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EDITORIAL

David A. Mappin
Guest Editor

With this issue the Canadian Journal of Educational Communication begins its twenty-fifth year as a journal concerned with the use of technologies for learning and teaching. This seems to me a considerable accomplishment, both by the former editors of the publication, and by the Association for Media and Technology in Education in Canada (AMTEC) as well. It is to the credit of AMTEC that while the Board of Directors has always been amenable to compromise and to new approaches which have allowed the journal to continue and to flourish even during difficult times for the association. On behalf of all the former editors, thank you, to all of the Board members who have agonized over the issues involved in publishing a scholarly journal.

I would also like to thank those scholars and researchers who write for CJEC in both of Canada's official languages. Your active imaginations and diligence in your academic pursuits has helped make CJEC an interesting and vibrant publication.

Thank you, as well, to the members of the CJEC editorial board. These scholars work far harder than most people realize to provide a fair and in-depth analysis of the draft manuscripts which are sent to them. Finally, a thank-you to the Social Sciences and Humanities Research Council of Canada both for the financial support they have provided for CJEC in past years and will be providing for the next three, and for the peer comments received as part of the application process which help us to improve.

It is likely that CJEC will see some considerable changes between its silver anniversary and whatever anniversary some future editor may choose to celebrate. With an increasing focus on a networked world of electronic information it is only a question of when and in what form it will make most sense to put this journal entirely in an electronic form. However reluctant I might be, on an emotional level, to see that happen, there is no doubt that it must as all of us find and draw information from the prodigious stores that are developing and presenting themselves to our search engines, and soon, our search agents. I hope readers will work with us as we begin to form our ideas of an electronic journal. We ask that you provide feedback as to how you think access to the journal, peer review, and the editorial process might work. We expect to formally involve you in the process in the early fall when we send you a short survey asking for your opinions on receiving CJEC in an electronic form. Please watch for it and send in your comments.

As a celebration of what CJEC and the field of instructional technology/ educational communication have become, it seemed appropriate to mark our first quarter century by offering something of a retrospective on the field and the journal. We invited former editors to write short articles dealing with the field and/or CJEC during their term as editor. In this issue we present three pieces from the former editors Dr Richard Lewis, Dr. Denis Hlynka, and Drs. Robert Bernard and Stephen Shaw. I hope you will find it as intriguing as I did to reflect with them on where we have been and where we might be going.

From Magic Bullet to The Adaptive Learner

Richard F. Lewis, Ph.D.

In 1980, I started a term as editor of the *Media* Message. Early articles during this period focused on producing better messages and using media more effectively. As the name of our field changed from audiovisual media to educational communication and technology, the AMTEC Board and I felt that the magazine should change as well. The Association for Educational Communication and Technology had changed its title from *Audiovisual Communication Review* to the *Educational Communications and Technology Journal.* Beginning with the 1982 issue, we changed the name of the Journal to the *Canadian Journal of Educational Communication.* With the name change came a change in format and editorial procedures. We strengthened the procedure of peer review which encouraged the publication of better articles. This brief article reflects my perceptions of the field during the period when I was editor of the Journal.

The sixties and early seventies saw tremendous growth in all aspects of the education sector. A record number of children filled school classrooms. Universities all over Canada became established or expanded significantly. The late seventies showed signs of an economic slowdown and harder times coming. In our field, now being called instructional technology or educational technology instead of audiovisual media, change was also coming. During the sixties, Scarborough College had established its television campus. D.O. Hebb taught psychology to hundreds at McGill and the University of Windsor placed a TV in every classroom. Technology was the hope for dealing with the increased numbers of students. Individualized instruction had become a buzz-word. It really meant that students could work through material at their own pace.

The Search for the Magic Bullet

Three very similar theories of communication underlay the field: the mathematical theory of communication (Shannon and Weaver, 1954) and the Source-Message-Channel Receiver model (Berlo, 1960) and the work of Schramm's notions of the receiver as interpreter and two-way flows. Communication theorists have called this era the search for the Magic Bullet, which was a message designed so well that it could overcome noise and channel limitation to communicate with all who heard/saw it (Lowery and DeFleur, 1983). The well-designed message theory also formed the basis for university, college and probably late high-school instruction. If the teacher could only get the lecture right, all

students would learn. If they didn't, we just flunked them out. At first, communication and instructional media efforts were concentrated on faithfully reproducing instructional effects using new technologies. Well-researched, designed and produced instructional effects would achieve desired objectives with the students.

Evaluation Uncovers Shortcomings of the Magic Bullet Theory

Federally-funded programs both in the U.S. and in Canada called for evaluations. Every new initiative contained an evaluation component to determine whether the objectives had been achieved. Funding agencies wanted to make sure that money spent resulted in increased learning or efficiency. Goal-based evaluation, used standardized tests and other objective methods. But change was in the wind. Goal-based techniques gave only a partial picture of a phenomenon, measuring only what they thought should happen. Goal-free evaluation by contrast measured change without knowing anything about the intervention. Morin (1980) used anthropological methods to develop an evaluation system. His techniques focused on involving students at every phase of instruction and evaluation. He made extensive use ofjournals and participant observers to collect evaluation information which was used to improve instruction. Piaget's theories yielded another evaluation method which Baron (1982) used to research children and television. In La Method Clinique, the child's responses were used to guide the collection of information used to do basic research or to evaluate. These later methodologies revealed that we could not simply focus on the medium but had to consider the mental world of the learner.

Using Additional Learning Theories

Pioneers in the field used behavioural psychology as a theoretical base in which the response is the key element. The purpose of instruction is to achieve the desired response by reward and punishment and shaping. The teacher had to define the required response and then create minuscule instructional steps to lead the learner to the desired behaviour. Instructional technologists developed programmed instruction which used small units of information requiring a response. These small units were chained to form complete lessons and have the learner perform complex learning tasks. Fear of failure and encouraging words were two of the most commonly used control mechanisms to help students learn. But despite their comprehensiveness and obvious effects with most learners, programmed instruction and most other instructional materials did not work for all learners. Blaming the learner for failing to learn began to be questioned. Evaluations ofvarious programs at all educational levels had demonstrated that we had not discovered the magic bullet. Ball (1970) conducted the evaluation of *Sesame Street,* one of the first evaluations of a television series. *Sesame Street* had also incorporated formative evaluation to improve segments before they went to air by suggested changes to production variables. The early *Sesame Street* evaluations found that despite the program's success with middle and upper class children, it failed to achieve its

objectives for its primary audience: the inner city poor. Instead of focusing on producing better media programs, we needed explanations and so searched for other theories which would explain how students learned (Salomon, 1974). By the mid-seventies, we began to explore other theories of learning such as social learning theory, information processing theories and attitude change theory.

Tremblay (1982) improved on traditional instructional design models by using theories of Salomon and Schramm to suggest that we needed to examine how the learner processed information when designing instruction. Different learners needed instruction presented using different instructional strategies; some needed pictures before principles, others the reverse. Winn (198 1) suggested that since learners might be more flexible than originally thought, the learner could be cued to the learning task, in preparation for instruction. Schwier (1980) suggested a number of techniques to improve self-instructional models, based mainly on motivation theories. Fleming and Levie (1978) presented effective message design principles drawn from theories of perception, memory, concept learning and attitude change and motivation.

To the Future

The early 80s formed the basis of most of the principles we practice in the field today. Communication theorists like Fiske (I 990) suggested that a student be seen as a reader, making unique meaning from each text he/she sees. As Winn (198 1) suggested, learners can be taught how to learn because we need not assume that a learner's traits are immovable but changeable. I have always wondered why advertisers succeed in communicating much better than educators. I think it is because they know their audience much better than we know ours. They continually research this audience, charting its every mood and altering the message to meet latent and expressed needs.

As educational technologists moving towards the millennium, we need to learn more about our target audiences. We need to find out what they think and feel. We need to help them learn how to learn by preparing them for the instruction we provide, and for life. Tools like the World Wide Web will require us to teach students how to find, understand and interpret information instead of just remembering and regurgitating it. But while teaching students how to learn, we will still need to produce effective instruction, incorporating all the early emphasis on message design and the production of excellent mediated messages.

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The Last Word: From "Audiovisual Education" to "Information Technology"

Denis Hlynka

In honour of 25 years of AMTEC, former CJEC editors have been asked to comment on their "era" within the field of educational technology in Canada. I was editor for three years, from 1983 to 1985. I shall concentrate on only one aspect of my twelve issues. On the back cover of ten of those twelve issues appeared a feature titled "The Last Word". The intent of this wrap-up of each issue was to present relevant, thoughtful and significant comments from the field, presented without further elaboration, as a kind of Bartlett's Familiar Quotations for educational technologists. It is appropriate to look back at these quotations as indicators of past thinking and finally, now over a decade later, to provide some commentary, especially in light of current developments in our field. We turn to the Canadian Journal of Educational Communication, volume 12, #1, from Autumn of 1982. The very first quotation which inaugurated "The Last Word" page set the mood for what was to come: a definition of educational technology couched in a warning. The original statement was dated 1971, yet is remarkably current for 1996, some 25 years later:

> *"There is no technological miracle in education. Neither the hidden camera, nor the computer, norprogrammed learning can provide "instant" education. Educational technology is not a bag of mechanical tricks, but the organized design and implementation of learning systems, taking advantage of but not expecting miracles from modern communications methods, visual aids. classroom organization and teaching methods." (J R. Gass, director, Center for Educational Research and Innovation, 1971.)*

It is particularly interesting to read in this "definition" the now unpopular phrase "visual aids" paired with contemporary technologies represented by the "computer." Indeed, in 1995, one may speculate that the "visual aids" component of educational technology has been almost totally lost. When we talk about educational technology today, we seem to more often mean "information" technology. Multi-media no longer means using a variety of media, but a technological convergence of media into one computer-based delivery system. It is as if we are putting "all our eggs in one basket." We know that educational technologies have had only limited success in the classrooms of the past, yet if we persist in extravagant claims that this next medium is to be the master medium we may be in for a rude awakening. The history of technology is not a clear linear

and unexpected factors. Is their still room in educational technology for film, television, overhead projector-n use, slides, still pictures, and the chalkboard? Or have all of these now been digitized?

All of this leads us into the "Last Word" from Winter of 1983:

> *"'No other generation has been made so poignantly conscious of the perils of doing good We know that to set out to do good is to run the gauntlet of baffling, grotesque side effects. " (Eric Hoffer, Last things, First things, 1971).*

This CJEC volume I2 #3 quotation was a warning about technological side effects. In a time before Internet, society was well aware that technology could do strange things. It is not enough to want to "do good". It is not enough to be convinced that "information technology" will transform education for the better. Indeed it might, but the future technological classroom is not automatically so, just because it is a wonderful idea. Hoffer's statement is a warning, one which is still relevant.

> *"For the most part, teachers who do use educational technology are the ones who feel comfortable in handling media. Their attraction to non-print resources, then, is not based upon a revolutionary concept of education, but on sheer utility. " (To Know Ourselves, 1978).*

Volume I2 #4 quoted the important 1978 document titled To Know Ourselves. The argument of this government paper was that Canadian culture is at risk, and that it is imperative that as Canadians we begin "to know ourselves." Significantly, one section of this far ranging document dealt explicitly with teachers and educational media. Teachers must be comfortable in using the media, or else they will ignore it. Today the phrase "computer literacy" captures the same phenomenon.

Volume 13 #1 of the Canadian Journal of Educational Communication came out in January 1984. Surely the most appropriate quotation would come from George Orwell's futuristic novel titled 1984. He wrote it in 1949, and now, 1984 was here. From that novel, we discovered this dark prediction:

With the development of television, and the technical advance which made it possible to receive and transmit simultaneously on the same instrument, private life came to an end.

In summer 1994, the AMTEC conference was held in southern Ontario. One of the conference events was an evening at the famed Stratford festival theatre to see a performance of Shakespeare's Love's Labour Lost. It has been said that Shakespeare had an answer to everything, so the challenge was to find a quote within the play relevant to education, teaching or learning. In act 4, SC. 3 line 3 12 we found

> *"Learning is but an adjunct to yourself"*

Some 300 years later we think we have invented "constructivist" philosophy which argues that it is not enough to think that knowledge is merely given to the

progression of progress, but rather an evolutionary development based on disparate learner, but that it is also created by the learner. Knowledge is not independent, but is an adjunct to our own culture, knowledge and interests. Apparently, Shakespeare knew that, too.

Time Magazine on May 3, 1982 featured an article on computers with the thoughtful statement that

> *"The only difference between a machine and us is that a machine is an answer and we are a question. "*

That statement became "the last word" for Volume 13, #3.

The Volume 14 # 1 "last word" came from a 1993 speech by Arthur C Clarke. He was commenting on how difficult it is to predict the potential of communications devices, even for enthusiasts.

> *"There is always something new to be learned from the past... The mayor of a certain American city was wildly enthusiastic. He thought that the telephone was a marvellous device and ventured this stunningprediction. "I can see the time, " he said solemnly, "when every city will have one. "*

The Volume 14 #2 quotation is one of the most famous non-statements every made about the non-impact of educational technology. It is meant to be the summary of a noted research study. Written in flowing, informed and confident language, nevertheless the astute reader quickly realizes that what the glowing lines really say is "we don't know anything about the effects of television". Here they are:

> *"No informed person can say simply that television is bad or that it is good for children. For some children, under some conditions, some television is harmful. For other children under the same conditions, or for the same children under other conditions, it may be beneficial. For most children, under most conditions, most television is probably neither particularly harmful norparticularly beneficial, " (Schramm, W. Television In the Lives of our Children.)*

Yet, in a way, this seeming non-statement is indeed critically important. Research has shown that we can substitute the word "film" for television, or "programmed learning" or any other technology. Including computers. Even the Internet. So why is education spending more money than ever in a time of retrenchment? This is not to say that money shouldn't be spent, but rather that we need to think clearly what we really are doing, what our goals are and where we think we are headed. It is a salutary and cleansing experience to stop and think, at least once in a while.

Shramm's statement is important because he is right.

P. Hosford (1973) looked at the methodological side of instructional research and issued a warning with respect to quantitative measurement techniques in education:

"It is necessarily impossible to determine the absolute value of any instructional procedure by any experiment whatsoever. "

Finally, the last quotation to appear under the heading "the last word" in the Canadian Journal of Educational Communication focuses on issues of plurality, multi-culturalism, and a shift away from a "one best way" towards multiple ways of viewing the world. And yet this postmodernist quotation is 200 years old, and comes from Benjamin Franklin:

> At the treaty of Lancaster, in Pennsylvania, anno 1744, between the government of Virginia and the Six Nations, the commissioners from Virginia acquainted the Indians, by a speech, that there was at Williamsburg a college with a fund for educating Indian youth and that if the chiefs of the Six Nations would send down half a dozen of their sons to that college, the govermnent would take care that they be well provided for and instructed all the learning of the white people. The Indian's spokesman replied. We are convinced that you mean to do us good by your proposal, and we thank you heartily. But, you, who are wise, must know that different nations have different conceptions of things, and you will not therefore take it amiss if our ideas of this kind of education happen not to be the same with yours, We have had some experience of it,. Several of our people were formerly brought up at the colleges of the northern provinces. They were instructed in all your sciences. But, when they came back to us, they were bad runners; ignorant of every means of living in the woods; unable to bear either cold or hunger, ; knew neither how to build a cabin, take a deer, nor kill an enemy; spoke our language imperfectly, were therefore neither fit for hunters, warriors, nor counsellors; they were totally good for nothing. We are, however, not the less obligated by your kind offer, though we decline accepting it, and to show our grateful sense of it, if the gentlemen of Virginia will send us a dozen of their sons, we will take care of their education instruct them in all we know, and make men of them.

So, what does all of this say? Our quotations have focused on multiple voicing, alternative genealogies, critical analyses, cultural criticism, hopeful predictions. All of this was pre-1985.

Then it happened. Concepts like postmodernism, deconstruction which had been stirring in the background, suddenly hit full force. Feminist literary theory took one particular perspective, while cultural studies focused differently. Derrida, Foucault, Eco, and Lyotard became household names.

