

Discount Multimedia: Action research in the development, use, and evaluation of mixed mode teaching resources

Mary Tate
Mark Wilson-Munro
Marco Zhang
Beverley Hope
Eusebio Scornavacca

School of Information Management
Victoria University of Wellington
Wellington, New Zealand
e-mail: mary.tate@vuw.ac.nz

Abstract

This research-in-progress paper describes action research in the development, use, and impending evaluation of purpose-built mixed-mode teaching resources for introductory web development. The material combines web-based self-study exercises, face-to-face demonstrations, tips, examples, and reviews - all within single workshop sessions. The aim was to achieve many of the advantages of multimedia and computer-based instruction whilst minimising the disadvantages. Preliminary observations and anecdotal evidence suggests that both students and workshop tutors are responding positively to this teaching innovation, although in the absence of an established pedagogy, it is likely that further research and experimentation will be required.

Keywords

Multimedia, instructional design, e-commerce teaching, action research, flexible learning, flexible learning

INTRODUCTION

In the current, competitive educational environment, informed students are demanding modes of instruction that suit their individual needs (Mitchell & Hope, 2002). Increasingly, information technology (IT) is being used to provide flexible forms of education, moving teaching from broadcast to interactive modes and information presentation from linear to network formats. Despite its increasingly widespread use, there is little consensus on the most effective use of IT. This is especially so for hybrid or mixed-mode instruction. By mixed-mode we mean the combination of face-to-face demonstration and instruction with online self-study exercises, tips, and examples all within the same session. In this paper we are concerned with mixed-mode within each class session.

Faced with perceived problems of mediocre workshop attendance, student reluctance to ask questions, and failure of some students to grasp key concepts, we decided action was necessary. In the absence of a clearly established pedagogy for mixed-mode teaching, we decided to conduct action research to develop, use, and evaluate purpose-built teaching resources based on multimedia instructional design principles. The aim was to improve the enjoyment and effectiveness of student learning.

In this paper we present the results of that research. First we present the problem or issue through an explanation of the learning environment. We then present some key ideas from our examination of the academic literature and web resources on computer-based and multimedia instructional design, including issues of quality, evaluation, and best practice. We then summarize the research design, actions taken, and preliminary or anecdotal results. Full evaluation takes place early in June and results will be available at the conference.

TEACHING AND LEARNING ENVIRONMENT

Staff in the School of Information Management (SIM), at Victoria University of Wellington have been practicing mixed-mode teaching in undergraduate courses since Blackboard was introduced in 1999. Blackboard is a suite of products providing an e-education infrastructure through provision of such functionalities as content management, discussion forums, and a gradebook. Staff commonly post announcements, course documents, and some resources. Many also offer asynchronous discussion forums on a variety of topics. In addition to the online material, courses commonly include large group lectures, small group tutorials, and practical workshops in computer laboratories with face-to-face tutors.

Since 2000, SIM has offered a major in electronic commerce, with two possible threads, one managerial, the other more technical with a focus on multimedia design. The foundation course for both threads is ELCM 201 Foundations of Electronic Commerce, a 12-week, full trimester course. Most students entering the course have at least a basic understanding of systems development concepts and some hands-on experience with Microsoft Access. Enrolments have ranged between 100 and 200, with up to 30% non-English Speaking Background (NESB) students.

Almost a third of the course assessment for ELCM 201 is based on a practical web development assignment, developed using Macromedia products, primarily DreamweaverMX™ and FireworksMX™. Dreamweaver is a web authoring tool, and Fireworks is an image manipulation tool. Hands-on workshops of one hour per week provide instruction pertinent to this assignment.

For two years, we experimented with a range of approaches for teaching Macromedia products in computer-based workshops. In 2001, we offered no formal instruction, neither face-to-face nor online. During scheduled workshop sessions, students were expected to teach themselves using help files and self-sourced online resources. Tutors were available to assist when requested. In 2002, we continued providing staffed workshop sessions where tutors would provide assistance upon request. Some tutors also gave demonstrations based on workshop guides provided to them by the senior tutor. In addition we published on Blackboard, static self-study notes that students could work through at their own pace and offered an asynchronous online question forum. Student attendance at workshops was not mandatory and attendance was not recorded.

The course received acceptable summative teaching evaluations overall, being at or slightly above the school average for the type and level of course. However, we did not carry out detailed formative evaluations of workshops. Consequently, we had only subjective observations and tutor feedback regarding the workshops. This feedback suggested:

- Mediocre attendance at workshop sessions, that is, about 50% of those registered. This was possibly due to publication of the self-study notes. Clearly many students did not see a benefit in attending the staffed workshop sessions. Yet anecdotal evidence suggested a relationship between workshop attendance and performance in practical assignments.
- Workshop tutors were often unclear about which concepts were causing students concern and, therefore, where to focus their energies within workshops.
- Students, especially NESB students, were reluctant to ask for help even when they were struggling.
- Some key concepts, for example, opening web sites from an index page, were still poorly handled in up to 20% of assignments, despite being repeatedly reinforced in the self-study notes.

