economics Using Synchronized Multimedia. *Proceedings of E-Learn 2002* (pp. 2195-2198). Montréal, Canada: Association for the Advancement of Computing in Education (AACE).

Stasko, J.T. (2002). *Questionnaire Design.* Retrieved February 10, 2003, from Georgia Institute of Technology, College of Computing/GVU Center. Atlanta Web site: http://www.cc.gatech.edu/classes/cs6751_97_winter/Topics/quest-design/

Stephens, L., & Leavell, J. (1999). Producing video-cases that enhance instruction. *Journal of Technology and Teacher Education*, 7(4), 291-301.

Stiward, I. (2002). *Introduction to a Questionnaire for Student Evaluation of Web-Based Instruction.* Retrieved January 30, 2003, from University and Community College System of Nevada Web site: http://www.nevada.edu/~stewarti/mathweb/quest/intro.htm

Stigler, W. (2002). Creating a knowledge base for teaching. *Educational Leadership*. 59 (6), 6-12.

Terrill, T. (2002). CD-ROM Enabled Web Sites. *Proceedings of E-Learn 2002* (pp. 2280-2281). Montréal, Canada: Association for the Advancement of Computing in Education (AACE).

Trant, J. (2002). *Multimedia Evaluation Criteria.* Retrieved February 1, 2002, from Archives & Museum Informatics, CIDOC Multimedia Working Group Web site: http://www.archimuse.com/papers/cidoc/cidoc.mmwg.eval.crit.html

Valaitis, R. et al. (2002). Health Sciences Students' Perceptions of Online Problem-Based Learning. *Proceedings of E-Learn 2002* (pp. 2317-2320). Montréal, Canada: Association for the Advancement of Computing in Education (AACE).

Vassileva et al. (2002). Advanced Interactive Web Technologies in Industry Training. *Proceedings of E-Learn 2002* (pp. 986-975). Montréal, Canada: Association for the Advancement of Computing in Education (AACE).

Vesper, J.L. (2002). Challenges in Providing e-Learning Solutions in the Regulated Pharmaceutical Industry. *Proceedings of E-Learn 2002* (pp. 41-46). Montréal, Canada: Association for the Advancement of Computing in Education (AACE).

Vora, P. (1998). *Human Factors Methodolgy for Designing Web Sites*. In C. Forsythe, E. Grose, J. Ratner (Eds.), Human Factors and Web Development. Mahwah, NJ: Lawrence Erlbaum Associates.: from Gabriele Mouty (1999)

Wai, K.M. (2002). An Introduction to the Text-to-Speech XML-Driven E-Lecture Delivery System. *Proceedings of E-Learn 2002* (pp. 2663-2664). Montréal, Canada: Association for the Advancement of Computing in Education (AACE).

Weinman, L. (1996). How to prepare images and media for the Web. Indianapolis, IN: New Riders.

Weston, T., & Barker, L. (2001). Designing, Implementing, and Evaluating Web-Based Learning Modules for University Students. *Edcuational Technology 41*(4), 15-22.

Wiebe, E.N., & Howe, J.E. (1998). Graphics design on the Web. In C. Forsythe, E. Grose, & J. Ratner (Eds.), *Human factors and Web development* (pp. 225-239). Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.

Wilson, S. (1995). *World Wide Web design guide: Learn to design professional Web pages*. Indianapolis, IN: Hayden.

Williams, R. (2002). *Web Design Workshop.* Berkeley, CA: Peachpit Press.

Willie, S., Pui, C., & Palmer, A. (1999). Remote Lecture Presentation Preferences for Internet Delivered Continuing Medical Education. *Proceedings of ED-MEDIA 99 World Conference on Educational Multimedia, Hypermedia & Telecommunications, 1999* (pp. 190-195). Charlottesville: Association for the Advancement of Computing in Education.