Educational technology became enmeshed in a philosophic and ethical dilemma. On the one hand, Educational technology products and programs presented a single best way. Film, television and computers were supposed to be a better way to learn. Content presented via these media were not normally the concern of instructional designers, but of subject matter experts. On the other hand,

new technologies such as the Internet became a proving ground of postmodern philosophies. Good and bad, naive and sophisticated, racist and neutral, beautiful and ugly, useful and useless. All kinds of content began to appear on listservers, on discussion groups, and on Web pages. "Every hue of every view" can now be found in a postmodern jungle of data and information. Today we are trying to hack our way through this verbiage. Most educational technologists believe that these technologies have the potential to change education for the better. But we are forewarned that the path is neither easy nor obvious. The quotations which appeared in CJEC under the heading "The Last Word" point to our awareness of the aspirations and the contradictions which occur in our search for a better way.

The Canadian Journal for Educational Communication should not be a search for the ultimate best way to teach and to learn. Rather, CJEC should become a chronicle of the ways we have tried to present technological approaches to learning over 25 years. To go back over 25 years of the issues of CJEC will provide a historical continuity which can shed much light on what we do today.

It seems then, that "The Last Word" is yet to come, and indeed, in a true postmodern sense, what we have learned is that there cannot be and should not be ever a "last word."

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CJEC: THE YEARS 1986 TO 1989

Robert M Bernard
Steven Shaw

In 1986 CJEC went through some fundamental changes, in terms of editorial policy, format and production process. In that year a working editorial board was established and each manuscript was reviewed by at least two and most commonly three peer reviewers using a double blind system (i.e., neither reviewer nor author knew the name of the other). This process increases the chances of fair treatment for both author and reviewers.

In this issue the format of CJEC was changed from that of a magazine to a format more in keeping with that of other academic journals. This format has been retained to the present, although more recent editors have had the good sense to remove the stylized CJEC logo from the front cover.

The production process for the journal also changed radically. For the first time Desktop Publishing software running on a Macintosh microcomputer was used to create on-line pages which were output, initially, to McGill University's newly installed Linotronic 300 typesetter. We were McGill's first Macintosh customer. Later the cost of this output process ($4.00 per page) became prohibitive and the camera-ready pages were output on the Department of Education's newly acquired 300 dpi laser printer.

The contents of CJEC during the following three years varied widely from profiles of development projects to experimental studies, but three areas can be identified as significant departures from the usual unsolicited content. These areas are: formative evaluation, computer mediated communication and the series of articles addressing the future of educational technology. These three areas will be discussed in turn.

Formative Evaluation

The first issue of 1986 (Vol 15, No. 1) was devoted to an examination of issues and techniques associated with the process of conducting formative evaluation. Formative evaluation as we have all come to know is "evaluation of educational programs during their development phase; an evaluation for the purpose of improvement" (Weston, p. 5). She goes on to list four variants of formative evaluation that are suggested in the literature: expert review, developmental testing, the three-stage model and learner verification and revision. She describes differences among the variants, procedures for obtaining feedback from students, considerations for selecting an approach to formative evaluation, the process of revision once formative data has been collected and analysed and the application

of formative evaluation to any medium. After all of this, she concludes by saying "The evidence is consistent; any kind of formative evaluation, any kind of review, improves instructional materials and improves student learning." (p. 16).

In the same issue Baggaley focused on the formative evaluation of educational television using the then novel Program Evaluation Analysis computer (PEAC). This device "employs a set of push-button hand-units to record the responses of individual audience members on measures such as interest value and credibility" (p. 32). He goes on to describe the development of the PEAC system and its educational application at Concordia University. Three case studies are presented as examples of how the system works and how data resulting from testing are analysed and used to make educational decisions: the U.S. presidential debates; the impact of smoking prevention films and formative evaluation of a skin cancer film. He ends with the warning that this technology will undoubtedly be used in the political and commercial arenas to fine-tune persuasion techniques, but hopes that it will also emerge as a powerful tool "leading to an increased awareness of the public's needs and to an understanding of the differences and similarities between cultural groups:" (p. 42).

In the final article focusing on formative evaluation, Parsons and Lemire present an overview of the formative evaluation process at TVOntario. They focus on ways of interacting with audiences and the different stages of production when formative evaluation can occur. While they point out what formative evaluation cannot guarantee the improvement of educational media products, given the constraints of producers, evaluators, the budget and time available, they conclude that it is a valuable tool to make a product that more precisely responds to the needs of the audience.

Computer Mediated Communication

In the spring of 1987 (Vol. 16, No. 2) we put out an issue on computer mediated communication (CMC) and its educational applications that, from the point of view of dissemination, was the most successful issue of the four year editorship. In all, more that 1100 copies of the journal were sent to members and subscribers, through mail purchases and through sales at a CMC conference at Guelph University.

The first article of this special issue was by Don Beckwith who describes the potential of CMC for group problem-solving. He states that "Computer conferencing has the capability of bringing like-minded and not so like-minded individuals together for a variety of social interactions which can range from information exchange, through social interaction, to purposeful change through group problem-solving" (p. 90). He goes on to describe what problem solving is and concludes that group problem solving is the "mutual creation of an original, synnectic process – using relevant media and human and non-human resources – that will yield an original systemic product specifically designed to satisfy a substantial and verified social trend that has not been sufficiently satisfied through traditional means" (p. 92). The then compares what he sees as the ideal situation for group problem solving via CMC with the status quo. He concludes these sections

by saying that "While successful group problem-solving is a rare commodity at a best, it would seem that it could be achieved via computer conferencing. What is needed is a) an operational definition of successful problem-solving; a set of principles and heuristics to be followed in the application of computer conferencing to group problem-solving; and c) suggested ways of researching the effectiveness and efficiency of computer conferencing-based group problem solving" (p. 99). He lists the principles of dynamism, anonymity, accessibility, control, catalysis (i.e., from catalyst) and the system as necessary ingredients for the fulfilment of the ideal. He concludes by saying that the ideal is achievable, but only through the application of "a) the operational definition of group problem-solving; b) the group problem-solving models; c) the principles to effect group problem-solving; d) the essential capabilities of the system; e) the interaction analysis instrument; and f) the suggested research approaches" (p. 104).

The next paper in this issue (McCreary & Van Duren) focused on the application of the CoSy conferencing system at the University of Guelph. First, ten educational functions of computer conferencing were identified and explained. These functions ranged from "the notice board" to "inter-community networking". They then identified the factors that influence student conferencing behaviour, namely accessibility and perceived benefits. They conclude by providing recommendations for successful academic conferencing. These are described as: a) preparation for the student participant; b) on-going advice and assistance; c) recognizing the problems of working at a distance; d) preparation for the instructor-moderator; and e) the actual moderation process.

Tony Kaye reports on the application of CMC for distance education at the UK Open University. In the last section of the paper, entitled Looking Ahead, he makes three points that are to him important for the successful adaptation of CMC to distanced learning contexts, The first is the need for easily available equipment and software in students' and tutors' homes. The second as he says requires the "active, cooperative and group involvement of learners, otherwise the technology will merely be used as a substitute for noticeboards, written mail or one-to-one telephone contact; but it is not evident that distance learners, used to study at home will want to adopt a conferencing medium which involves group involvement" (p. 164). His third point is an important one. He says that it is the motivation and skill of tutors that will determine the success or failure of CMC in distance learning environments. "Tutors are only liable to accept and use the technology if they find that it helps them organize their time more efficiently, and/or if they find it more effective and stimulating than their traditional modes of interaction with students" (p. 165).

The final section of the issue is the reporting, in three ways, of the results of a computer conference that was held among the invited participants from Roger Hart in British Columbia to Tony Kaye at the Open University in England. The first segment demonstrates what CMC on CoSy actually looks like to a participant on the system. The messages have to be strung together by the user in order for threads of meaning to be found. The second segment demonstrates how a future generation of computer conferencing system (now already upon us) could thread messages

together for the user so that the meaning can be more easily grasped. The third section, entitled Collective Intelligence, is a reconstruction of various parts of the computer conference into a message that is entirely different from the intended meaning and explores a possible attribute of CMC editing in systems of the distant future.

The Future of Educational Technology

The third and final special issue (Vol. 18. No. 2), published in the summer of 1989, was a forum offering reflections from seven commentators concerning the prospects for the field of educational technology. The idea for the forum was inspired by an article written by David Mitchell, published in the previous issue, entitled The Future of Educational Technology is Past. This was one of a series of perspective articles which we solicited, addressing the broader issues in the professions of educational technology and communications, which were published in the first issue of each new volume.

Mitchell's article was certainly provocative. His thesis was that educational technology has been derailed. In his view the original intention of professionals in the field, viz, to develop educational technology as "the central human discipline of the future", had been forgotten, subjugated to the imperatives of short-term survival and credibility. In the process, the true purpose of educational technology, which he identified as nothing less than a radical transformation of learners and learning processes which could contribute to the solution of global social and economic problems, was "lost within the mists of routine applications of standard (though not necessarily valuable) procedures" (p. 5).

Mitchell argued the need for more sophisticated representations of the phenomena addressed by the field. In particular, "each person and educational technologist must learn how to express models of their own activities that have sufficient alternative courses of action from which to choose" (p. 20). It was his thesis that the field could only be salvaged by abandoning the traditional approach to research and theorizing, which focuses on isolating and manipulating variables to infer casual relations, In its place, he maintained, we should adopt a systemic approach, more specifically a hybrid of cybernetics and control theory that might afford us the powerful unifying theory he maintained was lacking and needed, and thereby the models to which he referred.

The reactions to Mitchell's polemics were varied. Beckwith replied that educational technology already has a unifying theory. However, the theory he sketched in his response really amounted to a visionary statement comprising a set of beliefs and values concerning how the field should be oriented. At the core of Beckwith's vision was the concept of empowerment: the development of the capability within learners to structure their own environments for meaningful learning.

Several commentators took issue with Mitchell's claim that educational technology had failed. Hannafin pointed out that there are many fields within the profession of educational technology. Some at least, such as flight training or medical training, have enjoyed considerable success. Likewise, Duchastel and Winn

both pointed out that even routine, systematic methods have proved valuable within the narrower contexts of training. Hannafin also noted that, in any event, the failure of educational technology to make a truly significant contribution to the solution of global societal ills was not unexpected and should not impugn the field. As he expressed it, "we cannot reasonably assess the potential or performance of educational technology by its lack of impact on problems for which it was neither intended nor implemented" (p. 140). Duchastel seemed to echo this view when he rejected what he described as Mitchell's radical, change agency conception of educational technology, a view which he implied could only perpetuate unproductive attempts to foist solutions on an unreceptive system.

The commentators were divided, also, on the matter of a unifying paradigm for educational technology. Torkelson agreed largely with Mitchell's analyses, but he warned that the task of creating an appropriate control system would be enormous. He cautioned that in the short term we may only be capable of effecting "a kind of triage, treating only those learners most seriously ill educationally" (p. 147). Hannafin, on the other hand, rejected the call for a consolidation of the field, arguing that there is tremendous strength and vitality in the existing diversity of subfields and methodologies.

Other commentators rejected Mitchell's arguments in favour ofcontrol theory, while still acknowledging the need for some sort of paradigm shift. Winn and Duchastel both argued for psychology as a basis for the field, rather than control theory. Winn also argued that we ought to focus more on factors relating to cognition that are predictable, such as preattentive perception. Duchastel, for his part, called for a change in orientation away from instruction to the design of learning environments and made the point that Mitchell's proposal still posited "a refinement of control through instruction, even if that control is meant to be more responsive to student needs" (p. 138).

Kerr went further, pointing out that systems theory has been tried in many other complex fields, without any conspicuous success. He hinted that, given the need to come to terms with the social and political contexts ofeducational systems and their diversity, it might be more helpful to employ qualitative, ethnographic approaches.

Finally, some of the commentators picked up on another distinction, one perhaps closely allied with the distinction between radical and routine embodiments of the field: the distinction between practitioners and scholars of educational technology. Winn concluded that Mitchell's view of the moral and intellectual bankruptcy of the field applies more to scholars than practitioners. In a similar vein Kerr exhorted educational technologist to work within the educational system: to become practitioners and activists versed in the social and political dimensions of the educational sphere.

Wrap-up

Aside from improving the quality of CJEC over the four year period of our editorship, three other goals were set. One was to increase Canadian subscriptions. The second was to increase the international awareness of the journal. The third was

to introduce French content into the journal. The first goal was largely achieved. There was a threefold increase in subscriptions and AMTEC memberships during this four year period. The second goal was not achieved to any significant extent, even though we advertised abroad and put flyers in one issue of the *British Journal of Educational Technology.* We were moderately successful with respect to the third goal. Two French papers were published in Volume 17 and since that time French articles have appeared sporadically and French-language abstracts appear for every paper. All in all, we feel that we passed on a journal of superior quality to the next editor, Richard Schwier.

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WWW TO SUPPORT CLASSROOM TEACHING

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Abstract: This paper evaluates the usage and perceived usefulness of the World Wide Web (WWW) to support classroom delivery of University courses. The study used qualitative and quantitative tools focusing on two undergraduate classes. Roger's (1995) theoretical mode1 for adoption of innovation was used to identify and classify barriers to adoption of this educational innovation. An author developed survey instrument was administered to student participants and two focus group style class interviews were used to triangulate data from the survey instruments. Descriptive details outlining the process of developing WWW documents and navigational aids are provided.

The study revealed that the WWW is perceived by students and instructors as a valued education enhancement. There were, however, significant barrier to adoption including access restrictions, questions related to relative advantage ofthe technology, and problems in the creation and organization of large quantities of WWW pages.

Résumé: Cette article évalue l'usage et l'utilité perçue du Web comme élément de support dans l'enseignement universitaire. Cette étude, visant deux classes universitaires de niveau premier cycle, utilise des outils appartenant aux méthodes de recherche quantitative et qualitative. Le modèle théorique de Roger (1995) sur l'adoption et l'innovation aete utilisé afin d'indentifier et de classifier les contraintes reliées à l'adoption de cette innovation en éducation. Un instrument de sondage a été administré aux étudiants participants. Deux entrevues de groupe des classes ont été utilisé afin de trianguler les données provenant des sondages. Des détails de nature descriptive illustrant le processus de développement de documents sur le Web ainsi que des outils d'aide d'utilisation du Web sont suggérés.

Cette étude révèle que le Web est perçu comme élément d'amélioration en éducation et cela par les étudiants et les éducateurs. Toutefois, des contraints d'adoption ont été soulevées quant aux restrictions d'accès, les avantages de la technologie et les difficultés de création et d'organisation d'un grand nombre de pages du Web.

Perceived Effectiveness of the World Wide Web to Supplement University Level Classroom Instruction

The World Wide Web (WWW) (December & Randall, 1994) has emerged as a user friendly system for accessing information and communication resources on the Internet. This ease of use, coupled with exponential growth in the number and quality ofresources to be accessed, has resulted in the large popular and professional interest in developing applications using this medium. Educators are experimenting with ways to apply the concepts and tools of the WWW to learning and teaching applications (Saltzberg & Polson, 1995). This article reviews the process of creating WWW pages for support

of classroom delivery in two undergraduate courses at the University of Alberta. The paper also presents students' and teachers' data relating to perceptions of the effectiveness, utility and data on usage. It documents both the benefits and the problems that accompany WWW use and notes the need for critical evaluation, rather than impulsive adoption of the technology.

Theoretical Base

This study is based upon the model of adoption of innovation described by Rogers (1995). Rogers' model has been used for over 30 years in many contexts and has been found useful to understand the process of adoption of both technological and non-technical innovations. Rogers (1995) postulates that during the persuasion stage of adoption, when potential users are making initial adoption decisions, five characteristics of the innovation influence the rate of adoption. These characteristics are relative advantage, compatibility, complexity, trialability and observability. The results of this study address each of these issues and it is hoped that the somewhat detailed documentation of the process of creation and administration of this innovation will serve to enhance the "observability" of the innovation.