We were convinced we were not gaining the maximum possible benefit from our fledgling mixed-mode teaching. The self-study material was rudimentary, yet many students were trying to use it as a substitute for attendance at staffed workshop sessions. Workshops functioned more like a help desk, with little or no formal instruction. We wanted to use the talents, resources and media available to us more effectively.

The academic and research student tutors on the course shared an interest in multimedia instruction, and we began to explore the idea that we could borrow ideas from multimedia instructional design to develop *discount multimedia* – quickly produced mixed-mode teaching resources which maximized advantages whilst minimising disadvantages. We would use self-paced online study material in conjunction with targeted face-to-face instruction within a single classroom setting. To do this, we first needed to examine the literature and practice for pedagogy and best practice.

THEORETICAL BACKGROUND

To seek a solution to our problem, we examined academic literature and web resources on computer-aided, distance, and multimedia instructional design to determine the advantages we might expect to achieve. We also explored the literature and web resources on multimedia quality, evaluation, and rubrics for insights into the strengths of multimedia resources for different types of instruction.

Selecting Appropriate Media

Gange et al. (1992), identify five categories of learned capability: intellectual skills, cognitive strategies, verbal information, motor skills, and attitudes. This research concentrates on the capabilities required for the course, primarily *verbal information* as a building block leading to *intellectual skills*. *Verbal information* is more factual knowledge, the kind 'we are able to state' (Gange et al. 1992, p. 46). *Intellectual skills* are skills that

“enable individuals to interact with their environment in terms of symbols or conceptualisations” (Gange et al. 1992, p. 43).

In the ELCM 201 context, instruction started with verbal skills, such as specific syntax and commands, led to intellectual skills, such as selection of appropriate colour or creation of usable websites with an appropriate structure and navigation hierarchy. We were interested in using the most appropriate media for each learning capability. Gagne et al’s suggestions for recommended and excluded media for teaching intellectual and verbal skills are summarised in Table 1.

Multimedia instruction uses rich media capable of providing the necessary feedback, verbal messages, and elaborations (Lee and Owens 2000, Swan 2001, Gagne et al. 1992). It has particular advantage for instruction in web development, where it can be used to show the software code used to achieve a particular result, provide tips about best practice, or supply visual demonstrations of desired results.

Table 1: Recommendations and Exclusions of Media for Learned Capabilities

Learning capability	Recommendations	Exclusions
Intellectual skills	Media providing feedback to learner responses	Media having no interactive feature
Verbal information	Media able to present verbal messages and elaborations.	Equipment or simulators with no verbal accompaniments

Source: Gange et al. (1992), p.220

Advantages of Multimedia Instruction

Presentation of the same information in multiple media has been shown to increase learning and retention (Gonzalez et al. 2000). We hoped that by using multiple media, matched to our desired learning capabilities, overall learning outcomes would be improved.

Good content organisation and delivery is critical to all instructional design (Gagne et al. 1992). Research in content design for multimedia instruction suggests the need for detailing tasks to be included in the instruction, setting clear and measurable learning outcomes, and matching both of these to the appropriate media (Lee and Owens 2000). We were already engaged in some mixed mode delivery in the course, so we explored the possibility of improving and better integrating the components into a consistent whole.

Our exploration caused us to consider the multimedia quality literature which we found emphasizes the importance of consistent screen design and layout (Swan 2001, McCullen, 2003) and consistent organisation and delivery of material (Lee and Owens 2000, McCullen 2003). Our previous online, guided self-study material had been developed using a template, giving rise to consistent screen design and layout. However, our face-to-face instruction had been ad-hoc, driven largely by student questions. This resulted in inconsistent organisation and delivery of material. By developing a single lesson structure that encompassed both online and face-to-face teaching, we hoped to achieve consistent delivery and clearer linkages to lesson objectives.

Multimedia presentation enables self-paced learning. Many studies have shown that learner control over lesson pacing and opportunities for independent practice are a major advantage of online learning (Lee and Owen 2000, Swan 2001, Gagne et al. 1992). Student demand for course materials to be published online already provided evidence that many students preferred to work at their own pace. Our proposed mixed-mode, within-class instruction would add to this. In addition, online material allows users unlimited opportunities for review and self-testing until confidence is reached. (Swan 2001, Lee and Owens 2000).

To summarise, based on online and multimedia instructional design and quality literature, we identified the potential advantages of mixed mode teaching as being the use of rich media to provide feedback, verbal messages and elaboration, good content organisation and delivery, consistent screen design and layout, learner control over pacing, and unlimited opportunities to review.

Disadvantages of Multimedia Instruction

Some potential disadvantages to online, multimedia learning are identified in the literature. One of the most important is the potential breakdown in the relationship between instructor and learner, resulting in a feeling of isolation (Swan 2001, Beorner 2002). Andersen and Andersen (1982) identify a set of communication behaviours that they term “teacher immediacy,” which are associated with excellence in actual and perceived learning. These include non-verbal signals of availability, closeness and warmth, and verbal behaviours such as

spontaneous humour, praise, and following up on student initiated topics. Teacher immediacy is, not surprisingly, highest in the face-to-face setting (Carrel & Menzel, 2001).

