Interactive Multimedia in Education and Training

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Preface

There have been many experiments and innovations in the field of education and training regarding knowledge delivery. From face-to-face to virtual education, different technologies have played great roles at different times. In the last two decades, due to the advent of computer technologies, information delivery has got new meaning. Development, access, and transfer of text, sound, and video data have given a unique face to classrooms, libraries, and training and resource centers, in the form of interactive multimedia programs.

Interactive multimedia as a subject/topic is still in its stage of infancy, which excites and attracts educational technologists. However, design and development of an interactive multimedia program is a complex task involving a team of experts, including content provider(s), multimedia developer(s), graphic designer(s), and, of course, the instructional designer(s), who most of the time plays the role of a project manager as well. This book is not about multimedia development, but the subject matter delves into the complex issue of planning, guiding, and designing multimedia from the instructional perspective. As such, we address pedagogical issues, applications, and effectiveness.

What is Interactive Multimedia?

Multimedia has been defined in a number of ways. It is not our intention here to go into the details of these definitions. But, in order to clarify the use of the term in the context of the book, we would prefer to quote a few of them:

Definition 1: "Multimedia is the combination of a variety of communication channels into a co-ordinated communicative experience for which an integrated cross-channel language of interpretation does not exist" (Elsom-Cook, 2001).

This definition gives way for two approaches—one that is termed the "multiple-media" utilization, and the other in which a combination of different channels acquires unification as a medium. The latter approach leads us to the next definition:

Definition 2: "… multimedia can be defined as an integration of multiple media elements (audio, video, graphics, text, animation, etc.) into one synergetic and symbiotic whole that results in more benefits for the end user than any one of the media elements can provide individually" (Reddi, 2003).

Definition 2 essentially tries to emphasize the second approach of Definition 1 with more clarity and spells out the components of multimedia. Taking a systems theory perspective, it also tells us that the overall effectiveness of multimedia is better than any one component of it. But, neither of the definitions explicitly includes the "interactive" power of multimedia, as in Definition 3:

Definition 3: "The term 'interactive multimedia' is a catch-all phrase to describe the new wave of computer software that primarily deals with the provision of information. The 'multimedia' component is characterized by the presence of text, pictures, sound, animation and video; some or all of which are organized into some coherent program. The 'interactive' component refers to the process of empowering the user to control the environment usually by a computer" (Phillips, 1997).

Though the authors of various chapters use different words and phrases throughout the book, the intentions are invariably in tune with Definition 3 referred to above.

Multimedia has been a favorite area for organizations as a means of training employees. McCrea and others (2000) and Urdan and Weggen (2000) found online training being given preference by organizations, considering that with this method, employees can be trained in less time, with less cost, and more effectively than with other methods. It has been found that integrating multimedia into course delivery certainly adds to the advantages (Najjar, 1996).

Authors of the various chapters in this book critically examine interactive multimedia as a tool for education and training in various settings. Much has already been said in the literature about how-to aspects of multimedia development (Boyle, 1997; Phillips, 1997; Villamil & Molina, 1998; Lachs, 2000; Elsom-Cook, 2001; Low et al, 2003; Reddi & Mishra, 2003). Here, the authors make

an attempt to build a theoretical understanding based on experience and research. The pictures projected in all these chapters are successful implementation stories of multimedia, and how it is useful as an educational tool. Nevertheless, there is a huge amount of literature on "no significant difference." Kahn (n.d.), in a short review, questions the effectiveness of multimedia in online training but recommends that it has a place "where visual/ or auditory depiction could enhance the learning experience." Contributors of different chapters share their innovative uses of the potentials of multimedia, and this is expected to further motivate and guide other teachers and readers to use multimedia in their teaching. The chapters in the book are organized in three parts—planning and design considerations, pedagogical issues, and application and case studies.

Planning and Design Considerations

Planning for multimedia is a much broader consideration than the design and development issues. It is important because the implementation of multimedia-enabled teaching and learning has to be integrated into an already existing system and practice. Moreover, issues such as media mix, choice, and teaching—tem and practice. Moreover, issues such as media mix, choice, and teaching—learning functions should match the requirements of the subject. It is in this context that Patrick Fahy, in Chapter 1, discusses the characteristics of multimedia in relation to basic pedagogic tasks and organizational realities. He emphasizes that successful implementation of multimedia-enabled teaching and learning includes organizational change, changes in attitudes, and issues related to cost, acquisition of appropriate technologies, and human resources. In Chapter 2, Geraldine Torrisi-Steele provides conceptual guidelines and a planning framework for effective use of multimedia in education. Banerji and Scales in Chapter 3 review current developments in performance support systems and recommend use of interactive multimedia based on performance-centered design for teaching and learning. In Chapter 4, Loreen Butcher-Powell provides a theoretical framework for enhancing teaching through the use of Web-based multimedia. In Chapter 5, Yoshii and others discuss the Irvine-Geneva development strategy for computer-based learning materials that can be adaptable to many languages and cultures. Based on the experiences gained in the development of a group of software systems, the authors describe software characteristics and tools that can be successfully implemented in global education. In the last chapter of this part (i.e., in Chapter 6), Lisa Gjedde describes a narrative (storytelling) framework for designing multimedia learning environments.