Research Questions

The theoretical model gives rise to two research questions bearing on the process of adoption and use of new technology:

1. Is the WWW perceived by students and instructors as a valuable aid to the teaching/learning process?

2. What are the barriers (as perceived by both teachers and students) to adoption and use of this technology?

Literature Review

The world wide web (WWW) is a hypertext system which has been enhanced by the capacity to link not only text, but graphics, audio, video files and executable programs that are located anywhere on the Internet. To be effective, such a hypermedia system must be more than a linking of multimedia resources but must, in Jonassen's words, be a "network of nodes that are conceptually organized and interrelated by a linked structure", (Jonassen 1991, p.84). Determining an optimal design of this linked structure is a challenge to educators (Park, 199 1). Jonassen (1988) noted that one of the advantages of hypertext is the capacity to "represent in its own structure and presentation the structure of knowledge that it is attempting to convey". However, designing hypertext structures that mirror both the supposed structure of the knowledge domain and provide useful navigational learning paths through this domain is not an easy task. Further, some authors have claimed (Jonassen, 1988, MacAleese, 1990) that hypertext structures are ideal learning environments in that the complex linking structures, which can be created within

the learning materials, match the internal processing which takes place in the learner's brain. However, even if this assertion is true, it does not necessarily imply that learning is improved through use of structures which may model human brain activity (Morariu, 1988). WWW designers are thus presented with at least two different models for organizing their materials, one which looks to the subject matter to logically define the structure and a second which attempts to create a cognitive web which mirrors the students mental conceptions. In the cases described in this study, the designers have taken the former route and relied upon a highly structured overview of materials, designed to mirror the process of software engineering and the hierarchical classification of entomology.

Unlike more structured computer based learning modules, the hypermedia structure of the WWW maximizes learner control in that learners are free to follow or create multiple paths through the subject domain. Too much learner control, especially in large and complex hypertext documents, often results in students becoming disorientated or lost in the material (Park, 1991) with resulting frustration and lack of adoption. The designers in this study made special efforts to design navigational systems into the hypermedia so that students would have consistent guidelines and retraceable paths to guide their navigation through the subject domain. The success of their efforts, in reducing cognitive disorientation, should be reflected in the students' perception of relative advantage and thus, adoption.

Study Design

The study was exploratory in nature and used a mixed methodology employing qualitative and quantitative data to answer the research questions. The qualitative analysis was based upon case study analysis of the creation of the W WW coursewares, interviews with instructors using the WWW, a focus group interview with students enrolled in WWW supported classes, and responses to open ended survey questions. Quantitative analysis consisted of an author-developed questionnaire (http://nvquist.ee.ualberta.ca/~wjoerg/SE/forms/Ext_Q1.html) which was administered to students in a third-year software engineering course and to students in a second-year Entomology course.

Quantitative analysis of the survey was complicated by the different use of the WWW in the two classes. As Clarke (1983, 1994) has conclusively argued, the use of instructional design of an educational technology has a larger impact on learning than the technology itself The two sample classes used the technology in quite different ways, thus, combining the data tended to obscure rather than inform the research questions. Analysis of the classes in isolation reduced the sample size below levels upon which valid inferences could be made, and thus, data analysis was largely descriptive and must be considered as very exploratory. This paper focuses primarily on data from the software engineering students, and makes reference to the Entomology class only in comparison. The authors acknowledge that the different context of learning precludes direct comparison between the two case studies. We have however, included presentation of data in side by side format to illustrate perceived differences by student participants – we caution the reader to keep in mind that comparing apples and oranges helps us

understand fruit salad more than the qualities and characteristics of either fruit in isolation!

The Teaching/Learning Context

Objectives for using the WWW. The objectives for enhancing the classes with WWW tools were to:

1. build a set of highly structured and linked documents, with clean graphics and colour, suitable for class presentation;
2. make this set, plus additional in-depth material, accessible to the students for exploration and review "anytime", "anywhere";
3. provide an omnipresent opportunity for interaction between students, teaching assistants, and the instructor;
4. develop a mechanism to keep students, continuously informed about deadlines, project news, report formats, and problem sets;
5. simplify and automate the collection and evaluation of weekly logs and other submissions.

Summary of the main WWW concepts. The World Wide Web is a non-hierarchical, global system for accessing digital information. Although WWW display programs, called browsers, can display information designed for many Internet applications, the native language of the WWW is Hypertext Markup Language (HTML). HTML documents are in plain text format and can, therefore, be created using any text editor. Such text consists of the original text information annotated (or marked up) with "tags" to allow for formatting of the text, inclusion of graphics, sound or animation clips, highlighting of text or pictures for reference to other information, and setting up of input fields for interaction.

HTML supports a few simple but powerful concepts applied in a consistent manner. The most significant concept – linking- is a unified addressing scheme to access other documents (text, segments, graphics, sound or video) locally or externally at any site on the Internet with a simple mouse click. A link (or HREF) may originate from various entities such as arbitrary sized text strings, pictures or selected areas in pictures. Such origins are displayed visibly by net navigators by underlining, colouring or framing the active area (hot spot). The destination of a link is described by its URL (Universal Resource Locator) consisting of the transmission scheme, the site address, and the directory path.

Links are followed by simply "clicking" on the active area of a link origin which causes the target document to be retrieved and displayed. Most browsers offer two buttons to provide sequential access of previously visited documents. The explored links can be traced backward, using the "back" button, and forward navigation, along earlier "backed" paths, is achieved through the "forward" button. Such sequential access can become tedious, therefore, browsers keep track of visited documents in a history menu, from which documents, visited earlier in the same session, can be selected randomly. The links to documents of particular interest can be saved from session to session as bookmarks.

Another important concept – forms – provides for user interaction through fill-in forms, which can be created at will with text input, check boxes, radio buttons, and hidden text. We have extended the basic e-mail feature on our server with a service that recognizes the various forms created for these courses, authenticates submitted forms, transforms them into an annotated e-mail message, and dispatches it to one or more destinations depending on the submitter's request. The authentication mechanism allows for form-dependent password specification and monitors the number of form submissions against limits specified for each individual password. Specific forms like the weekly logs are collected and routed to a program that transforms the message into a format readable by most spreadsheet programs.

Navigating structured documents. Linking in HTML is unstructured and not constrained. The resulting freedom forces teachers to spend particular efforts into structuring educational material. In order to preserve the didactic value of those structures, and to allow for their systematic exploration by the students, particular care must be given to the use of links. We have followed a strict set of rules governing the use of links during document creation. Direct use of links is limited to backward referencing (to previous material in text, in problem sets, in directives, and to bibliographic references). Forward links are limited to the immediate sub-topics of a given page (topic), and to this effect all topics follow a generic (possibly recursive) structure consisting of a brief introduction and a list of sub-topics.

To facilitate navigation in structured documents we have incorporated two additional means for navigation. For relative navigation along the structure implied by the topic/ sub-topic hierarchy, each topic is preceded by a collection of four buttons: arrow left up (up to next higher level in the hierarchy), arrow left (to previous topic at same level), arrow right (to next topic at same level), and arrow right down (down to first sub-topic). For absolute navigation, important topics are headed by a set of named buttons that lead directly to frequently accessed pages such as home page, index, schedule, etc. It must be realized that these additional navigation tools are part of the document, and are subject to scrollingjust like any other information displayed on the screen, Particular attention has been given, therefore, to the size of "pages" and to the positioning of the navigation buttons, such that repetitive use ("clicking") of the same button can be achieved without the need to move the mouse.

Figures 1 and2 illustrate some of the above points. Fig. 1 shows the top lines of the HTML code that generates the "Feedback" page presented in Fig.2 (through Netscape). Lines 1,3,5 and 7 are part of the basic structure of an HTML document; the tags <html> and <body> are complemented with their respective "closing bracket" </html> and </body> at the bottom of the document (not shown); line 10 defines an anchor; lines 1 1 - 14 contain the references to the images for the relative navigation buttons, embedded into link descriptions that connect to other HTML documents (lines 11 - 13) or a local anchor #news (not visible) in line 14; lines 16 - 2 1 create a list of absolute (non-graphic) navigation buttons with their links; lines 25 and 26-28 create the course logo and the document heading respectively; lines33 - 38 generate a group of six graphic buttons linked to local anchors, and lines 40 - 4 1 link a group of two buttons to other HTML documents (forms, in this particular case); lines 49 - 50 unordered list of subtopics itemized by "bullets".

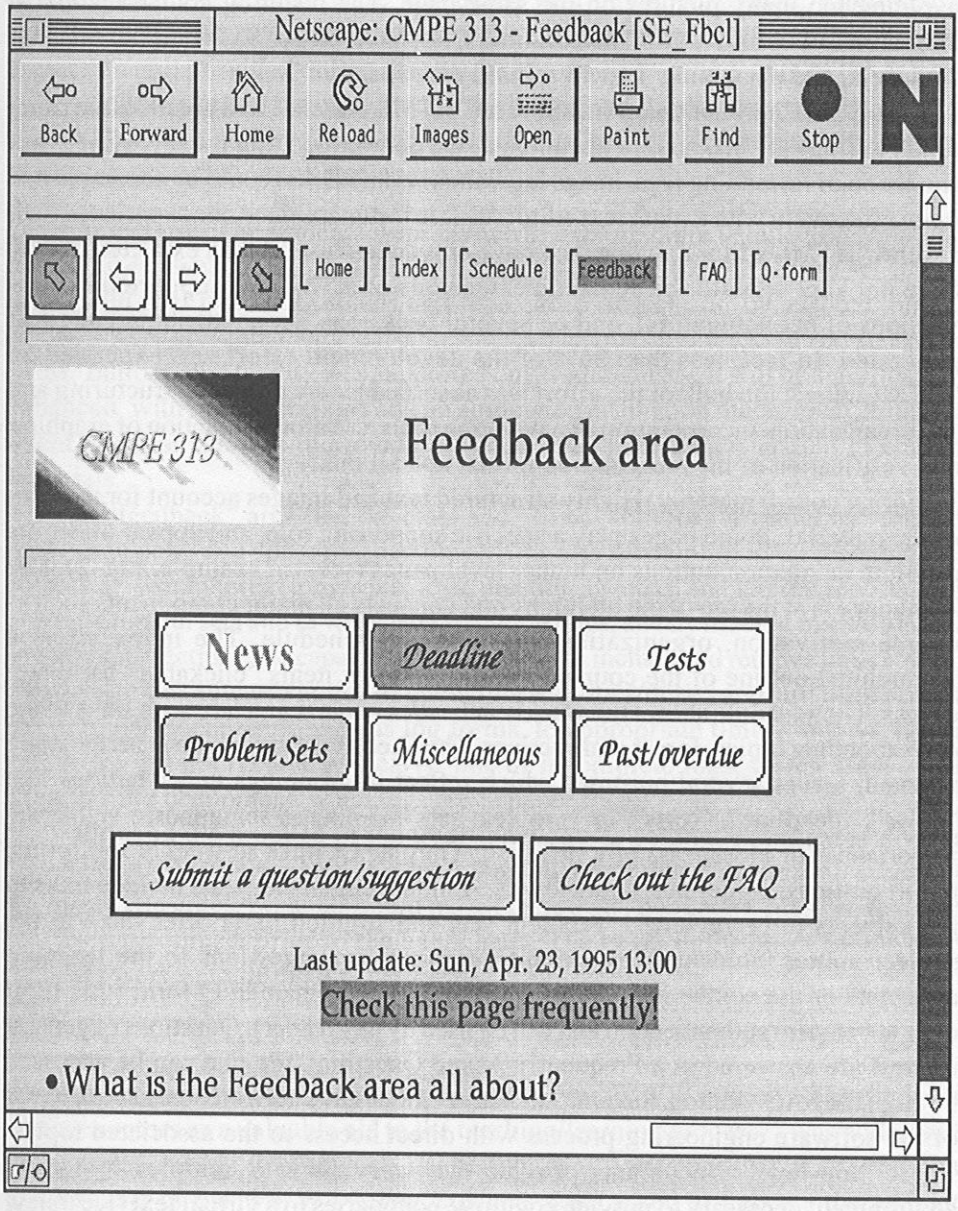
Figure 1: Sample HTML code from the "Feedback" page.

```
<html>

<head>
   <title>CMPE 313 - Feedback [SE_Fbck]</title>
<head>

<body>
<!-- Top Menu bar ++++++++++++++++++++++++++++++++++++++++++++>
<HR size=1 width=100% noshade>
<a name=top> </a>
<a href=index.html> <img src=imgLib/navig/leftup.GIF align=absmiddle> </a>
<a href=SE_Schd.html> <img src=imgLib/navig/left.GIF align=absmiddle> </a>
<a href=SE_SEC.html> <img src=imgLib/navig/right.GIF align=absmiddle> </a>
<a href=#news> <img src=imgLib/navig/rightdown.GIF align=absmiddle> </a>
<font size=5>
   [<font size=2><a href=index.html>Home</a></font>]
   [<font size=2><a href=SE_Notes.html>Index</a></font>]
   [<font size=2><a href=SE_Sched.html>Schedule</a></font>]
   [<font size=2><blink>Feedback</blink></font>]
   [<font size=2><a href=SE_FAQ.html>FAQ</a></font>]
   [<font size=2><a href=forms/SE_Q.html>Q-form</a></font>]
</font>
<HR size=6 width=100%>
<!-- ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++>
<img align=left src=imgLib/CE313_logo2.GIF hspace=5 vspace=5>
<center>
   <H1>Feedback area</H1>
</center>
<BR clear=all>
<HR size=6 width=100%>
<P>
<center>
   <a href=#news> <img src=imgLib/buttons/news.GIF> </a>
   <a href=#deadlines> <img src=imgLib/buttons/deadlines.GIF> </a>
   <a href=#tests> <img src=imgLib/buttons/tests.GIF> </a><BR>
   <a href=#problems> <img src=imgLib/buttons/psets.GIF> </a>
   <a href=#miscell> <img src=imgLib/buttons/misc.GIF> </a>
   <a href=#overdue> <img src=imgLib/buttons/past.GIF> </a>
   <P>
   <a href=forms/SE_Q.html> <img src=imgLib/buttons/submit.GIF> </a>
   <a href=SE_FAQ.html> <img src=imgLib/buttons/check.GIF> </a>
</center>
<P>
<center>
   Last update: Sun, Apr. 23, 1995 13:00<BR>
   <font size=+1><blink>Check this page frequently! </blink></font>
</center>
<P>
<UL type=circle>
   <LI><H3><a href=#what>What</a> is the Feedback area all about?</H3>
```

Fig. 2: Presentation of the "Feedback" page (code from Fig. 1) using Netscape



Process of creation of WWW learning documents. Starting from an initial set of over 400 transparencies, of which about 75% were available in computer readable form (text and black and white graphics), the entire software engineering course material was restructured for conformance with the above generic structure. In order to achieve an acceptable wait to load [reload] ratio for users accessing the notes through modem, the size of individual HTML documents was limited to a

range of 5 - 30 kilobytes. Particular attention was given to appropriate (i.e. sparing) use of graphics, limiting pictures/diagrams to the essence of their message, and avoiding too many pictures on the same page. The resulting course materials, after an effort of nearly 1500 person-hours, is a hierarchy of 850 files, nested up to six levels, and occupying 4.5 MB of hard disk space.

Through experimentation with several "HTML editors", and practice in writing (and reading) HTML source documents, we determined that most routine work (insertion of formatting tags, image tags, anchors and links) could be accomplished quite effectively with a plain text editor. This is fortunate since our experience with several "HTML editors" is that they have proven less useful than expected as they have not kept up with the syntactic extensions of HTML (as supported by new versions of net navigators), and on several occasions wrong attribute code was generated. In fact, less than 25% of the development effort was expended on "HTMLizing"; the bulk of the effort was absorbed by document restructuring and file organization, incorporation of navigation tools, creation/adaptation of graphics, and verification of the presentation format and all links.

Resulting course material. Highly structured text and images account for the bulk of the material. Some pages play a specific supporting role, and appear under the absolute navigation buttons on higher level pages (see, for example, Fig. 2). The homepage is at the top of the hierarchy and connects all major components such as course motivation, organization, material and schedule. The index offers a hierarchical outline of the course topics, with most items "clickable" for direct access. The schedule shows the weekly activities in class and lab, with links to the corresponding topics, forms or directives. The Feedback area which is periodically updated, serves several purposes which reflect in groupings under buttons like "news", "deadline", "tests", or "problem sets". Coloured semaphores signal the importance (or closeness) of a deadline. They boast links to weekly log forms, report outlines, guidelines, or standards. Announcements for tests include links to the subjects to be reviewed. Problem sets and solution hints offer links to the subject matter. Students may submit questions or suggestions to the teaching assistants or the course instructor by filling in a form named Q-form (this form does not require authentication and can be used by any reader). Questions of general interest are answered in a Frequently Asked Questions-file that can be accessed through the FAQ - button. Several "clickable" maps have been created as overviews of the software engineering process with direct access to the associated topics. These "top-level" documents provide the overview to a complex hypertext environment necessary to provide cognitive boundaries to a virtual text (Kearsley, 1988, p. 21).