In addition to a lack of teacher immediacy, a potential disadvantage of distance learning is the lack of peer support and contact (Boerner 2002). This can affect student's actual and perceived learning (Swan 2001). While strategies are available to build effective online learning communities, the task of website development does not lend itself well to these. We felt students needed the capacity to demonstrate and discuss with peers the visual design and usability of their embryonic websites in face-to-face sessions.

A further disadvantage of exclusive use of online multimedia instruction is the difficulty in providing positive and corrective feedback. Positive feedback "tells students they are correct and what comes next"; corrective feedback "explains why the answer was wrong, (and) reveals what the correct answer is" (Lee & Owen, 2000, p. 125). In practical instruction for web design, both positive and corrective feedback are difficult to give except in a face-to-face context. What is 'good' tends to be based on expert judgement and heuristics (Neilson 2000) rather than hard and fast rules. Online discussion forums worked well for technical questions such as, "In DreamweaverMX™, how do you make invisible the table lines you used to layout the page?" However, it was of limited or no value for more open-ended questions such as, "Are my visual design mock-ups on the right track?" According to Gagne's (1992) intellectual skills questions are most suited to a media that provides feedback to learner responses. This could be provided most effectively by face-to-face instruction.

While opportunities for review and self-testing can be a strength of online and multimedia instructional material, the pre-programming this requires can lead to inflexibility for the learner, (Lee and Owen 2000, Boerner 2002). Learners are restricted to the range of pre-programmed questions and answers provided by the instructional designer.

As well as the learning disadvantages inherent in the media, online multimedia resources are time and labour intensive to produce. Methodologies for multimedia design typically suggest a large, multi-disciplinary project team, including roles such as author, creative director, graphic artist, evaluation specialist, and instructional designer, to name a few. Estimates of the hours of effort required to produce one hour of multimedia instructional design vary between 250 and 750 hours (Lee and Owens 2000). We did not have the resources to assemble such a team, and further, we were concerned that the dynamic nature of our content meant it would not be cost-effective to maintain (Tooth, 2000).

In summary, we identified the potential disadvantages of online multimedia instruction for learners as being lack of teacher immediacy, lack of peer support, inflexibility, and lack of context sensitive feedback. For the teaching staff, the major disadvantage was the time needed to develop and maintain online materials. We hoped to mitigate these disadvantages by coupling multimedia instruction with face-to-face instruction. Furthermore, we hoped the face-to-face sessions would contribute to creating a sense of community and peer support for learning amongst students.

RESEARCH METHOD

We chose an action research approach. A widely cited definition of action research is that of Rapoport (1970, p.499):

Action research aims to contribute both to the practical concerns of people in an immediate problematic situation, and to the goals of social science by joint collaboration within a mutually acceptable ethical framework.

Avison et al. (2001) identify three risks for action research projects. The first risk relates to the legitimacy of the research: whether project initiation is driven by the researcher (a solution looking for a problem), or the client (a problem with limited potential for contributing to knowledge). The second risk relates to potentially mixed authority: whether authority is vested in the organisation or an external researcher. The third risk relates to formalisation (control of project scope and objectives) and the possibility that the project may evolve and change over time in response to business pressures.

The ELCM 201 project was an ideal candidate for action research, because all three risks were effectively mitigated by the project structure. Both researchers and 'client' were drawn from staff teaching on the course, as the authors held multiple roles in the project encompassing both teaching (practice) and research. Ultimate responsibility for both research and practice was vested in the principal researcher who, as course coordinator, became a single point of control for authority and formalisation.