Pedagogical Issues

Learning is primarily the process through which we become the human beings we are, and it takes place through a variety of media, strategies, and processes, of which interactive multimedia is just one. Using these media and technologies, we internalize information and knowledge available in the external world to construct our own experiences. Research into human learning is primarily categorized into three distinctive groups: behaviorism, cognitivism, and constructivism. There are others who also believe in experiential learning and andragogy. All of these have significance for the design and development of interactive multimedia. In this part dealing with theoretical issues, there are six chapters. In Chapter 7, Vassilios Dagdilelis discusses the principles of designing educational software and emphasizes that "construction of educational software should be based on some method; otherwise it is in danger of failing of costing too much or of being greatly delayed." Michael Sankey, in Chapter 8, continues the discussion of multiple representations in multimedia materials raised in the previous chapter. Sankey reviews the issue of multimedia literacy of learners and investigates the learning styles, visual representations, and cognitive constraints experienced by the learners when information is presented in multiple ways. Based on these analyses, Sankey suggests a set of 12 design principles. In Chapter 9, Paul Kawachi discusses a four-stage model for learning critical thinking skills using multimedia. The four stages of Design for Multimedia Learning (DML) model are brainstorming cooperative group learning using synchronous media, lateral-thinking collaborative learning using asynchronous media, hypothesis testing in a collaborative synchronous manner, and experiential learning in cooperative synchronous media. Though this model is more about multiple-media use in teaching and learning, it has a new innovative framework to offer in the context of use of interactive multimedia on the Web. Peter Doolittle and others in Chapter 10 focus on multimedia and the effect of cognitive load on teaching, training, and learning. Based on a review of research, they present seven principles of multimedia design:

Individuals learn, retain, and transfer information better

1. when the instructional environment involves words and pictures rather than words or pictures alone (multimedia principle)

2. when the instructional environment involves auditory narration and animation rather than on-screen text and animation (modality principle)

3. when the instructional environment involves narration and animation rather than on-screen text, narration, and animation (redundancy principle)

4. when the instructional environment is free of extraneous words, pictures, and sounds (coherence principle)

5. when the instructional environment involves cues, or signals, that guide an

individual's attention and processing during a multimedia presentation (signaling principle)

6. where words or narration and pictures or narration are presented simultaneously in time and space (contiguity principle)

7. where individuals experience concurrent narration and animation in short, user-controlled segments, rather than as a longer continuous presentation (segmentation principle)

In Chapter 11, Elspeth McKay examines contextual issues involved in interactivity of multimedia instructional materials and the cognitive style construct as a meta-knowledge acquisition process. From a human–computer interaction (HCI) perspective, she describes a framework applicable in Web-based educational systems. In the next chapter (Chapter 12), Retalis looks into the issue of interoperability of multimedia learning objects. This chapter describes a brokerage system for the exchange of learning resources.

Applications and Case Studies

Interactive multimedia has applications in a variety of situations in education and training, in corporate presentation, in advertising, and in many other areas. In this part, there are six chapters presented as illustrative case studies of the application of multimedia. In Chapter 13, José Rodríguez Illera describes the use of interactive multimedia in AIDS prevention. The design of the multimedia package adopts some of the lessons outlined in Parts I and II of this book, especially the use of role play as narrative and the social construction of meaning that make it a successful program. Katia Tannous in Chapter 14 describes some examples of multimedia use in engineering education that extensively uses the power of simulation. In Chapter 15, Balram and Dragicevic report a new embedded collaborative system for structuring and managing multimedia in cartography teaching and learning. In Chapter 16, Leo Tan Wee Hin and others describe a multimedia system for learning science in an informal setting of a science center in Singapore. The authors present a case of high-quality visualizations, interactivity, immersive experiences, and stereoscopic imagery in the multimedia virtual environment that contributes toward experiential learning and has the significant influence of the constructivist approach. In Chapter 17, Mike Keppell and others describe the use of multimedia in dental and health science courses. Using a case-based learning design and learner-centered approach, the illustrative multimedia examples demonstrate the importance of instructional design. In the last chapter of the book (i.e., Chapter 18), Felicia

Zhang reports on the use of interactive feedback tools to enhance language learning, in this case, Chinese Mandarin.