Access to the electronic course material is possible from any platform connected to Internet and capable of running a WWW net navigator. Off-campus access was made possible through a large 250 installation modem pool and SLIP7/PPP accounts on the University network.

Method of Use

In-class use. The classes were scheduled in a newly renovated, multimedia classroom. The room supported access to the university network, and a large screen projection unit provided output display for the class. The top layers of the course material were projected through these facilities, and used to support the lecture and in-class discussion processes (structure of topics, key points, illustrative examples and reference to earlier material).

Out-of-class use. The students were invited to explore more detailed information in the lower levels of the hypertext on their own. By using the course schedule, they could find upcoming topics and read ahead of lectures. In selected topics, students were presented with self-assessment questions by "clicking" on an active "Test" button. This facility was supported only rudimentary; it will be significantly enhanced, with more questions and an automated evaluation mechanism, with the intent to assist students in providing feedback on their understanding of course materials.

The "feedback" area tied the class and project activities together by alerting students to news and upcoming deadlines. This was accomplished by changing the colours of semaphores (for weekly logs, meeting agendas, and interim reports), by posting problem sets and (a week later) solution hints, and by moving overdue items to a separate section. The capacity for the teacher to include and remove links at will, allowed for fair advance notice of upcoming activities/duties and still limit access to particular documents, such as log forms, to appropriate time windows. (As a result, we did not receive any early, late or incomplete logs, which are a quite exasperating phenomena when logs are in paper form).

Following the practice of the traditional course setting, examinations were "open book". They were held in a computer lab, providing students with access to the electronic notes. Students could install their own "bookmark files" of familiar netbased resources, prior to the exam start. The exam description and answer booklets were in traditional paper form.

Results

Student perspective. The research question "Is the WWW perceived by students and instructors as a valuable aid to the teaching/learning process?" was addressed by separate survey items which queried student perceptions of at the various components of the WWW system. Students were asked to indicate the amount they used the various components of the WWW support system (Likert scale l-5 where 1 is never used and 5 is used frequently). They were also asked to report the perceived usefulness of each component (Likert scale where 1 is not useful at all and 5 is very useful). The results are reported in Table 1.

Table 1: Amount of Use and Perceived Usefulness of Components of WWW Support
Likert scale l-5 where 1 is never used and 5 is used frequently.

	Software Eng. n=24		Entomology n=36	
	Amount Used Mean	Usefulness Mean	Amount Used Mean	Usefulness Mean
Class lecture notes and summaries	4.00	4.17	3.49	3.97
External WWW links	4.08	4.46	1.50	3.27
Course schedule & syllabus	3.75	4.08	2.11	3.97
Problem sets and test answers	2.92	3.76	2.31	3.53
Administrative Announcements	3.63	3.80	1.46	3.00
Private e-mail to other students	2.08	3.02	2.00	3.26
Private e-mail to professor	2.22	3.17	1.33	4.00

The three items related to use of course materials by the software engineering students (syllabus; lecture notes and summaries; problem sets and test answers) indicate a high degree of usage and perceived usefulness. The use of the system to browse other materials on the WWW including resources on the University campus and external resources also had high levels of reported use and perceived usefulness.

A second component of acceptance is actual usage. Software engineering students reported a mean of 6.9 logins per week (range of 2 to 15 and SD of 3.62) with a mean of 8.63 hours ofon-line time on the system. Both these means indicate significant usage of the system by undergraduate students.

The WWW was used in the Entomology class to provide access to the course syllabus, some class notes, and as a source ofgraphic images. The Entomology course used the system only for certain portions of the class and therefore it was used in a more periphery manner than the software engineering course. This less integrated use of the WWW system, resulted in a much lower usage (mean of 1.5 logins/week, range 0 to 8, SD of 1.42 with a mean of 1.8 hours per week on-line). The amount of use and perceived usefulness of the WWW system was also significantly lower amongst the Entomology students (see Table 1).

Perceived value in an educational context must be grounded in comparison to other learning resources. Thus, students were asked to value the WWW pages in comparison to other resources and the results are shown in Table 2.

Table 2: Perceived Value of Learning Resources where l is Useless and 5 is Very Valuable

Learning Resource	Software	SD	Entomology	SD
Lectures	4.04	86	4.35	.90
Labs	3.92	.93	2.60	I.55
WWW Pages	3.58	1.14	3.14	I.45
Assignments	3.58	l .06	2.94	1.29
Examinations	3.13	1.08	3.50	1.32
Texts	2.96	I.13	2.88	l .49

It is interesting to note that the lectures are perceived as the most valuable learning component of these courses. This implies that the WWW pages were not used in a stand-alone manner such that they could replace the lectures for time or place bound students. It is also interesting to note that the WWW pages were perceived by both classes as the third most valuable resource with ratings higher than the text book in both classes.

A final indicator of perceived value was the question related to preference for future use. Seventy-one percent of the software engineering students and 94% of the entomology students indicated that they would like more of their courses to use WWW support. It is somewhat surprising to find the entomology students more interested than the engineering students in expanded use of this tool, given their lower perceptions of value. Perhaps this illustrates the somewhat naive first impression of the WWW experienced by many new users – that this tool is tremendously powerful and entertaining – a sentiment that can wane after more prolonged exposure as experienced by the engineering students. In summary, the perceived usefulness data indicates that the students perceived the WWW enhancement as a valuable component of the learning experience in both classes and that students looked forward to more WWW support in subsequent courses.

Barriers to Use. The survey asked ten questions related to potential barriers to use and adoption. The results of these items are shown in table 3.

Table 3: Perceived Barriers to Use

Student Perceived Barriers to Effective Use	**Software Eng.** mean score 1 =no barrier, 5=major barrier	SD n=24	**Entomology** mean score 1 =no barrier, 5=major barrier	SD n=36
Inconvenient access to terminals	2.33	0.46	2.50	1.13
Inadequate training	1.29	0.55	3.34	1.62
Difficulty logging in to system	2.17	1.37	2.95	1.35
Poor keyboarding skills	1.29	0.81	1.57	1.20
Difficulty reading screens	2.17	1.17	1.59	1.06
Saw no value in using the system	1.46	0.72	1.49	0.93
Kept getting lost in the pages	2.83	1.20	1.79	1.24
Slow speed of the system	3.08	1.25	2.09	1.14
Inability to connect from home	3.75	1.48	2.99	1.71
Difficulty in learning to use	1.29	0.46	3.19	1.53

The Software Engineering student sample were all competent computer users with 100% describing themselves as being at either intermediate or expert levels of computer expertise. Thus, barriers of poor keyboarding skills (mean of 1.29, where 1 is “no barrier at all”), inadequate training (mean of 1.29), difficulty in learning to use the system (mean of 1.29) were not reported as barriers to usage.

Higher barriers amongst the Engineering students related to access with 67% of the students (mean of 3.75 where 5 is a "major barrier") reporting that busy lines resulting from crowded modem pools were a barrier to their use of the system. Students also cited the slow speed of the system as creating a barrier (mean of 3.08). Consistent with the literature on hypertext (Neilson, 1990) is the problem of students getting lost in multi-paged systems. Early reports of this barrier caused one of the authors to completely reorganize the WWW pages and add additional navigational links to existing hypertext course notes.

As expected, the less computer experienced Entomology students (3 1% self-described as novice users) reported higher barriers to usage. Factors of inadequate training (mean of 3.34 where 1 is "no barrier at all") and difficulty in learning the system (mean of 3.19) were reported as barriers to usage. Like the software engineering students, Entomology students also reported problems accessing the system both from labs and from home.

Qualitative results. During the focus group interview, a number of interesting factors emerged which were not captured in the survey data. Generally the students were supportive of the professors' efforts in experimenting with the technology. They were, however, not without complaint nor did they report uncritical acceptance. Issues of access were at the heart of many student comments. On the one hand, access to course materials is improved as they are accessible 24 hours a day from any machine connected to the Internet. As one Entomology student commented: "If you miss something in class – you can look it up." On the other hand, access is restricted to locations where networked machines are located – thus, precluding study and review on buses, in non-networked classrooms or when access to the modem pool is restricted. Despite the University of Alberta having doubled its modem pool in the past year to over 250 modems, increases in demand result in very long delays for access during the day and early evening hours. Until students have access to Internet resources through alternative suppliers, the University will be met with an almost insurmountable barrier of providing ever increasing numbers of modems. The University is attempting to resolve this barrier by negotiating special access through commercial Internet suppliers which will charge a time-based, usage fee for this service. To facilitate access, students suggested that the electronic notes be made accessible off-line (e.g. by downloading as compressed archives, or through external media such as diskettes or CD ROM). This was done in the second offering of the Engineering course, providing the WWW pages in compressed "zip" format which students could download and expand on their own machines, so that students could access the non-interactive components of the course without being connected to the Internet.

A negative pedagogical impact of WWW use was reported by a student who noted the incapacity to annotate, highlight, and add personal notation to class materials. This capacity is widely used by students reviewing and studying from textbooks and other printed materials. The capacity to create connections, enhance with personal anecdotes, and otherwise "personalize" and make new material personally relevant, is a crucial component of deep learning (Ramsden, 1992).

Future applications of the WWW for educational use will need to develop tools whereby students can easily highlight, cut and paste, and otherwise personalize class notes.

A number of students reported appreciating the hypertext linkages embedded in the course material and the resulting capacity to review the content for areas of personal interest. One software engineering student commented: "I can follow the flow of the information that you require without having to read through a bunch of stuff that is not relevant to what you are looking for." There were also a number of comments relating to the inappropriateness of current computer monitors for reading large amounts of text-based materials. One software engineering student commented: "I get (physically and mentally) tired after looking at a computer monitor for long periods of time. I find using paper notes not as hard on the eyes as using a computer for reading. The computer is a great tool, but I don't think it is where large amounts of reading can or should be done."

Finally, some students reported concerns over the time spent exploring external WWW sites. This perception of the WWW system as "time wasting" probably reflects the capacity of the WWW to divert users into interesting and entertaining, (but potentially unproductive) "surfing" of WWW sites.

To summarize, students reported that the use of WWW changed the dynamics of access by facilitating the use of class materials at any time and from home or class laboratory. Students also reported enhancements to the speed with which class materials were revised by the instructor, enhancements in their capacity to review materials, and reduction in the amount of paper consumption in the course. Most negative comments related to access problems that were due primarily to restrictions in hardware and telephone line availability and to the inability to personally annotate class notes and materials.

Instructor's perspective. Not all of the features built into the WWW system were used by students. For example, only a relatively few students made use of all the electronic reading material made accessible on the system. The feedback section, however, was often visited and it was important to evaluation conscious students that the deadlines and news sections were updated frequently (with inclusion of time and date of the last update). Relatively little use was made of forms for submission of questions to the instructors (on average one question per day from a class of 35). The use of electronic forms for submission of assignments and reports was widely used and resulted in quicker evaluation returns and better capacity to track class progress.

Adding relative navigation tools simplified the mechanics for classroom presentation. Their impact on the notes as a learning tool, however, is ambivalent. On one hand, very positive feedback acknowledged the ease of navigation; on the other hand, the majority of students insisted on obtaining hard copies of the notes, and in general they preferred copies of the old, more "sequential" notes, to printouts of the highly structured electronic notes. The preference of sequential text over highly structured material seems to be related to different phases of learning: during the first exposure to new material, students wanted to make sure they covered it

all, which favours sequential organization; whereas a highly structured organization was preferred for reviewing "known" material. As a consequence, it appears that (at least) two documents with different styles ought to be generated from the same source material. We are presently looking for effective ways to address this dichotomy.

Developer's perspective. Developing a WWW based course is time consuming. In spite of having much of the course material available in electronic form, a total of 1400 · 1500 person-hours were expended to create the full set of WWW notes. Keeping proper track of all links in a maze of more than 800 tiles was a challenge. Proper file organization, consistent with the topic hierarchies simplified the problem, but we are still in search of development tools that offer real support in managing such complexities. Most documents followed a generic structure which allowed the creation of templates for the few different types of documents required. To make the documents more readable (and therefore more maintainable) we successively refined (and followed) rules for HTML style dealing with item separation, heading sizes, indentation, anchor naming, etc.

Discussion

This case study, of early use of WWW tools to support classroom mstruction, reveals that the tool has unrealized potential. Rogers' theoretical model suggests that the innovation must be perceived by the users as offering relative advantage over traditional ways of accomplishing the same task. Relative advantage of WWW delivered materials is less apparent for students who are on-campus on a daily basis and for whom access to learning materials is generally taken for granted. We speculate that relative advantage would be much higher for distance education students for whom access to learning materials would otherwise consist of a long physical journey or even be impossible by any method except those that support distance access. A second area of relative advantage, for traditional teaching above that in a WWW enhanced environment, is the difficulty for students to annotate and personalize materials. New tools are needed which allow students to store, update and share annotations to materials presented in HTML format. Developments in WWW capacity such as client based programming in support of computer assisted learning will add relative advantage to the WWW in coming years. The greatest relative advantage is yet relatively unrealized, but indicated by the high usefulness score reported by computer engineering students relating to use of external links. Since this data was gathered in April 1995, the volume and quantity of network resources relative to software engineering and most other disciplines has grown immensely. We see huge relative advantage in linking learning, documentation and even promotional literature on the nets to traditional course syllabi, this creating a vibrant and growing resource base which students can continue to interact with long after the conclusion of the formal course. The relative advantage gained by more exploratory forms of learning supported by access to diverse and plentiful WWW resources promises new ways of approaching learning (Pea, 1993). These developments hold promise for the creation of learning

environments capable of sustaining interest and use by lifelong learners long after the course has been completed.

Rogers' second characteristic, compatibility, is illustrated in the different degree of usage between the two student groups in this study. The software engineering students used computer tools on a regular and frequent basis and, thus, addition of WWW documents is compatible with much of the work that they perform. For many of the Entomology students, accessing the WWW documents entailed learning to use new computer tools and application software, some of which is incompatible with current practices -thus, adoption and use by the Entomology students was much lower.

Complexity, as a factor in adoption by students, is dependent upon the tools used to access the WWW pages. Users with the "point and click" and consistent user interface of graphical browsers (such as Netscape Navigator) were able to access the pages with relative ease. Those unfamiliar with computers and those using text based browsers found the medium more complex and thus, had lower rates of adoption. Complexity for course developers and teachers is a major barrier to adoption. We are concerned that the development tools necessary for teachers to easily author and coherently organize large quantities of course materials are not yet available in WWW. Early adopters, are forced to use first generation creation and maintenance tools and navigation techniques which are desperately in need of improvement. The recent introduction of "frames" by Netscape provides a capacity to maintain navigational aids on the screen despite changes in accompanying content frames. The latest version of the computer engineering course makes extensive use of this frame feature. We continue to develop courseware today, waiting for, developing and incorporating better tools as they become available.

Perhaps the greatest value of WWW as an innovative application of network-based learning is the ease with which single pages can be created and trialed in face-to-face or distance application. Initial developments can be as simple as marking up the course syllabus or creating links to other subject related content on the WWW. Thus, the medium is trialable and can easily be used as a publishing and distribution system for course materials.

The final factor in Rogers' adoption model – observability – is also not a constraining factor in the adoption of WWW technology. Documents placed on the World Wide Web can easily be observed by other students and instructors on-campus as well as by anyone with access to the WWW. This observability is key to the rapid development of WWW documents as new users view and incorporate the design ideas from other sites into their own works.

Rogers' theoretical model helps explain the variation in adoption between the two classes in this study. The relative advantage for on-campus students seems to be the largest factor inhibiting adoption. We speculate that WWW will be most readily adopted by students for whom access to educational resources via the networks is the only, or preferred option, to face-to-face instruction.

Recommendations for Further Research

This study focused on the perceptions of students and their willingness to adopt a new learning/teaching technology. We acknowledge that perception data is only the first in a sequence of information needed to evaluate educational innovations. Phillips (1996) notes four other areas namely specific learning; transfer to other application domains, measurable results and return on investment. We must continue to expend time and energy evaluating these additional and often more difficult components of a holistic evaluation. Positive perceptions and adoption are important, but evaluating both the cost and leaning effectiveness of the innovation is an essential next step.

Conclusion

We believe that the WWW will be a major component of a re-engineered university system that seeks to provide quality education which can be delivered independently of time or distance. The WWW also has a place in more traditional face-to-face delivery of university courses. The capacity of the WWW to display class materials as presentation graphics in class; be used by students at home or in the labs; and be used as the front end for more elaborate computer assisted learning and computer conferencing systems; and to access other net resources, makes the WWW a valuable educational tool.