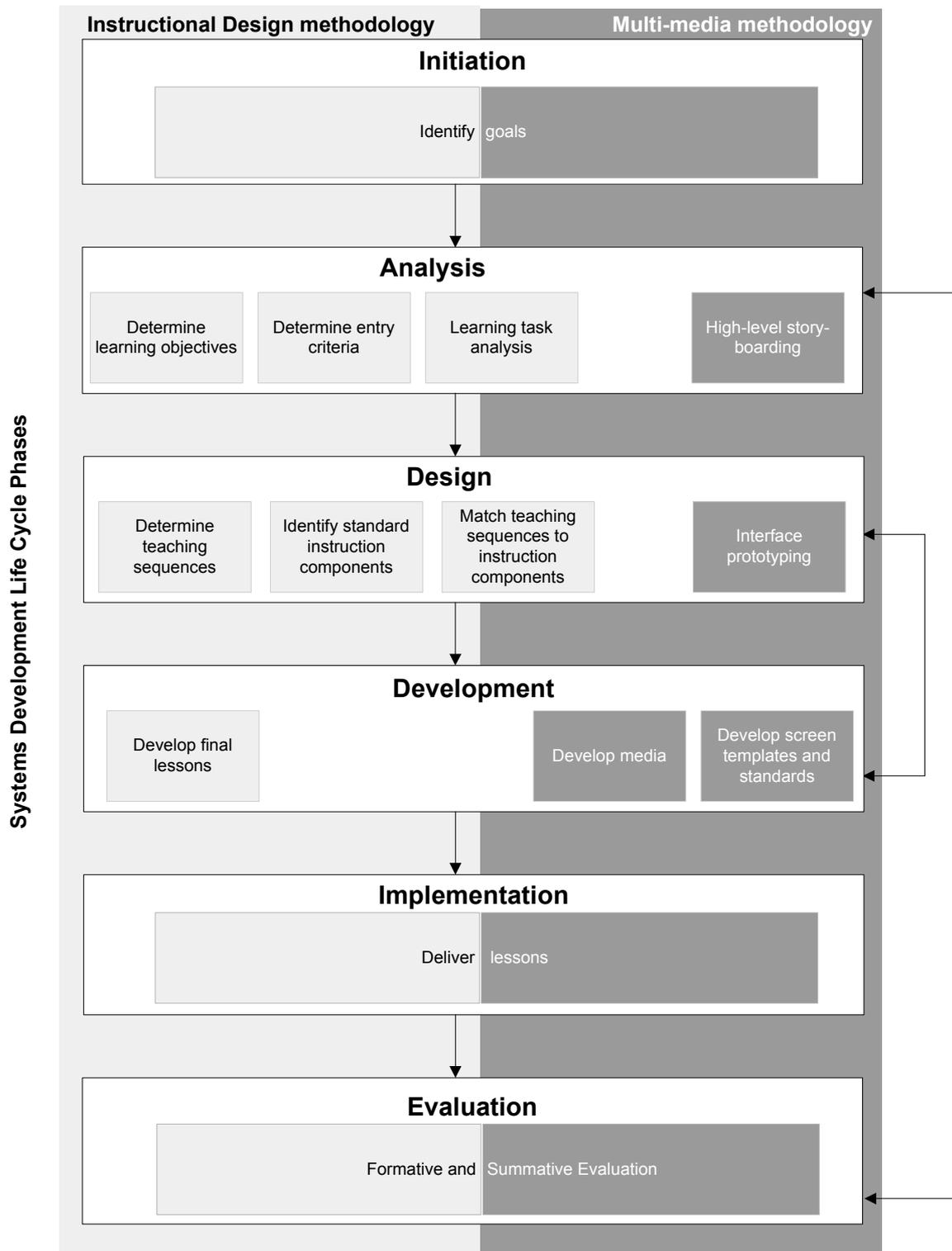


Figure 1: Discount multimedia development methodology

Within the overall action research framework, the authors developed their teaching resources using a systems approach adapted from instructional design, multimedia design, and systems development methodologies (work-in-progress Tate & Wilson-Munro, 2003). The approach was framed by a variation on Hoffer, George, and Valacich's (2002) systems development life-cycle (SDLC). This provided an overall development life-cycle consisting of 6 phases, initiation, analysis, design, development, implementation and evaluation. To this, were added instructional design and multimedia design activities at appropriate life-cycle phase (Figure 1: Discount multimedia development methodology). For example, during the analysis phase, instructional design activities (determine learning objectives, determine entry criteria, learning task analysis) were carried out instead of the more traditional user requirements elicitation. As we were aiming for a mixed mode delivery, we also included high-level story-boarding during the analysis phase, based on multimedia methodologies.

The instructional design activities were based on a learning task analysis (Gagne et al.1992). Learning task analysis involves setting an overall objective, and then revealing the learning objectives that would enable that overall objective. For each learning objective, teaching sequences were developed detailing a series of steps and the required skills for each step. This approach provided a structured and consistent approach to content design for both the online and face-to-face components of instruction.

The multimedia activities were based on the methodology outlined in Lee and Owens (2000) supplemented by the work of Vrasidas (2002). Figure 1 shows how instructional design and multimedia design activities were carried out during each of the system development life-cycle phases.

RESULTS

The action research resulted in both outputs and outcomes. The output was an integrated series of mixed-mode workshop lessons incorporating online face-to-face, and mixed-mode components. The outcome will be student perceptions of the learning environment and objectively assessed performance on the web development assignment.

Output: The Mixed-Mode Workshop Lessons

The reader will recall that our Figure 1: Discount multimedia development methodology called for a six stage process comprised of: *initiation, analysis, design, development, implementation, and evaluation*. The action research concentrates on the design, development, and evaluation stages of methodology. This is because the initiation and analysis stages were, to a large extent, already established in pre-existing course design and administration activities.

In the initiation phase we determined that, based on the course objectives and assessments, our overall objective for the workshop stream was to teach students how to design an appropriate website for a specified case, and how to develop a working prototype using DreamweaverMX™ and FireworksMX™.