Conclusions

In education and training settings, interactive multimedia packages have been found to be used as library-based multimedia resources for teachers and students; as supplementary curricular material for a specific course; as a tool for teaching and reinforcing analytic and reading skills and for building an entire course around the use and creation of multimedia materials (Bass, n.d.). In the modern society, where computer and Net technologies are becoming indispensable, the learning technologies are found to be deployed in all sectors: schools, colleges, universities, and industries. The emergence of the knowledge and educational content industry, the emergence of virtual campuses of learning, the availability of new learning and training tools, and the deployment of such tools to meet the diverse needs of learners have greatly influenced education and training systems. The needs for lifelong learning, just-in-time training, and retraining led to the development of widely accessible and reusable digital multimedia content and learning repositories. As the contributors of this book point out, the advantages are multifarious: increased interoperability, reusability, and individualization of digital learning materials. The learners are benefited in terms of increased quality, relevance, and contextualization of their learning.

The primary objective of *Interactive Multimedia in Education and Training* is to document and disseminate relevant theoretical frameworks and the latest empirical research findings and showcase illustrative examples of multimedia applications in various disciplines. The 18 chapters included in this book have attempted to achieve this objective and shall be useful to teachers, researchers, educational administrators, and policy makers as a one-step reference point on innovative use of multimedia, based on sound pedagogical principles. Nevertheless, there are still gray areas, such as the assessment of multimedia packages, their costs, and return on investment (ROI). In spite of this gap, it is expected that this book will encourage teachers/trainers and administrators to plan, design, develop, and implement interactive multimedia in educational settings: in basic, secondary, higher, and further education, and in business and industrial training.

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Acknowledgments

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involved in optimizing the instructional designer–subject matter expert interaction; and knowledge management (project management, systems and processes). His current interests at the Institute focus on technology-enhanced authentic learning environments, online communities, problem-based learning, and learner-centered assessment.

Ngaire Kerse is a general practitioner at the University of Auckland, New Zealand. Her Ph.D. from the University of Melbourne was an evaluation of a comprehensive education program for doctors, and her continuing research interests aim to improve education for doctors, improve primary care of older people, and inform innovation in primary health care.

Elspeth McKay is a senior postdoctoral research fellow on Human-Computer Interaction (HCI), at the School of Business Information Technology, RMIT University, Australia. Elspeth has extensive industry-sector experience in computer systems. Her Ph.D. (Computer Science and Information Systems) thesis breaks new ground for effective learning from multimedia with innovative approaches to visual instruction. She also has a Bachelor of Business, with distinction (Business Information Systems), a Graduate Certificate of Applied Science (Instructional Design), and a Graduate Diploma of Education (Computer Studies). Her doctoral research identified that not all individuals cope effectively with graphical learning. Elspeth's research findings clearly identify the complexity of the visual learning environment, and outline prospects for customizing e-learning shells, based on ontological requirements. The prospect of customizing e-learning shells tailored dynamically to the requirements of individual learners has stimulated contemporary research into knowledge mediation, and the associated ontological strategies, of actual learning contexts with Web-enabled asynchronous learning frameworks, design and development of enhanced accessibility through touch screen technologies. Elspeth's continuing commitment to mentoring scholastic achievement is also evident in the number of her international invited Editorships.

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José L. Rodríguez Illera is the director of the Research Center on Virtual Learning of the University of Barcelona (Spain), where he also teaches courses on Educational Multimedia at the Faculty of Pedagogy. His recent publications include books on *Multimedia Technology for Teaching and Learning in Higher Education* (2003), *Virtual Learning* (2003, in press), as well as articles on "Electronic Reading," "Collaborative environments and task design in the University," and "Multimedia Learning." His work is also focused on research and development. During the last 15 years, he and his group have developed both educational multimedia applications and open tools addressed to teachers, many of them related to language learning. Current interest is on the study of comprehension strategies of digital multimodal texts.

Michael Sankey currently works at the University of Southern Queensland (USQ) in Australia as an instructional designer at the Distance and eLearning Centre and a teacher of Web Design in the Faculty of Education. Michael's current doctoral research is in the areas of the multiple representations of concepts when utilizing multimedia technologies and how the use of these electronic environments can enhance the learning opportunities for students, particularly for those students studying at a distance. With a background in art and design, Michael is passionate about the way in which aesthetically enhanced learning environments can better transmit information and concepts to be communicated to students of all backgrounds. He believes that the use of the Internet and online education hold wonderful possibilities for the future of education, particularly higher education.

Glenda Rose Scales is the assistant dean for Distance Learning and Computing in the College of Engineering at Virginia Tech (USA), where she provides leadership for implementing a world-class distance-learning program. She earned her bachelor's degree in Computer Science from Old Dominion University, her master's degree in Applied Behavioral Science from Johns Hopkins University, and her doctorate in curriculum and instruction from Virginia Tech. Dr. Scales began her career working for the Department of Defense in Fort Meade, Maryland, as a computer analyst. After completing her terminal degree, she accepted a major leadership position at North Carolina A&T State University, where she, along with the distance-learning team, launched the University's virtual campus. She has presented her research in Electronic Performance Support at national conferences and, most recently, a market research study on graduate distance-learning programs for working engineers at the American Society for Engineering Education national conference.

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