Note: Interested readers may explore the current versions of the two courses discussed in this article at the following addresses. Please note that extensive revisions have been made to both courses since the date of the evaluation reported here.

Software Engineering 3 13 at: http://www.ee.ualberta.ca/-wjoerg/SE/
Entomology 207 at: http://gause.biology.ualberta.ca/

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THE USE AND HELPFULNESS OF COMPONENTS IN A FIRST GENERATION MULTIMEDIA SYSTEM A STUDY OF INDIVIDUAL DIFFERENCES

G. Burt

Abstract: Use and helpfulness of course components have been selected by the British Open University as key performance indicators. To investigate whether or not greater use of components is a good thing, a study is made of the effects of institutional control over students' use of components. If there is strong institutional control it may happen that students will be forced to use a component which they find less helpful. If students are given control then they adjust their level of use in order to maintain a certain level of helpfulness. The correlation statistics exhibit clusters due to integration in the design of the components, and also clusters due to individual differences in predisposition and taste. Because predispositions and tastes exhibit a great variety of dimensions the institution needs to provide a wide range of components if it is to meet students' widely varying needs.

Résumé: L'université British Open University a identifié l'utilité et les éléments pratiques apportés par les composantes d'un cours comme étant des indicateurs clés de performance. Pour découvrir si l'utilisation d'un plus grand nombre de composantes est plus ou moins valable, une étude a porté sur les effets du contrôle pratiqué par les institutions sur l'utilisation des composantes par les étudiants. Si un grand contrôle institutionnel existe, les étudiantes peuvent être forcés d'utiliser des composantes qu'ils jugent moins pratiques. Si les étudiantes possèdent ce contrôle, ils ajustent leur niveau d'utilisation afin de maintenir un certain niveau pratique. Les corrélations montrent des groupements dus à l'intégration dans le design des composantes ainsi que des groupements attribués aux différences individuelles quant aux prédispositions et aux goûts. Puisque les prédispositions et les goûts démontrent une importante variété de dimensions, les institutions devraient fournir une grande variété de composantes afin de répondre aux besoins variés des étudiantes.

Introduction

In 1994 the British Open University formulated a set of fourteen strategic aims for the decade 1994 to 2003. One of these strategic aims concerned educational technology:

> 'To operate at the forefront of educational and technological developments relevant to large scale, distance education.'

To ensure that this strategic aim was achieved the Open University adopted the methodology of performance measurement (Eccles, 199 1; Burt, 1995). According

to this methodology the organization must identify the performance which would constitute the achievement of the aim, select some 'indicator' of the desired performance, continuously take measurements of this indicator and if necessary take remedial action when targets are not being met. For the particular strategic aim just quoted, two performance indicators were adopted. One performance indicator concerned the use of computing. The other performance indicator concerned the use and helpfulness of course components:

> 'Improved use and helpfulness ratings of course components as revealed in annual surveys of students.'

In the annual surveys referred to, students rate each course component on whether or not they used the component and if so how much of it they used. For example, some students may have read all of the set book whereas other students may have had time only to read part of it. Some students may have gone to all the tutorials while others may have gone to a few or none. Students are also asked to say how helpful they found each component for their study of the course. For example the teaching text might be more or less helpful according to how well the ideas have been explained. The survey leaves it up to the student how they intrepret 'use' and 'helpfulness' -for example does the question mean 'helpful for learning and understanding' or 'helpful in passing the exam'?

This seems fair enough, but what would count as 'improved use and helpfulness ratings'? One view might be that the greater use of components is a good thing. For students are likely to get the best out of an integrated system only if they make full use of the components which are meant to be integrated. Also it may sound implausible to claim to be at the forefront oftechnological developments if students are not using the technological components. However this is only half the story. An alternative view is that greater use is not necessarily a good thing. For instance it is always possible for the institution to increase the use of a component simply by making it compulsory. However doing this may force certain students to use a component which does not help them or for which they need to pay some extra cost. According to this second view then, institutional control may prevent students exercising choice and using the components in the way best suited to their own individual needs.

What is involved here is the balance between institutional control and student freedom of choice. Institutional control is expressed in the components in a variety of forms: satisfactory completion of the assignments is required in order to pass the course; the summer school component is compulsory; all course components are designed to have varying degrees of integration with other course components; and the design of each component is such that it offers the student some kind of reward schedule. On the other hand students usually have a certain degree of freedom of choice in their use of components, particularly those components which have an ancillary role.

The rationale for greater institutional control is that the institution has the necessary knowledge and expertise to design the student experience in such a way

as to optimize the students' learning. Indeed much (but not all) educational design research is intended to discover the design principles which can provide the foundations for such expertise. The rationale for student choice is that it is the student who knows their own self-interest best, that the institution does not have that knowledge and even if it did variation between students would obstruct the design of a system which would be ideal for all. For students have different needs and preferences and a variety of components should be offered so that these individual differences in student needs can be catered for. (See Burt 1996a for discussion and evidence on whether the student knows best in the context of their decision to continue study; and Burt 1996b for a discussion of the social choice issues involved when students' needs differ). The emphasis in this second view, then, is on open and flexible learning. The contrast between these two views is encapsulated by the following two questions:

> To what extent does institutional control over the use of components force students to do components which are less helpful?
> How varied are the individual differences which need to be catered for?

The aim of the present paper is to answer these two questions by analysing the use and helpfulness ratings for the course components of a second year course at the British Open University. The present study shares certain features with other recent investigations. Saga (1995) reports on the use and importance of instructional components as perceived by students at the Allama Iqbal Open University in Pakistan (the main concern of the study is however the students' attributions of learning from the media). Valcke (1995) reports on a multivariate analysis of the use of components of a multimedia system. Factors were identified yielding a clustering of components according to their design function. However it is von Prummer's (1995) study of the Fernuniversitat in Germany which most closely shares the concerns of the present paper: she notes the relationship between media provision and issues of equity or openness; she notes the distinction between usage and helpfulness ('use' and 'preferences' in her terms); and she notes that:

> The actual communication patterns of distance education students are the outcome of various interacting factors such as: personal likes and dislikes, abilities and disabilities; access to different types of communication, cost of using it and time needed; and institutional requirements and provisions. (p. 294).

In this study 'personal likes and dislikes' are included in the more general concept of 'tastes'; access, cost and time variables are seen as influencing a person's predisposition towards the use of a particular medium; and institutional requirements and provisions are addressed using the concept of institutional control and the concept of the designed integration of components.

The course and the questionnaire

The results to be reported in the present paper concern a second year course at the British Open University. The components of the course include Tutor Marked Assignments (TMAs), Computer Marked Assignments (CMAs), the main course text, the summer school, the video, the audio, the television, the video notes, the audio notes, the television notes, the study guide (one for each of the three blocks of the course), the course guide, other notes (including the summer school notes) and the tutorials. This set of components is rather typical of what Burt (1996c) has referred to as a first generation multimedia system (adapting a distinction made by Bates, 199 1). He notes that the components in a multimedia system form a coherent structure and suggests that, in 'first generation' multimedia systems the structure of components is such that the text is still the dominant medium even though a variety of other media are also used. In contrast in 'second generation' multimedia systems a computer environment supports the learner and it is the computer which is the lynchpin in the structure of components.

Burt (1996c) suggest that one of the key features of a media component is its educational function or role in the multimedia system. Looking at the Course Guide for the course we are studying here, he analyses the advice in it in order to establish how the components fit together. The discussion in the Course Guide implies a mutual understanding between the course team and the students that study is to a large extent assessment-driven although the course team is at the same time anxious to broaden the students' approach to study. The Course Guide also indicates that text is dominant. Other media are related to the text in different ways and to varying degrees. The advice on the use of other media recognizes the centrality of the assessment and of the text. Supporting the use of these media are various guides. Also in a supporting role are the tutorials arranged by the Open University regions (the regions have different geographies and this creates a need for variation of treatment). Finally the course provides a summer school which is compulsory. In summary the structure of components here is as follows. The goal is to gain a course credit. This is achieved by satisfying the *compulsory* summer school attendance and by achieving the goal of passing the *assessment. Theprimary* teaching components provide the knowledge and skills required for this and they are supported in this by *secondary* teaching components, themselves supported by *guidance* notes.

At the end of the course a sample of 353 students completed a questionnaire which included questions about the use and helpfulness of the course components. Of these 254 students replied, a response rate of 72%. (These respondents are likely to be students who have somewhat better course performance than non-respondent students). They were asked whether they had used all or most or some or none of each component. They were also asked to rate each component as very or fairly or not very or not at all helpful for their study of the course (Student Research Centre, 1994).

Data Analysis

Each of the following sections provides evidence regarding the effects of institutional control and of individual differences. The first section presents data on use and helpfulness for the group of students as a whole. Thereafter the evidence deals with individual differences, firstly considering each component separately and then considering correlations between components. Correlations between the use of components, correlations between the helpfulness of components and, finally, correlations between the use and the helpfulness of components are studied in turn. At the start of each section a brief overview of the key points is given.

Use and helpfulness: the group response

This section is concerned with the response of the group of students as a whole. The group's use of course components is shown to depend on the balance between institutional control and student choice. Some course components are designed by the institution to be necessary. For these components, use levels are high and helpfulness is high but varied. Other course components are designed to be ancillary. For these components, use levels are low and varied but helpfulness remains at a constant low level. Thus if there is strong institutional control it may happen that students will be forced to use a component which they find less helpful. In contrast if students are given control they adjust their level of use in order to maintain a certain level of helpfulness.

Table 1 : Use and helpfulness of different components.
Use: percentage of students using all/most of the component
Helpfulness mean: 1 very; 2 fairly; 3 not very; 4 not at all

Component	Function	use	helpfulness
Computer Marked Assignments	assessment	99	1.85*
Tutor Marked Assignments	assessment	96	1.56*
Tutor Marked Assignments	assessment	96	1.76**
main course text	primary	95	1.47
summer school	compulsory	95	1.94
videocassettes	primary	89	1.68
audiocassettes	primary	80	2.02
course guide	guidance	79	2.13
other printed material, e.g. summer school notes	guidance	76	2.06
study guide	guidance	75	2.14
audiocassette notes	guidance	67	2.01
videocassette notes	guidance	66	1.99
TV programmes (as broadcast or recorded)	secondary	59	2.07
TV notes	guidance	54	2.14
tutorials	secondary	40	2.13

* The rating is for the helpfulness of the assignment in consolidating learning.
** The rating is for the helpfulness of the tutor's comments on the assignment.

Table 1 lists the course components and specifies their function in this particular course. It then presents indices of use and helpfulness for the group of students as a whole. The index of use is the percentage of students who used all or most of the component. The index of helpfulness is the mean helpfulness rating for each component. The mean is calculated designating very helpful as 1, fairly helpful as 2, not very helpful as 3 and not at all helpful as 4.

Components which have assessment or primary teaching functions or are compulsory are more used and more helpful than components which have a guidance function or a secondary teaching function. So the components which have greater use are also rated as more helpful. However this relationship takes a particular form. For the primary or assessment or compulsory course components, the use and helpfulness levels are both high. Whereas the high use levels vary little, being compressed in the range 90 to 100%, the high helpfulness means vary a great deal, ranging over half a scale point. For the guidance or secondary course components, the use and helpfulness levels are both low. Whereas the low use levels vary a lot, ranging from 40% to 80% use, the low helpfulness means vary little, all very close to 2 corresponding to a rating of fairly helpful. High use may be due to strong institutional control. If this is the case it may happen that students will be forced to use a component which they find less helpful-the summer school is a clear example of this. In contrast if students are given control -as is the case for guidance components and secondary teaching – they adjust their level of use in order to maintain a certain level of helpfulness. So where there is choice, those who feel that a component would be unhelpful can choose not to use it.

Individual differences in use and helpfulness: each component separately

This section looks at individual differences in response, taking each component separately. An earlier study (Student Research Centre, 1995) indicated that the course components are designed by the institution to have a certain reward schedule. Most students made sufficient use of any given component to satisfy the minimum reward threshold for that component. Individual differences between students in the use of the component occurred primarily at levels of use above the threshold level. Turning to differences between students in their helpfulness ratings, the components which exhibit greater variation between students are those components where there is variation of provision by the institution.

The previous section has reported on the use and helpfulness of the components for the group as a whole. However not all students give the same rating. Table 2 gives the standard deviation of the helpfulness ratings for each component. The magnitudes of the standard deviations are roughly between half a rating point and a whole rating point (between 0.5 and 1.0). Most components have a standard deviation of around 0.7. The text has a slightly lower standard deviation but that is probably an artifact: the high mean rating constrains the distribution of ratings to be mainly at the top end of the scale. The highest standard deviations indicate a more substantive point. For these are to be found for the following components: the tutor's comments on Tutor Marked Assignments, the summer school, the tutorials and the

television programmes. One possible explanation of the higher level of standard deviation in these four cases is that it reflects variability in provision by the institution. Whereas students experience the same text and the same videocassette they experience different summer school tutors and different course tutors. There may be a similar explanation for the higher standard deviation of the television. Here too there may be variability of provision in the sense that many students may watch the television when it is broadcast even though the students are at different stages of their study. If the television has been designed for a particular stage of study then it may be too early for some students and too late for others. (Of course these comments do not apply to the group of students who pre-record the television for later use).

Table 2: Differences between students in their helpfulness ratings: the standard deviations in the ratings for each component.

text	v c	VCn	CG	TMAc	
.57	.68	.69	.69	.69	
TV	SG	other	A C	ACn	CMAc
.70	.71	.71	.74	.74	.78
TMAt	TVn	s s	tutorials		
.86	.88	.90	.91		

Key:
TMA: Tutor Marked Assignments; CMA: Computer Marked Assignements; VC: videocassette; AC: audiocassette; TV: television; SG: study guide; CG: course guide; SS: summer school; n: notes; c: consolidation of learning; t: tutor comments,

'Individual differences: correlations'

In the previous section we considered variation in the use and helpfulness of each component separately. We shal I now look at how the use or helpfulness of one component relates to the use or helpfulness of another component. We shall do this for each pair of components, in this way investigating the multivariate variation in the use and helpfulness of components. In this section we present a discussion of the implications of finding correlations of different magnitudes. We refer in this discussion to helpfulness, but similar remarks apply to use.

The key question here is: if a student finds component A very helpful, does that same student also find component B very helpful. Roughly speaking there are three possible answers to this question:

(a) Yes, students tend either to find both A and B very helpful, or to find both A and B not very helpful. This situation is represented statistically by a positive correlation.

(b) Quite the contrary to (a), if students tend to find A very helpful then they find B not very helpful, and vice-versa. This situation is represented statistically by a negative correlation.

(c) Neither A nor B: whether students find A very helpful or not is unrelated to whether students find B very helpful or not. This situation is represented statistically by a zero correlation.

Under what circumstances might we obtain each of these answers? If each component has its own special characteristics (as some media specialists argue) then the helpfulness of a component will depend on these special characteristics. This might suggest that the correlations between components would be zero. Alternatively there are also reasons for supposing that positive correlations might be found. There are two main ways in which this might happen. Firstly if the multimedia system is designed to be integrated then the students will only benefit if they study the components in association with one another. We shall refer to this as 'correlation due to integration'. However a correlation might still arise even in circumstance where there is no integration between components. There may instead be a common 'taste' factor which if present encourages the student to use both components. In this case the components are related indirectly: they both share the same taste factor. We shall refer to this as 'correlation due to taste'.

Whereas we shall refer to taste in the context of correlations between helpfulness ratings, we shall refer to 'predisposition' in the case of correlations between use ratings. The distinction between predisposition and taste can be explained as follows. A student may have a predisposition towards the use of the tutorials because he or she lives close to the study centre and his or her work and leisure activities fit in well with the schedule for the tutorials. However these factors do not imply that the student has a taste for tutorials as a teaching device-they do not imply that the student will rate tutorials as very helpful. On the other hand if the student has a taste for tutorials then that taste also contributes to a predisposition for tutorials.