Through analysis, we identified the learning objectives as: familiarisation with the Dreamweaver and Fireworks interfaces, interface, adding images, selecting and using appropriate image formats, adding text, using tables, website management and working with images. The entry criteria were predetermined by the course prescription and pre-requisites, which require a pass in an entry-level Information Systems course. In reality, this provides an inadequate definition of the entry criteria for the workshop stream of the course and there is very wide variation in the skill-level of students entering the course. Skill level on entry is included as a variable in our formative evaluation, but at the time of writing, the impact of this disparity on student's perceived and actual learning is unknown. In the analysis phase, we drew on multimedia methodologies to develop high-level storyboards to conceptualise the structure and flow of the lesson content for the workshop stream as a whole, and to identify the nine individual workshops.

In the design phase, learning objectives were broken down into teaching sequences. Figure 2 shows how the learning objective, "selecting and using appropriate image formats", was decomposed to four teaching sequences building from verbal learning (factual knowledge) to intellectual skills (knowing how).

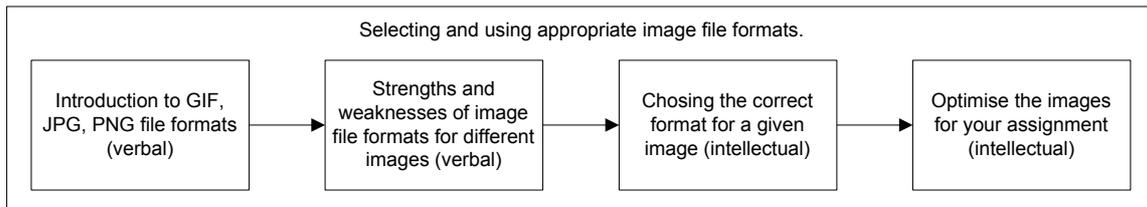


Figure 2: Teaching Sequence for the Learning Objective 'selecting and using appropriate image file formats'.

During the design stage, we concentrated on applying innovative use of a variety of teaching media to the explicated teaching sequences. To achieve the advantages of rich media, each teaching sequence included combinations of visual demonstrations by tutors, visual demonstrations online, verbal explanations by tutors, textual information provided online, practice exercises, tips, and mixed-mode review activities. This provided complementary information and activities in a range of media. We conceptualised a standard set of instructional components that would be used in each lesson; tutor presentations, background information, concept checks, tips, and activities (Table 2). Each component is either delivered fully online or is mixed-mode utilising both online and face-to-face resources.

Tutor presentations are brief, face-to-face mini-lectures supplemented, where appropriate, by online demonstrations to create a mixed-mode component. They are most commonly used to provide an initial orientation to a learning objective. An outline of the mini-lectures is provided online so students may prepare before the session or review afterwards. The information presented is primarily verbal information supplemented by comments and illustrations covering how it can be applied to course assessments. **Background information** also provides verbal information to support the each learning sequence.

Concept checks consist of selected, in-class multiple choice review questions. They are intended to provide the tutor with immediate feedback on student comprehension of the more difficult concepts. Each student has four differently coloured cards to represent their answer: Red for A, Green for B, Yellow for C, and Blue for D. The tutor poses the question, and students display the card for their chosen answer. This gives the tutor immediate feedback on the level of student understanding. It also provides motivation for students and keeps them on task.

Tips provide intellectual skills (learning how) advice and suggestions about best practice for a particular skill included in the lesson. They can be applied to activities within the workshops, but are also aimed at assisting students with independent practice and problem solving.

Activities are hand-on exercises for the students. They are often commenced during workshop sessions and completed at the student's own pace. In many instances, activities contribute directly to completion of an aspect of the assessed assignment.

Table 2: Discount multi-media instructional components

Code	Name	Delivery media	Description
TP	Tutor presentation	Mixed-mode	Visual demonstrations (e.g., of a page produced by some specific HTML code) Verbal explanations Online summary provided
BI	Background information	Online	Factual, historical and contextual information provided online in text format.
CC	Concept Check	Mixed-mode	Online review questions, that are also responded to in-class and reviewed by the tutors.
T	Tip	Online	Hint provided online in text format.
A	Activity	Mixed-mode	Hands-on activities for students to practice learned concepts. Each activity is described online, and time is allocated to it within the workshop session. Tutor assistance can be obtained. The student can review the activity in their own time.

How the mixed-mode workshops met the learning objectives

Our design approach provided the advantage of consistent organisation and delivery of content across time and between different workshop tutors.

To achieve consistency in screen design, the workshops for each teaching sequences follow a consistent layout. For example, the opening screen for a workshop shows the teaching sequence, an index to online resources, and an estimated time for completion of each step. Alongside each teaching sequence is the component type (TP, BI, CC, A) identified by a distinctively colour coded and meaningful icon. Meaningful icons were used because they convey comprehension at a glance, and because icons are accessible to colour blind users. Figure 3 shows the opening screen for the workshop sequence introducing HTML