Individual differences: use correlations and helpfulness correlations

An earlier study (Student Research Centre, 1995) investigated the correlations between the use of one component and the use of other components. Clusters of components were identified. Within each cluster there was a tendency for students either to make a lot of use of all the components in the cluster or for them to make little use of all the components in the cluster. The membership of some clusters appeared to correspond to the functional integration of components which had been designed by the institution. The membership of other clusters appeared to correspond to the differential predispositions of the students towards specific types of components. A corresponding analysis will now be carried out on the correlations between the helpfulness of one component and the helpfulness of other components. Clusters were identified here too, some but not all corresponding to the use clusters

identified in the earlier study. Here too clusters appear to correspond either to functional integration of the components or to the differential 'tastes' of the students for specific kinds of components. The general conclusion is that clustering occurs as a result of institutional design and student predisposition and taste. The presence of many clusters and the presence of several 'uncorrelated' components indicate that predisposition and taste have many dimensions.

The set of correlations between all the pairs of components in terms of helpfulness ratings can be displayed as a correlation matrix. The correlation matrix is displayed in two parts in Table 3. One approach to analysing the correlation matrix would be to establish which correlations were statistically significant. In fact with a sample size of 254 students even very low correlations of 0.15 are significant at the 95% level. By this criterion most of the correlations in the matrix are significant. However this is not what is most interesting about the correlation matrix. Here the main interest is to identify clusters of high correlations. (A good analogy here is with a map of the physical features of a country. What is of prime interest is the distinction between the highland regions and the lowland regions.) To do this I adopt a somewhat arbitrary definition of high and low (just as a physical map does). I shall consider a correlation of 0.4 or above as high and a correlation of below 0.4 as low.

From the first part of the correlation matrix it would appear that situation (c) obtains. Correlations between components are low. This suggests that the text, the Tutor Marked Assignment, the Computer Marked Assignment, the summer school the tutorial and the videocassette each have quite specific characteristics and it is these specific characteristics which affect students' helpfulness ratings rather than any common characteristic. So for these components tastes are specific, associated with just one type of component. (However the earlier study did find some common predispositions amongst these components, Student Research Centre 1995).

The second part of the correlation matrix provides a different answer. Here it would appear that situation (a) frequently obtains. The highest correlation is between the course guide and the study guide, constituting a cluster of 'strategic guides' (a taste correlation, r=0.78). Next the correlation between audio notes and video notes constitutes a cluster of 'cassette notes' (a taste correlation, r=0.77). Next there is the set of media guides, now including the television notes (the median of the correlations is r=0.68, a taste correlation). The correlation between the audiocassette and the corresponding audiocassette notes constitutes an audio cluster (r=0.67, an integration correlation). The cassette components, both video and audio, and also programme and notes come next (median r=0.56, a taste correlation). The cluster of 'guides for the current block of material' includes the media guides and the study guides, but not the course guide (median r=0.54, an integration correlation). Median correlations of 0.48 are obtained for the following clusters of components: the media components, that is including the video, the audio and the television, and also the programmes and the notes; the media programmes, the visual components, both video and television, and also programmes and notes; and the videocassette components, both programme and notes. Median correlations of 0.47,0.46,0.44 and 0.43 are obtained respectively for: the television components,

both programmes and notes; the entire set of guidance notes; the non-media guidance notes; and the summer school, both the school itself and the notes. These later clusters are a mixture of taste and integration clusters.

Table 3: Correlations between the helpfulness of the components

	text	TMA	CMA	SS	VC	AC	other compts.
Text	01	*30*	*36*	*22*	*16*	*23*	**
TMA		01	20	14	11	26	*
CMA			01	21	13	31	*
Summer School				01	08	13	* (*43* SSn)
Videocassette					01	55	see below
Audiocassette						01	see below

	VC	AC	TV	VCn	ACn	TVn	SG	CG	SSn	tut
vc	01	55	48	48	***	***	*	*	**	*
AC		01	*29*	*57*	*67*	***	*40*	***	***	*
TV			01	**	*	*47*	*	*	*	**
VC notes				01	77	68	52	42	***	*
AC notes					01	52	52	46	***	*
TV notes						01	55	***	***	*
Study Guide							01	78	44	*
Course Guide								01	***	*
SS notes									01	*
tutorial										01

Notes:
(i) *, ** ,*** denote low correlations of -0.10 to +0.19, 0.2 to 0.29 and 0.3 to 0.39 respectively.
(ii) TMA: Tutor Marked Assignments; CMA: Computer Marked Assignments; VC: videocassette; AC: audiocassette; TV: television; SG: study guide; CG: course guide; SS: summer school; n: notes; c: consolidation of learning; t: tutor comments.

How the student's use of component relates to its helpfulness

An earlier section studied the group of students as a whole and found that components which were used a lot were also the components which were rated more helpful. That group result depended on comparing different components. Here we take each component separately and study differences between students: if a student uses the component a lot do they also tend to find it more helpful? The relationship is shown to depend on the balance between institutional control and student control.

Some course components are designed by the institution to be necessary. For these components, use levels are only weakly related to helpfulness. Other course components are designed to be ancillary. For these components, use levels are strongly related to helpfulness. As before if there is strong institutional control it may happen that individual students will be forced to use a component which they find less helpful. In contrast if individual students are given control they individually adjust their level of use in order to maintain a certain level of helpfulness.

Table 4 below presents the results. There are high correlations between usage and helpfulness for each of the audiovisual components and also for the tutorial. Somewhat lower are the correlations for the study guide, the summer school notes and the course guide. The correlation for the text is lower still. Usage and helpfulness are virtually uncorrelated for the Tutor Marked Assignment and the Computer Marked Assignment.

The most natural way of interpreting the high correlations between usage and helpfulness is to say that the student decides whether or not to continue using a component on the basis of how helpful the component has proved so far. Students who have found the component helpful continue to use it. Students who have not found the component helpful stop using it. Where there are low correlations the decision to continue using the component must be made on some other basis. For example assignments are used in order to pass the course, and texts are used because they are necessary for the assignments.

Table 4: Correlations between the level of use and the helpfulness for each component separately.

text	TMA	CMA	SS		
31	08	24	-		
VC	AC	TV	VCn	ACn	TVn
61	60	61	56	56	55
SG	CG	SSn	tutorial		
50	42	49	59		

Key:
TMA: Tutor Marked Assignments; CMA: Computer Marked Assignments; VC: videocassette; AC: audiocassette; TV: television; SG: study guide; CG: course guide; SS: summer school; n: notes; c: consolidation of learning; t: tutor comments

An alternative interpretation of the high correlations would be that the more a student used a component the more he or she got out of it, that is the more helpful it was found to be. This effect seems particularly plausible in the case of guidance notes, although even here it might be judged that the effect postulated in the previous paragraph would be more powerful. (Another alternative explanation is that the effect is due to cognitive dissonance).

How use and helpfulness interact across components

The previous section shows how individual students adjust their use of a component depending on how helpful they find it. In this section it is tentatively suggested that students who find a particular component helpful may be encouraged to use certain other components.

In the previous section the correlations between the use of a component and the helpfulness of that same component was investigated. Now the correlation is investigated between the use of one component and the helpfulness of a different component. Usually such correlations were low, below 0.4. However there were a few high correlations involving the audiovisual components and the guidance notes. These correlations are presented in Table 5. For example, the entry of 44 next to the top left comer indicates that the use of the videocassette has a correlation of 0.44 with the helpfulness of the audiocassette. Notice that the entries in the main diagonal are the same-component use-helpfulness correlations presented in the previous section.

As in the previous section a high use-helpfulness correlation can be interpreted in two ways. Firstly if one component is helpful then that may encourage the student to use another component. This is a possible explanation of the correlations between the helpfulness of the programme notes and the use of the corresponding programmes (see the bold diagonal: 46, 47, 42). The correlations between the helpfulness of the audiocassette and the use of the videocassette and vice versa and the correlations between the helpfulness and the use of guidance notes for different programmes may also indicate that the helpfulness of one component fosters the use of similar components. (This may also explain the correlations between the helpfulness of the study guide and the use of the guidance notes, although here the explanation appears less plausible).

The second interpretation of a high correlation is that if one component is used then that may render another component more helpful. For example the correlation of 0.44 suggests that the use of the audiocassette notes renders the audiocassette more helpful (note that this effect is at best weak for the videocassette and the television).

Conclusion

In the introduction it was reported that use and helpfulness of course components had been selected by the British Open University as key performance indicators. The question was raised as to whether or not greater use of components was a good thing. It was suggested that in order to answer this question evidence was required concerning the effects of institutional control over student use of components and concerning individual differences in student needs.

Table 5: Correlations between the use and helpfulness of different components.

	VC	AC	TV	VCn	ACn	TVn	SC	CG
Use:								
v c	61	44	***	46	***	***	**	*
AC	43	60	**	47	47	***	**	*
TV	**	**	61	**	*	42	*	*
VCn	***	40	*	56	45	48	40	**
ACn	**	44	*	58	56	49	45	***
TVn	**	**	***	49	***	55	40	**
SG	*	**	*	***	***	***	50	***
CG	*	**	*	**	***	**	45	42

Key:
VC: videocassette; AC: audiocassette; TV: television; SG: study guide; CG: course guide; n: notes.

The subsequent sections have provided the required evidence. Different forms of institutional control have been shown to affect the use and helpfulness of components. The statistics for the group of students as a whole provided evidence that if there is strong institutional control then it may happen that students will be forced to use a component which they find less helpful. In contrast if students are given control they adjust their level of use in order to maintain a certain level of helpfulness. This latter point is also indicated by the correlation between the use of a component and the helpfulness of that same component. Such correlations were high for components over which the student had greater freedom of choice. The correlation statistics exhibit clusters some of which were interpreted as being due to integration in the design of the components. In all these ways then, institutional control had an influence on use and helpfulness.

Other results also demonstrate the influence of institutional control. For each component the range of variation in levels of use depends on the reward schedule, in some cases exhibiting a threshold level. There is also evidence of variation in the institutional provision of certain components, with students experiencing different course tutors and different tutors at summer school, and with the fixed delivery schedule of television programmes having a differential impact on students operating different study schedules.

The results mentioned in the preceding paragraph concerned differences between students in the use and helpfulness of each component separately. Individual differences have also been studied via correlation clusters. Correlation clusters were interpreted in terms of the designed integration of the course

components, and the individual differences between students in predisposition and taste towards different kinds of components.

Within a single correlation cluster, there is a tendency for students to vary along a single dimension, namely the overall level of use or helpfulness of the components in the cluster. However the study has identified a variety of different clusters. This points to multidimensional variation of student predisposition and taste-over many dimensions. In addition to the clusters, components which do not have high correlations with any other components constitute extra dimensions on their own.This increases the number of dimensions even further.

This fact provides the answer to the second question of how varied are the individual differences which need to be catered for. The fact that predispositions and tastes exhibit a great variety of dimensions implies that the institution needs to provide a wide range of components if it is to meet these widely varying needs. When such a range of components is provided, students will adjust their level of use of the components to suit their varied predispositions and tastes. So attempts to use institutional controls to boost use in accordance with the performance indicators may force students to use components which are not helpful. This conclusion is relevant not just to the British Open University but also to other institutions which provide a similar mix of components. Indeed the use and helpfulness ofcomponents are key performance features of any multimedia system, and so the arguments of this paper are of general relevance.

The present study possess a number of limitations. The evidence here derives from just one source, the responses to a single questionnaire. As with any survey, respondents are likely to be somewhat atypical of the whole population. There is a need to validate the responses against some other data source. Also the evidence refers to just one course in just one institution. To what extent would evidence about other courses and other institutions produce similar results? There are also a couple of methodological issues which need further exploration. To what extent does the nature of the rating scale distort the various statistics? Assuming the statistics are robust, what scope is there for analysing the statistics using a more sophisticated method such as hierarchical cluster analysis, factor analysis or structural equation models (Murtagh and Haeck 1987; Cattell 1978; Goldberger and Duncan 1973). A major project is now under way to remedy some of these deficiencies. This will involve the analysis of forty-five courses across the full range of academic disciplines and substantial enhancements in statistical sophistication are planned (Simpson, Young & Burt, 1996). One important issue which a wider study might usefully address is whether or not the results reported in the present study are artefactual: perhaps what is important is not the medium itself or even its functional role in the system – perhaps what is really important is the quality of design of a media component. This latter hypothesis is akin to some of the arguments advanced by Clark (1994) and it might be given some credence if it proves impossible to reproduce the pattern of correlations reported here for this one course.

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THE EFFECTS OF INTERACTIVE IMAGES ON LANGUAGE ACQUISITION FOR ADULTS

Farough Abed

Abstract: An interactive mnemonic strategy known as progression (which previously has been shown to be useful in recognition memory in adults) was used in this study involving foreign language vocabulary acquisition. Progression uses a series of five panels: the first displays the stimulus item (a foreign Word), the last displays the response item (a picture of the referent), and the intermediate panels represent a gradua1 visual metamorphosis (change in shape) from the first item to the last. Adults viewed either the five pane1 progressive illustrations or one of two non-interactive conditions: the first and last pane1 only (word + picture) or the written foreign word and its written English equivalent (word + word) Recall of the meanings of foreign words was significantly better for the adults viewing progressive displays than for those viewing non-interactive stimuli.

Résumé: Une stratégie mnémonique interactive connue sous le terme progression a été utilisée dans cette étude portant sur 'acquisition de vocabulaire dans une langue étrangère. La progression utilise une séries de cinq étapes: la première montre le stimulus (un mot étranger), la dernière présente un item réponse (une image du référant) et l'intermédiaire représente une métamorphose visuelle graduelle (changement dans la forme) du premier item au dernier. Les adultes ont soit vu les cinq étapes d'illustration progressive ou une de ces deux conditions non-interactives: 1) la première et la dernière panels seulement (mot et image) ou 2) le mot étranger écrit avec son équivalent écrit en anglais (mot et mot). Le rappel de la signification des mots étrangers était plus élevé chez les adultes a qui on avait présenté les illustrations progressives que chez ceux à qui on avait présenté des stimuli non-interactifs.

In a number of studies interactive illustrations have been shown to be effective in facilitating memory. These illustrations vary widely and are used for avariety of purposes, but all fall under the "interactive" category by virtue of the fact that the symbols depicted in the illustration in some way interact with each other. Hence their common denominator is the visual link or association show in the picture. Several types will be discussed.

In the 1970s researchers began exploring the possibility of using interactive pictures to facilitate the association of word pairs. Studies overwhelmingly demonstrated the efficacy ofthese illustrations as opposed to separate pictures (e.g., Emmerich & Ackerman, 1976; Lippman & Shanahan, 1973; Lutx & Lutz, 1977). Usually the two items are shown in a syntactic relationship, either active or spatial (e.g., a *monkey* smoking a *cigar* or a wagon on a *roof* SO that a visual link in the illustration directly corresponds to the items to be remembered. The mental

association of the two items is required so that the presentation of the stimulus item elicits the interactive scene, which in turn allows retrieval of the response item.

A more complex version of this type of interactive illustration is used by Levin, Anglin, and Carney (1987). They describe transformational pictures which aid in the recall of prose information. These pictures rely on the interactive relationship of items to be remembered. For example, a transformational picture intended to convey the information *Karl Jansky invented an antennafor improving the quality of telecommunications* recodes the name *Jansky* into the acoustically similar but more concrete form *jam,* and depicts children eating jam and talking on phones with antennas on top. As with paired associates, a simple interactive relationship is used in which key symbols are displayed in an active or spatial relationship. In this case children are depicted interacting with the symbols, *jam, antenna,* and *telephone.* Just as described with paired associates, the visual link in the illustration corresponds to the items to be remembered. However, in transformational pictures there are the initial acoustic link (to make the target information concrete) and a final step of decoding the symbols into the proper form expressing the intended information (a semantic link).