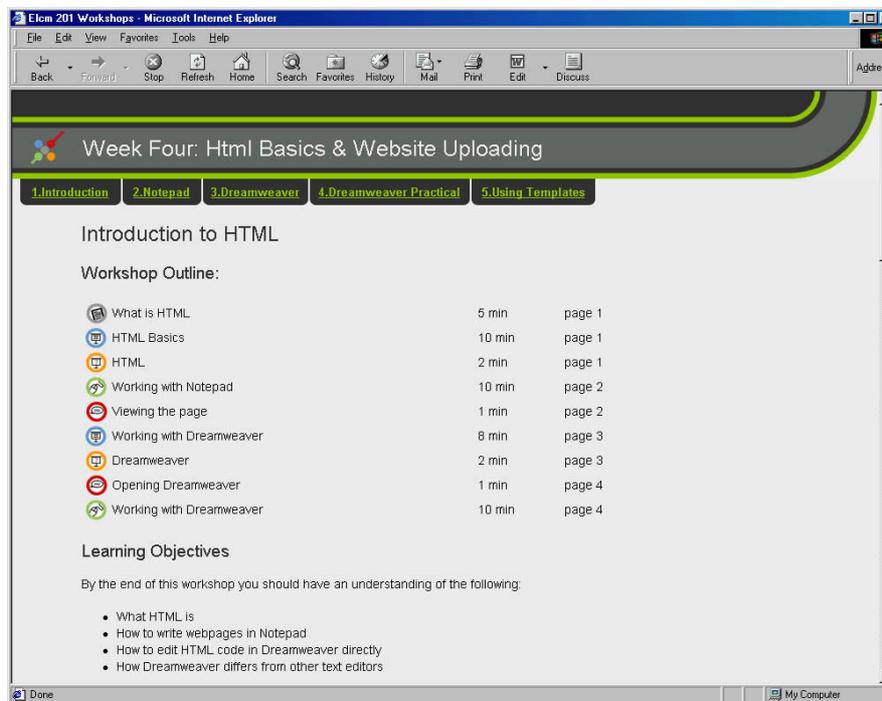


Figure 3: Typical lesson outline: Introduction to HTML.

In addition to pedagogy, three further objectives influenced our screen design:

Rapid download: Because the workshops would contain screenshots, which can be slow to download, the rest of the interface had to be very lean.

Template ease of customisability: The template needed to be a suitable container for all the types of content that would or might be put on the site. For example, the buttons are not images. This allows them to be easily changed without requiring the use of a graphics package.

Resize-ability: To cater for students accessing the site off campus and for changes of technology on campus, the website needed to work at a number of different resolutions.

Our literature search identified learner control of pacing as an important advantage of online instruction. In our design, each workshop included activities for self-paced practice. These were also available online so that students could complete the activities out of class at their own pace. The literature review also identified lack of teacher immediacy and peer support as disadvantages. By scheduling face-to-face workshops, we hoped to encourage peer learning and to provide encouragement and feedback associated with teacher immediacy.

Frequent opportunities for testing are a potential strength of online instruction. However, they are achieved at some inflexibility to the learner. To address this issue, our design included mixed-mode concept checks (Figure 4) Following these, the tutor can adapt in real time: reviewing the material with the whole group if a majority have not understood it, or circulating individually to a few students if the check suggests this would be more appropriate.

This teaching approach and our teaching resources are still a work-in-progress. Our formative evaluation, aimed at determining the extent to which our objectives have been met, will tell us what our next steps must be.

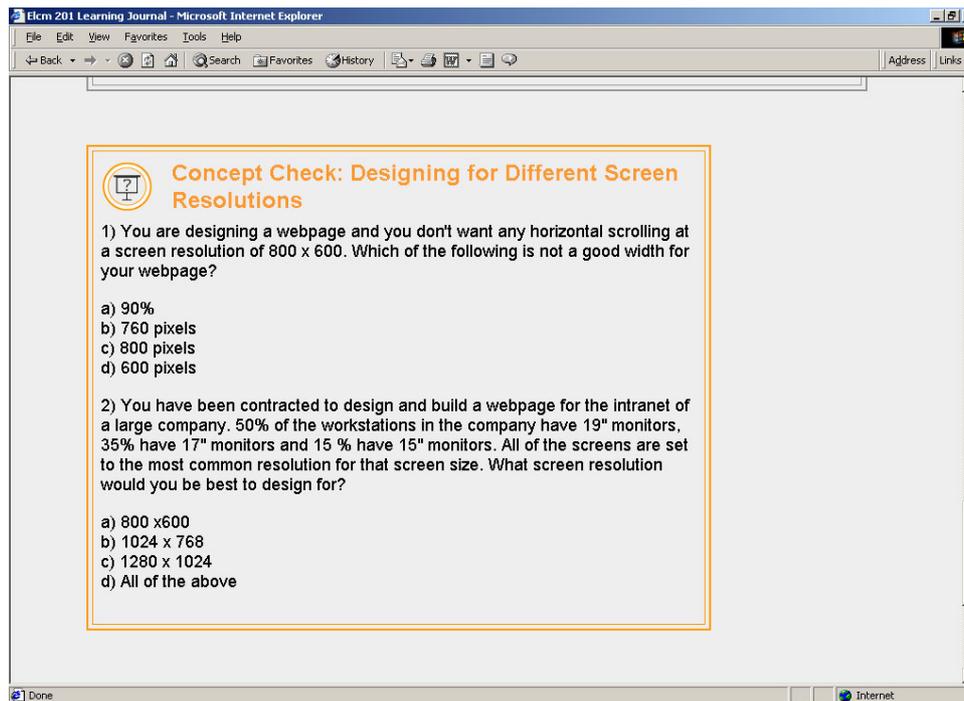


Figure 4: An example of a mixed-mode concept check

Outcomes: Student and Tutor Perceptions of Enjoyment and Effectiveness

To obtain data on the extent to which we had met our goal of enhanced perceived enjoyment and effectiveness of student learning, we developed a four stage evaluation process in line with Pinsonneault and Kraemer (1993). The stages are briefly described below. The results of this process will be triangulated with measures of actual learning, based on the technical quality of student websites.