Illustrations have also been used in conjunction with the much-studied keyword method, developed by Atkinson (1975) and Raugh & Atkinson (1975) as a mnemonic device for foreign language vocabulary learning. The method utilizes two steps: first, an acoustically similar English word (keyword) is found for the foreign word, and second, the keyword is imagined in an interactive scene with the foreign word's meaning. For example,pato, a Spanish word meaning *duck,* sounds like the Englishpot. The learner might imagine a duck with a pot on its head. This mental image would assist the learner in remembering that *pato* means *duck.* Keyword researchers conducted a number of studies, including generating keyword sentences rather than mental images for young children (Pressley, Levin, & McCormick, 1980), experimenter-provided rather than subject-generated images (Pressley & Levin, 1978), and keyword effects on concrete and abstract words (Pressley, Levin & Miller, 198 1). Of particular interest is the work of Morrison and Levin (1987), who studied the effects of mnemonic strategies on the recall of mineral names and attributes by eighth grade students. The investigators taught subjects under three conditions to use a keyword strategy whereby the mineral name was associated with an acoustically similar keyword (i.e., *wolframite-wolf).* Likewise, attributes were characterized by symbols (i.e., *hard vs. soft* were represented by a man or a baby, respectively). In the illustration condition both keywords and attributes were depicted interactively; in the imagery condition subjects were instructed to experimenter-generated keywords and attribute symbols to create their own interactive image; in the unstructured condition subjects were instructed to generate their own keywords and images integrating those keywords with experimenter-generated attribute symbols. In the control condition subjects were encouraged to use their own strategies for remembering the mineral names and attributes. Results indicated that the illustration condition produced significantly

better retention of facts than the other conditions. Similar benefits from interactive illustrations have been demonstrated by Scruggs, Mastropieri, McLoone, Levin, & Morrison (1987). Like transformational pictures, these utilize an acoustic link, a visual link, and a semantic link for their mnemonic success.

What is it about these illustrations that accounts for their mnemonic effect? The answer lies in their ability to use interaction to evoke memorable associations. Cohen (1987), referring to keyword studies on second-language acquisition, has discussed this technique of recording material as the creation of a cognitive link, and the interactive pictures serve as cognitive mediators for reconnecting the link in the mind of the learner.

Another type of illustration that differs from the simple interactive pictures is the complex interactive illustration. These do not depict a simple active or spatial relationship between two objects (i.e., the wagon on the roof) that directly corresponds to the message (pair wagon and roof). Instead they depict symbols that represent ideas to be associated rather than objects. These symbols do not immediately convey the message, engaging the learner in visual problem-solving to discover the deeper meaning of the illustration.

Two studies have investigated the effects of such visuals on recognition memory. In one study Abed (1994) used visual puns, illustrations that associate two ideas or concepts to create a new meaning, often using a distinctive reference as a verbal pun. For instance, one visual pun contained the text Let my people go with the g in go formed by adjoining a hammer and sickle (see Figure 1). In this example the idea of freedom is associated with that of the former Soviet Union as an oppressive state. The interaction among the pictorial and textual units is immediately obvious, but comprehension of the visual pun takes place only after some reflection on the connection between the two ideas being symbolized. These visuals, then, engage the viewer in increased cognitive activity. They employ a visual link which evokes a deeper semantic link.

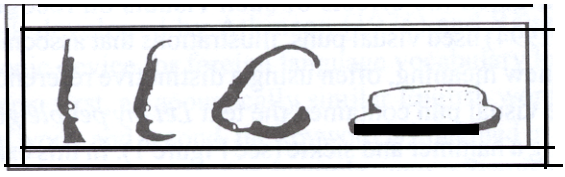
Figure 1.

Adult subjects in the study were shown either visual puns or non-interactive illustrations with equivalent messages. During presentation of the illustrations these were mixed with non-interativedistractor visuals. In Experiment 1 distractors were pictures of common objects (non-meaningful messages), while Experiment 2 used distractors with meaningful messages (i.e., a campaign poster). Both immediate and

delayed recognition tests demonstrated that the interactive visual puns facilitated recognition memory significantly more than non-interactive illustrations. The distractors, however, affected how long the memory trace remained. Long-term recognition remained high for visual puns when they were intermixed with non-meaningful distractors, but some decay over time was evident when meaningful distractors were used.

Abed (1992) also used complex interactive visuals, progressive visuals consisting of four, the first and last of which were easily recognizable items. The two intermediate panels represented the progressive change from the first item to the last; that is, they were identifiable amorphous shapes (see Figure 2). While encoding of the first and last panels could be both visual and verbal, encoding of the intermediate panels could be visual only due to the difficulty of naming these panels. Verbal encoding might occur at different levels as well. For example, the progression from the gun to the slice of bread could be verbally encoded simply by labelling the first and last panels, *gun* and *bread,* or by engaging in deeper cognitive analysis to comprehend the visual as a representation ofmilitary vs. humanitarian aid. As with visual puns, a visual link evokes a deeper semantic link.

Figure 2:



In this investigation subjects (college students) viewed one of three conditions: two interactive conditions under which they saw progressive illustrations with all four panels or only three panels (Panels 1,2, and 4), and one non-interactive (control) condition under which they saw only the first and last panels. Subjects were tested for recognition of the first and last panels only. Both interactive conditions yielded significantly higher scores than the non-interactive condition on a delayed test. No significant difference was found between the conditions for immediate testing.

The key to the success of complex interactive illustrations is derived from the fact that they do not expose their messages completely through a visual link, but instead require the learner to take another step by making a semantic link to understand the message behind the association of the two ideas. This concept can best be explained through the theory presented by Lockhart & Craik (1990). They differentiate between depth of processing, a reference to qualitatively different levels of analysis (e.g., sensory, semantic), and elaboration, or the richness of the processing within a given level. More extensive elaboration, within a level should lead to a stronger memory trace. This theory has generated a number of studies in diverse fields, but only those mentioned above have dealt with complex interactive illustrations, a relatively new and little-explored area of illustration research.

With regard to complex interactive illustrations, they demand processing first at the sensory level (visual) and then at the semantic level, with elaboration being

extensive on both levels. That is, the viewer first process the interaction between the pictorial and/or textual features, followed by elaboration on the semantic level involving the relationship between the symbols, how these symbols relate to viewer's past experience and general world knowledge, etc. The elaboration required to perceive the intended message will serve to facilitate the retention of that message. It is possible, though, that the visual link without the underlying association of concepts is enough to ensure benefits for retention?

The present study uses progressive illustrations to test their potential as facilitators in the retention of factual information, namely foreign language vocabulary. Foreign language words are visually linked with pictures of referents in a progressive format. The message to the viewer, therefore, is similar to that of the paired associates research discussed above: associate the two items. Understanding the message does not require the intense cognitive activity of either the visual puns or the progressive illustrations used in previous studies. However, it is possible that progressive illustrations will still be effective due to their visual link. Several studies have noted that subjects will use spontaneous, self-generated elaboration strategies (Belleza, 198 1; Hall, Wilson, & Patterson, 198 1; Ott, Butler, Blake, & Ball, 1973), and the visual link of progression may encourage this type of elaboration, which in turn will strengthen the memory trace. Given that progressive illustrations have in the past facilitated memory, the present study seeks to answer the following research question: will interactive progressive illustration facilitate foreign language vocabulary acquisition among adults? This study will explore the following hypothesis:

Interactive progressive illustration will facilitate recall of foreign vocabulary items to a greater degree than noninteractive paired associates (word-word and word-picture) due to the elaboration produced by the progression.

Methodology:

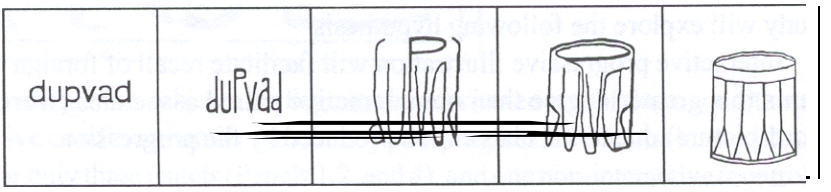
Subjects. Adults subjects were chosen to be consistent with the age range of participants in previous complex interactive illustration studies. Sixty adults were randomly assigned to one of three treatment groups. In the first group (identified hereafter as PROG) subjects viewed progressive illustrations in which a written foreign word progressively changed to a picture of its meaning. In the second group (WP) subjects saw the written foreign word paired with a picture of that word. Finally, the last group (WW) saw the written foreign word and its written English equivalent. Subjects were presented with visual stimuli and tested for recall on an individual basis.

Materials. Because adults subjects were likely to have had some exposure to a variety of foreign languages even if they had no formal training in a specific language, nonsense words were considered a practical alternative to choosing a foreign language. Accordingly, 50 words were created following the pattern CVCCVC, and these words were paired with meanings. Although research indicates a pronounced advantage to using pictures as stimulus items rather than response items (Paivio, 1971, p. 255; Postman, 1978), it was decided to use the foreign

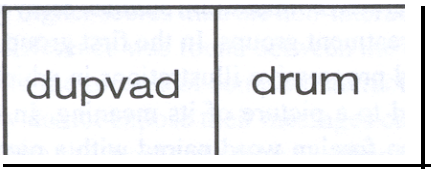
word as stimulus and the picture as response, thereby leading from the unfamiliar to the familiar, or from problem to solution as is typical in a learning environment. This strategy offers a discovery approach that encourages the learner to find out more about the foreign word. Progressive illustrations and other complex illustrations rely on the curiosity factor that stimulates the learner to link the unknown to the known. Progressive illustrations (11" x 14") were drawn depicting a written foreign word in the first panel, followed by three panels of progressive change, and ending with a picture. These 50 stimuli were tested using three criteria: smoothness of progression/lack of "jump cuts", ease of picture identification, and ease of pronunciation of foreign words. Of the original 50,23 were chosen for use in the study (see word list in Appendix A) as well as two additional items to be used as examples. For the WP group, the first and last panels of each stimulus item were used. For the WW group, the English equivalent was printed on an 11" x 14" panel and paired with the first panel. Legibility factors such as size, typeface, and spacingwere considered in printing all text items. The foreign word panel was used for testing. Samples of progressive stimulus items are shown in Figure 3.

Figure 3: Samples of Stimulus

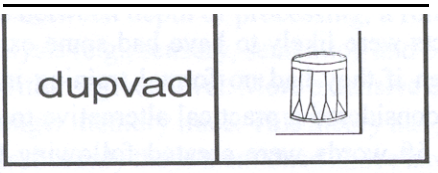
Example of Progression Stimuli



Example of Word-word Stimuli



Example of Word-Picture Stimuli



Procedure. Prior to the experiment, a random order was determined both for presentation and for testing of each subject. Thus subjects saw a different order of stimuli for presentation and for testing, and a different random order was used for each subject. Each subject saw 23 stimuli appropriate to the treatment condition.

Subjects were tested individually. Prior to the presentation phase, subjects from the PROG group were shown two examples of progression. The investigator explained how the word changes to the picture, and that the two are equivalent. Subjects were told that they must try to remember the foreign word and its translation because they would be asked to recall them later. Presentation of the stimuli then proceeded, with the investigator showing one stimulus item at a time on an easel. Subjects determined the length of viewing time, which ranged from 15 to 27 seconds. When all 23 stimuli were seen, subjects were asked to count backwards from ten. Again they were told that they would see a foreign word and needed to provide its meaning. Testing then proceeded, with presentation pace determined again by the subject. Subjects verbally gave their responses, and these were recorded by the investigator. One point was awarded for each correct response, with a possible maximum score of 23 points. Responses were judged to be correct if they labelled the picture with an appropriate name. For instance, either *bucket* or *pail* was an acceptable response for *sunmig.* The procedure for the other two treatment groups was the same, though the examples and testing stimuli given represented the appropriate condition (word and picture for the WP group, and foreign and English word for the WW group).

Results. The data were analysed using a single factor ANOVA, the results of which indicated a significant difference between means [$F(2, 57)) = 29.437$, $p < .0001$]. Using Tukey's HSD statistic for multiple comparison of means, a critical value of 2.127 was determined at the 0.1 level of significance. The test revealed a significant difference between the progression and word-picture treatment groups (mean difference = 4.6) as well as between the progression and word-word treatment groups (mean difference = 5.8). Means and standard deviations are shown in Table 1.

Table 1: Means and Standard Deviations For Recall Test

	Means	**SD**	**N**
PROG	15.1	2.673	20
WP	10.5	2.800	20
w w	9.3	2.029	20

Discussion. Progressive illustrations proved to be superior to the other two conditions in enhancing memory under the present circumstances. This fits in with past research given that interactive illustrations have a history of superiority over non-interactive illustrations. Interactive pictures as well as interactive mental images rely on a visual link (whether real or imaged) which is reinforced by another link, be it syntactic, semantic, acoustic, or some combination of these. In the present study the visual link is presented. What is occurring at the semantic level that

accounts for the results?

With complex interactive illustrations (visual puns and progressive illustrations such as gun changing to bread), the indirectness of the visual message stimulates greater cognitive activity in order to discern the deeper message. This, according to Lockhart & Craik (1990), leads to a stronger memory trace. It is presumed that this elaboration occurred with progressive illustrations. Viewers were likely to look for some deeper conceptual association that corresponds to the visual connection between guns and *bread* rather than looking at them as a simple word pair. When a foreign word progressively changes to a picture, what type of processing is occurring? First, the visual (sensory) processing is likely to be elaborate due to the time and attention given to viewing the progressive change itself. Perhaps the visual link is stimulating some intense cognitive activity at the semantic level as viewers try to make meaning out of it, this time in the form of word association (i.e., *valbil* means flower). Viewers might also be engaging in spontaneous elaboration activities, especially given the instructions to try and remember the word pairs. The visual link, though, seems to be the necessary factor since subjects in other treatment groups were also given instructions to try to remember the pairs but did not score as well.

The present study suggests the possibility of using progressive illustrations to aid in foreign vocabulary acquisition, at least with concrete referents that are easily drawn. The advantage of progression lies in the ability to visually link the two items without having to contrive an interactive scene using a keyword. It should be cautioned, however, that progressive illustrations should be well designed to ensure quality (possibly by using computer software that can easily generate progressive illustrations). Future studies should explore a number of questions. First, the possibility of generalizing the results from nonsense words to actual foreign language learning should be explored as well as the viability of long-term retention. Questionnaires should be designed to compare subjects' elaboration strategies used with progressive illustrations and other treatment conditions in order to determine how it is that progression stimulates the viewer to retain information. It would also be interesting to use progressive illustrations in conjunction with keyword imaging instructions to see if the combination would produce better results than either method alone. Further, it would be interesting to see the impact of progressive illustrations on retention of factual information in children. Finally, an investigation of how viewers process complex interactive illustrations at the semantic level would shed some light on their success as memory enhancers

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Appendix A: Stimulus and Response Items

1. Dupvad - Drum
2. Fanpol - Television
3. Boktin - Fork
4. Sunmig - Bucket
5. Ribset - Truck
6. Potmer - Typewriter
7. Valbil - Flower
8. Mufpan - Pencil
9. Milper - Wrench
10. Hodbel - Hat
11. Dontel - Telephone
12. Radpik - Airplane
13. Tupsin - House
14. Pedlid - Glasses
15. Zimtuk - Racket
16. Lotkam - Axe
17. Tugpan - Broom
18. Wepgof - Shoe
19. Kuzpid - Ball
20. Fenmop -Bird
21. Pogmel - Camera
22. Nuztup - Hammer
23. Supkon - Fish

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Book Reviews

Diane Janes
Editor

Technology and Education Reform: The Reality Behind The Promise by Barbara Means (Ed). San-Francisco: Jossey - Bass Inc., 1994. ISSN: I-5554-625-5, 232 pp. ($29.95 US)

Reviewed by Modest Levira

My reaction when I first saw the book was a quick reflection of annoying experiences I have had with similar titles which considered educational technology to be a warehouse for audio visual equipment as opposed to a system. However, before I finished reading the preface I realized that I had prejudged it wrongly.

Readers of CJEC will appreciate a book that articulates basic questions and suggests answers to why educational television of the 60's, computer assisted instruction of the 70's, and a whole array of recent educational technologies like the multimedia systems, interactive video discs and the computer systems have not accomplished the expected miracles in education.

Technology and Education Reform is a part of a project report of the National Study of Technology and Education Reform, conducted by the office of Educational Research and Improvement in the United States. The editor succeeds in the difficult task of putting together into a coherent pattern eight chapters contributed by different authors who also constitute a part of the research team. Each chapter is enriched with a substantial amount of supportive background literature blended in a straight forward language, style and humour that makes the book both interesting to read and simple to comprehend.

Chapters 1 to 7 give accounts of specific topics, namely: the use of technology to advance educational goals; multimedia for developing literacy for at risk students; computer networks; integrating technology with teacher education; using technology to support innovative assessment; evaluating the effect oftechnology in school reform and realizing the promise oftechnology. The last chapter describes in detail the project activities as performed in two of the sample schools fully provided with the necessary equipment and ideas and the teachers providing the students with experiences advocated by education reformers. The authors finish the chapter with what they foresee to be 'tomorrow's school in the United States. A bibliography is provided at the end of every chapter, while name and subject indexes are provided at the end of the book.