Definition of the target population: In the evaluation of perceptions, students attending the workshops and workshop tutors will be the target population. Students attending workshops for another 200-level course that uses a more traditional approach of guided self-study will participate as a control group.

Data Collection Instruments: Students will be approached through a survey and workshop tutors through an interview (Babbie 1999, Churchill 2001). The survey instrument for students is composed of three sections. In section one, we collect personal data to act as independent variables: age, gender, workshop attendance, and cultural background. Section 2 forms the major part of the instrument. It is composed of 22 statements on a 5-point Likert-Scale. Section 3 contains five questions that examine the students perceived level of technical skills with the software used in the course. The survey also contains two open-ended questions where students are asked to indicate the three things they most liked and most disliked about the workshops. The interview protocol for tutors is composed of eight open-ended questions designed to encourage tutors' freely expressed perceptions of workshop experience and effectiveness. The survey questionnaire and the interview outline received content and face validation by academic staff. (Litwin, 1995; Hoppen et al. 1996). The survey instrument is attached as Appendix One.

Data Collection: Survey data will be collected during regularly scheduled tutorial sessions in the final week of the course. Participation will be voluntary and confidential. Tutors will be interviewed after course conclusion by a third-party. Use of a third-party should avoid bias and encourage free and open disclosure.

Data Analysis: The data collected in the survey will be analysed in order to obtain descriptive statistics. Firstly, the socio-demographic profile will be accomplished by the measurement of the absolute frequencies of the answers on section 1. Afterwards, the data collected on sections 2 and 3 (Likert-scale items) will be analysed. T-tests will be used to test for differences in the means, χ^2 tests to test whether the observed frequencies of a variable differed and ANOVA to discover if there is a significant difference in the means of the studied sample (Mendenhall, 1990). Qualitative interview data will be analysed through content analysis to identify main ideas expressed by the workshop supervisors (Freiras and Jenissek, 2000).

Actual learning: Web-site Metrics: To triangulate measures of student perceived learning, actual learning outcomes will be obtained by scoring student websites from 2002 and 2003 using a range of technical metrics.

DISCUSSION AND CONCLUSION

This study aimed to contribute to the pedagogy of mixed-mode teaching, using multiple modes of delivery (on-line, face-to-face) within individual lesson components and teaching sequences. This was intended to achieve many of the advantages of on-line and multi-media educational material, whilst minimising the identified disadvantages by use of face-to-face classroom teaching where it was appropriate and cost-effective.

Preliminary data and anecdotal evidence suggest that student enjoyment and perceived learning have been enhanced by mixed-mode teaching. However preliminary data on student reactions to individual lesson components has been mixed. In particular, the pacing of the tutor presentations (TP) and the activities (A) has received mixed reviews. Despite providing the ability for students to review these on-line before or after the workshop session, many students have reported that these components moved either too quickly or too slowly. We are investigating the possibility that this may be explained by the wide variation in technical skill levels for students entering the course, or by differences between NESB students and other students. More complete data will be available by the time of the conference.

Our mixed mode lessons were developed by course instructors, at a ratio of approximately 8 hours of development to 1 hour on instruction. This was achieved by concentrating on providing textual information, examples and demonstrations on-line. Richer, more responsive, and more learner sensitive feedback were provided cost-effectively in face-to-face instruction. This compares favourably to estimates of the ratio of development time to instruction time for full multimedia development which range from 250:1 to 750:1 (Lee and Owens 2000). This suggests that "discount multi-media" using mixed-mode teaching is possible, and provides a strong motivation for further research into how to use the strengths of each media most effectively to develop a pedagogy for mixed mode instruction.

In conclusion, we are in the closing stages of one cycle of action research into an innovative mixed-mode teaching approach that combines on-line and face-to-face teaching within single workshop lessons and within lesson components. The process of developing the outputs described in this paper that is, the mixed-mode workshop lessons, has already yielded many useful insights for us as teachers of technology. The outcomes, that is, the detailed formative evaluation we are conducting with our students will yield more. The results of the formative evaluation will be reflected in future revisions to the workshop session material and delivery methods for future offerings of the course. Over time, we hope to be able to provide effective guidelines for information technology and electronic commerce faculty engaged in mixed mode teaching.