The title of the book carries two different terms, 'technology' and 'education', but the content successfully blends the two together to assume a fair concept of educational technology.

The authors present excellent arguments on an ideal two way relationship within and among subsystems of education needed before the sophisticated technologies such as multimedia and microcomputer networks that have invaded the classrooms can effect any positive reform in both the process and the product of education. Authors in most chapters also question the contention that knowledge flow assumes a one-way direction from the teachers to the students. They argue that such misconceptions of the term deny the rights of a give-and-take relationship and the reality of education as a process of knowledge sharing. Unequal distribution of resources, ill-prepared teaching personnel, teachers shying away from the technology explosion, questionable validity of our evaluation instruments, inadequate funding and unequal involvement of the sub-systems have allegedly been held responsible for any noticed failure in education reform. The authors urge educational technologists and planners to rethink more realistic socio-educational systems, enrich study programs and improve learning environments to create a more conducive atmosphere for generating knowledge. To use the editor's example; "Teachers who rethink their curricula, replacing short pieces of didactic instruction on separate topics in discrete disciplines with multidisciplinary projects in which students tackle meaningfully, complex tasks over extended periods of time, are establishing the prerequisites that will allow them to apply technology meaningfully to support students work" (p. xii).

On the negative side, this book neither provides detailed technical definitions and configurations of educational software involved in the Education Reform Project nor does it exhaust the long list of educational software currently available for school use.

The primary goal of the volume was to synthesize issues of technology and educational reform in a way that would help future innovators to avoid the potholes of the past. The authors finish by confirming that when technology is integrated into a broad effort, not as instigators of a course-all but as a set of tools to support intellectual inquiry, then educators, students, parents and communities have a powerful combination that may, indeed, bring necessary, positive change. In my opinion, this volume has accomplished its mission.

REVIEWER

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Software by Design: Creating People Friendly Software by Penny Bauersfeld. New York: M & T Books (division of MIS Press), 1994. ISBN: 1-55828-296-3, *325* pp. ($29.95 U.S.; $37.95 CAN).

Reviewed by Dan Fontaine-O'Connell

The title, though accurate, does this book a bit of a disservice. In lay terms the author has captured the fundamentals of project management, formative evaluation and iterative design between two covers, only three hundred and thirty easily read

pages apart. Granted while the focus of the book is on rendering the software development process more user aware, the scope is much broader. The approach Bauersfeld uses makes the techniques outlined easily translatable to the design of almost anything. What I found particularly relevant is the applicability of the techniques outlined in her book for the development of instructional media. The techniques themselves are not focused on instructional design, but that does not restrict them from being used for that purpose or any other non computer based media.

Having a stronger background in video production and other media, I was able to readily apply Bauersfeld's approach to the development of instructional video. My reason for selecting this book originally, however, was to expand my skills into the development of computer-based instructional media such as CD-ROM. Although she does not deal extensively with issues such as interface design or any of the myriad of other issues in developing computer based media, she provides the framework with which to proceed.

Bauersfeld takes a pedagogical tack in her presentation. The chapters of the book generally represent different stages in the design process, each contributing in progression to the completed design. Within each chapter, the author outlines the steps of that stage with justificationfor the approach based on user benefits and product development efficiency. She also provides a number of hints and tips based on her experience with software development along with exercises to help consolidate the skills in the reader.

As a practical exercise, Beuersfeld asks readers to develop a design of their own invention as they progress through the various stages she has outlined. She provides a broad context within which to design the product but I do not find the example project she has chosen to be practical despite its quasi-familiarity to most readers. She asks the reader to practice her techniques through the development of a piece of software for the food distribution industry, be it for taking inventory, facilitating grocery shoppers in finding food items or whatever. The intent behind her exercises is laudable. The problem is that the readers have to create their own context for the exercise. Consequently there is no avenue for feedback from the author because each situation would be too different for her to comment upon. She is not able to facilitate the reader in this project effectively so I question the approach. Straight forward examples of brief case studies demonstating the technique might have proven more effective.

The layout of the text is good with numerous subtitles and headings which provide an excellent overview of the topics being discussed. It reads as though she created an outline and then fleshed out each subject under the heading. This enhances the reader's ability to browse through the book, whether to get an overview or to find pertinent information quickly.

Admittedly, I found the first third of the book through to Chapter 4 unchallenging perhaps because of my familiarity with the material more so than her treatment of it. Chapters 3 through 8 provide the bulk of the value of this text.

Bauersfeld first outlines approaches to user studies emphasizing the primacy of this step to the overall design and success of the project. This includes observation techniques, interviwing, task anaylsis, expert interviews and more. Chapters 4 through 6 focus on the vaious stages of the design process from off-line design work to prototyping. Chapter 7 discusses evaluation methods and Chapter 8 creates a systhesis of the prior stages to advance the quality of the design.

It is not the type of book which one would pick up and read from cover to cover. Not all the information would be fruitful for everyone who used it but it could be a very useful reference guide for the design process in software development. It is also not a technical manual, theoretical position or manifesto of any kind. I would recommend the book as a very useful departure for someone embarking on the design of a software product, but also for the instructional design of material in any media. It is practical with a very hands-on approach. It is uncomplicated without being simplistic. And of course it's most redeeming quality is the emphasis on discerning the needs and desires of the end user as being *apriori* to any design.

REVIEWER

Dan Fontaine-O'Connell is a founder of CommonGround Communications, an educational communications firm based in Montreal and a Ph.D. student in Educational Technology at Concordia University.

Utilizing Multimedia ToolBook3.0, Tom L. Hall. Massachusetts: Boyd & Fraser Publishing Company, 1996. ISBN o-7895-003 1-O.

Reviewed by Brian D. Kerr

"Why re-invent the wheel?" is an expression that you have probably heard. Well, I say, "Go for it - especially if you can make it better!" That's exactly what Tom L. Hall has done with his book entitled *Utilizing Multimedia ToolBook 3.0.* He has developed a book that really makes it easy to get to know the ToolBook 3.0 program.

I have spent the past year struggling to master the software known as ToolBook 3.0 - this is an authoring package. As you know, User Manuals are not always easy to interpret and they can also be quite intimidating. So, over this yearlong period a great deal of information was gathered through trial and error, late-night telephone calls and lunch-time meetings with other users, on-line searches, and of course Internet news groups. I did everything short of the Vulcan "mind-meld" to figure this program out! Now, one year later, I spend two nights sitting in front of my computer with this book and it's all there in black and white

(sometimes purple) - with pictures too! If only I had received Tom Hall's book one year ago...

The book, *Utilizing Multimedia ToolBook* 3.0 provides a basic introduction to multimedia and obviously, the newly released Multimedia ToolBook 3.0. Descriptions are also provided of several other commercial multimedia products. I believe that Hall's book will suit any computer user's background, regardless of whether that person is a first-timer, or a real computer "geek". Hall has even included an appendix consisting of instructions to aid those who need a quick lesson on using Microsoft Windows 3.1.

Even though this book was designed to be a textbook, I would consider it to be the best reference book that I have seen for both ToolBook 3.0 and Multimedia ToolBook *3.O. Utilizing Multimedia ToolBook* 3.0 is very versatile. It is clearly written and includes hands-on lessons to introduce many of the software's specific features. As stated by Hall in the Preface, "A primary purpose was to provide as many examples of the software's use and as many illustrations as possible." The book is divided into five parts which, according to Hall, "...provides maximum flexibility to satisfy the needs of beginning and intermediate users."

The first three chapters review multimedia. These chapters on their own provide an interesting and informative overview of the concept of multimedia. Chapters 1 and 2 help provide background to the novice user, but may also fill any gaps within the knowledge base of veteran multimedia users. Definitions abound and Hall attempts to create a familiarity with many up-to-date multimedia tools and equipment. Once you reach Chapter 3, you embark on a journey. You are taken step by step from the construction of a basic application with only one or two pages and only a few objects to lessons that involve heavy user interactivity with the addition of animation, graphics, audio, and video multimedia components. As Hall describes it:

> "First, you are introduced to the structure of Multimedia ToolBook 3.0 and the fundamental building blocks of an application. Next, you are given a survey of the important commands to manipulate objects and determine their properties. The lessons then build applications using specific objects and commands. The final lessons add the different multimedia components."

And, as it is in textbook format, each chapter begins with an overview and ends with a summary complete with review questions.

Finally, if all that I have mentioned is not enough to make you run out and buy this book, there's more - a CD-ROM is included. The CD-ROM is loaded with all the tricks and examples you will need to perform tasks asked of you throughout the book. It contains all completed lessons from the textbook, sample ToolBook templates and applications, various media files, a number of sample runtime files for the Multimedia ToolBook 3.0 program, and even several shareware programs

including Paint Shop Pro 2.0. Wait, there is still more! The CD-ROM also contains a course syllabus as a guide for setting up a multimedia course devoted to the Multimedia ToolBook 3.0 authoring system. This syllabus includes a list of topics covered with each chapter along with suggested activities, as well as some scheduling ideas.

All in all, I have no hesitation in recommending this book to any ToolBook user. I am sure it will save a great deal of time and anguish, and will ensure a better end-product. I will conclude with some ToolBook script for you to ponder:

```
to handle end
if finished reading
go next Page
else
go to "start"
end if
end
```

REVIEWER

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Microware Review

(Len) F. Proctor

Available from: Macromedia,.Inc.,600 Townsend St., San Francisco, CA 94103

System Requirements:

SoundEdit Pro
Mac with 68020,2MB RAM, System 6.07
SoundEdit 16
Mac with 68030 processor, 2500K RAM, System 7, Sound Manager 3, QuickTime 2
At least 40 MB hard disk drive with access time of less than 40 ms.
Monitor that supports 256 levels of colour or grays
AV Macintosh or external digitizer (MacRecorder)

Software Description

SoundEdit makes it possible to record and edit music and voice, add special effects like echo or reverb to the soundtrack, analyse the results and compress the final sound track to reduce file storage space requirements. SoundEdit literally turns your computer into a sound recording studio.

Basic Functions

In SoundEdit the recording capacity is dependent on the amount of hard disk space available, not the amount of RAM memory installed in the computer. All editing changes are stored directly to disk in temporary files which are then automatically deleted after the editing tasks have been completed. Source input sounds are accepted from any device whose driver is compatible with the Macintosh Sound Input Manager. Sound recordings can be saved in 8 or 16 bit sample sizes and at any rate of sampling up to 48 kHz. All QuickTime sound editing, playback and synchronization tasks can be completed with SoundEdit 16. Both versions of SoundEdit are able to use several tile storage formats including the AIFF (Audio Interchange File Format). The AIFF format is the standard audio file format that is supported by most Macintosh multimedia applications. For cross-platform development purposes, the wave (.wav) file format is supported by SoundEdit 16, Using the Save As function within SoundEdit makes it easy to move back and forth between the various file formats to accommodate the file specifications of most current software applications that are able to integrate sound files into their functionality.

Documentation

The documentation accompanying the software is informative and well organized. Chapter 1 outlines basic system requirements and installation instructions for the program. Chapter 2 offers guidance on how to complete basic editing tasks. Chapter 3 is the reference section in which each menu options is described in detail. Chapter 4 in the soundEdit 16 guide is a 15 minute QuickTime tutorial in which the user learns how to open a movie, add soundtrack(s), synchronize sound with the movie frames and save the finished product. The appendix contains technical information on basic acoustic concepts, a listing of the frequencies of musical notes, file format descriptions and suggestions on how to use 2D and 3D spectrum displays. Browsing through the information in the appendix will leave the reader with a feeling of how much more there is to learn about the art and science of digital sound recording. The last section of the documentation contains a glossary of terms specific to editing sound files and an index.

Critique and Recommendations

SoundEdit Pro was installed and tested on a PowerBook 180. SoundEdit 16 was installed and tested on a Quadra 840AV and PowerMac 61 OOAV. In each case, the installations instructions were accurate and installation of the software with the installer program was uneventful.

The metaphor for this software package is the tape recorder. Editing functions have the look and feel of using a traditional tape splicing block. For example, to remove a segment of audio, highlight the segment and press the delete key or command-x. The segment is deleted and the edit is completed without having to get out the spicing tape to reconnect the two pieces of mylar. Similarly, to insert a sound segment into the sound track copy the desired sound to the clipboard, positioning the cursor at the appropriate place on the soundtrack and pasting it in. Many text books in the area of interface design suggest that an ideal interface is one that the user would not recognize as an interface while they are using it. In this application, SoundEdit developers have created a good approximation of an ideal interface.

To explore the file size generated by SoundEdit, a 20 second voice clip was recorded with the built-in microphone on the AV Macintosh. The parameters were set to 8 bit mono with a sampling rate of 11 kHz, and SoundEdit Pro file storage format with no compression. It took 224 K of disk storage space to save this file. While the sound track is under construction. SoundEdit also creates a temporary file of the same size as the original sound tile. In this example, there would have to be a minimum of 448 K storage space on the disk in order to create this sound clip. At this rate of consumption, a floppy disk, not counting construction space, would store a sound file that would play back in about two minutes. The quality of sound approximated that of an open reel-to-reel monophonic audio tape recorder running at 1 7/8 in. per second. This quality would probably be functional for use in-house for rapid prototyping applications. Multimedia products that are destined for external use would likely require a higher quality sampling rate. Recording in 16

bit stereo with a sampling ratio of 48 kHz gives CD quality sound but consumes correspondingly larger amounts of storage space. There will always be a trade off between file size and sound quality.

As with any time-dependent media files, a fragmented disk will slow down recording and playback time. For consistent sound quality the hard disk that is used to store sound files should be defragmented regularly. This point is particularly important when transferring sound files to CD-ROM storage media because access times of most CD players are significantly longer than they are on hard drives. Running SoundEdit 16 in the background when it is processing a file should be avoided because the foreground program may interfere with SoundEdit causing the entire system to lock up.

Leaving AppleTalk turned on when recording in stereo can have the same disasterous effect. Also, on older computer systems, better recording and playback performance may be gained using only the black and white settings for the monitor. Finally, while SoundEdit 16 can ope Windows files in the .WAV and .MOV formats, these files must be loaded into the Macintosh via one of the standard PC file access utilities such as Apple File Exchange. Files cannot be directly imported into SoundEdit 16 from PC-formatted CD ROM discs without having them stamped with a Macintosh resource that SoundEdit 16 can recognize.

By itself, SoundEdit is just one more piece of software that does a good job of assisting the user to complete a task. However when considered in the larger context of digital communications, the ability to edit sound with the same ease and accuracy as the ability to edit text opens up the option of using audio forms of communication to many more users without incurring major cost. Sound and images are becoming equal partners with text in the information processing arena. While this may sound like an advertisement for SoundEdit it is not. I like it because it is one example of a user-friendly enabling tool that helps this partnership to become a realistic possibility. So far, it has worked well for me.

REVIEWER

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Information for Authors

CJEC welcomes papers on all aspects of educational technology and communication. Topics include, but are not limited to: media and computer applications in education, learning resource centres, communication and instructional theory, instructional design, simulation, gaming and other aspects of the use of technology in the learning process. These may take the form of reviews of literature, descriptions of approaches or procedures, descriptions of new applications, theoretical discussions and reports of research. Manuscripts may be submitted wither in English or in French.

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Manuscripts should be printed on 8% x 1 l-inch ordinary white paper. All materials must be double-spaced, including quotations and references, include a title page on which appears the title of the manuscript, the full name of the author(s) along with position and institutional affiliation, mailing address, e-mail address, and telephone number of the contact author. An abstract of 75- 150 words should be placed on a separate sheet following the title page. While the title should appear at the top of the first manuscript page, no reference to the author(s) should appear there or any other place in the manuscript. Elements of style, including headings, tables, figures and references should be prepared according to the Publication Manual of the American Psychological Association 4th Edition, 1994. Figures must be camera ready.

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Send four copies of the manuscript to the Editor along with a letter stating that the manuscript is original material that has not been published and is not currently being considered for publication elsewhere. If the manuscript contains copyright materials, the author should note this in the cover letter and indicate when letters of permission will be forwarded to the Editor. Manuscripts and editorial correspondence should be sent to: David A. Mappin, Canadian Journal of Educational Communication, Faculty of Education, 3-l 02 Education North, University of Alberta, Edmonton, Alberta, T6G 2G5. e-mail: David.Mappin@ualberta.ca