REFERENCES

- Andersen, P., & Andersen, J. (1982). Non-verbal immediacy in instruction. In L. Barker (Ed.), *Communication in the Classroom* (pp. 98-120). Englewood Cliffs, NJ: Prentice-Hall.
- Avison, D., Baskerville, R., & Myers, M. (2001). Controlling Action Research Projects. *Information Technology and People*, 14(1), 28-45.
- Babbie, E. (1999). *Métodos de pesquisa de survey*. Belo Horizonte: Editora UFMG.
- Boerner, G. (2002). *Delivering Equitable Online Education: Full Online vs. Hybrid Courses Compared*. Paper presented at the CiTE, Denver.
- Carrell, L., & Menzel, K. (2001). Variations in Learning, Motivation, and Perceived Immediacy between Live and Distance Classrooms. *Communication Education*, 50(3), 230-240.
- Churchill, G. (2001). *Basic marketing research*. Fort Worth: Dryden Press.
- Freiras, H., & Janissek, R. (2000). *Análise léxica e análise de conteúdo: técnicas complementares, sequenciais e recorrentes para exploração de dados qualitativos*. Porto Alegre: Sagra Luzzatto.
- Gagne, R., Briggs, L., & Wager, W. (1992). *Principles of Instructional Design*, Wadsworth Thomson Learning.
- Gonzalez, R., Cranitch, G., & Jo, J. (2000). Academic Directions of Multimedia Education. *Communications of the ACM*, 43(1).
- Hoffer, J., George, J., & Valacich, J. (2002). *Modern Systems Analysis and Design*. Upper Saddle River, New Jersey: Prentice Hall.
- Hoppen, N., Lapointe, L., & Moreau, E. (1996). Um guia para a avaliação de artigos de pesquisa em sistemas de informação, *READ - Revista Eletrônica de Administração*. Porto Alegre: PPGA-EA-UFRGS.
- Lee, W., & Owens, D. (2000). *Multimedia-based Instructional Design*.: Jossey-Bass Pfeiffer.

- Litwin, M. (1995). *How to measure survey reliability and validity*. California, EUA: SAGE Publications Inc.
- McCullen, C. (2003). *Midlink Magazine (on-line magazine)*. SAS inSchool. Available: <http://www.ncsu.edu/midlink> [2003, 30 May 2003].
- Mendenhall, W. (1990). *Estatística para Administradores*. Cidade do México: Iberoamerica.
- Mitchell, G., & Hope, B. G. (2002). Teaching or technology: Who's driving the bandwagon? In E. C. (Ed.) (Ed.), *IT Education: Challenges for the 21st Century* (pp. 125-145). Hershey, PA: Idea Group Publishing.
- Nielson, J. (2000). *Designing Web Usability*. Indianapolis: New Riders.
- Pinsonneault, A., & Kraemer, K. L. (1993). Survey research methodology in management information systems: an assessment. *Journal of Management Information Systems*, 10(2), 75-105.
- Rapaport, R. (1970). Three dilemmas of action research. *Human Relations*, 23(6), 499-513.
- Swan, K. (2001). Virtual interaction: Design Factors affecting student satisfaction and perceived learning in asynchronous online courses. *Distance Education*, 22(2), 306-331.
- Tooth, T. (2000). *The use of Multimedia in Distance Education*. www.col.org/knowledge/ks_multi-media.htm [2003, 8-05-03].
- Vrasidas, C. (2002). Systematic Approach for Designing Hypermedia Environments for Teaching and Learning. *International Journal of Instructional Media*, 29(1).

APPENDIX ONE: SURVEY INSTRUMENT

Student Survey of Workshop Material

The aim of this study is to evaluate the effectiveness of the mixed mode (on-line and face-to-face) **workshop** teaching resources used in ELCM 201.

Consent

1. Your participation is voluntary, and you may decline to participate or stop completion at any time without consequence.
2. Participation in this survey will not affect your mark for ELCM 201 in any way.
3. By filling out this survey, you are indicating that you have read this statement and have agreed to voluntarily participate.
4. All information provided will be kept strictly confidential and used only for the purposes of this research.
5. You have the opportunity to view the results of this survey after it is completed. If you are interested, you can write your email address on the list at the front of the room before you leave here today.
6. Be spontaneous in your responses. There are no right or wrong answers.
7. All information provided by you for this research is confidential. Information will be used only to create a general profile of the people who responded to this questionnaire.

Personal Information

1. I usually attend **workshops** for ELCM 201 at (day/time)
Wednesday 9-10 Wednesday 10-11 Friday 3-4 Friday 4-5
2. The number of **workshops** I have attended for ELCM 201 is:.....
3. My age is:years
4. Gender: Male Female
5. My native (first) language is:.....
6. Other languages I speak fluently are:.....
7. The grade I expect to get in ELCM 201 is:
8. I have lived in New Zealand for:
less than 2 years 2-3 years 3-4 years 4-5 years more than 5 years
9. I am also enrolled in INFO 212 Yes No
10. List the three things you liked most about the **workshops**:
1.....
2.....
3.....
11. List the three things you liked least about the **workshops**:
1.....
2.....
3.....

Section 2: Evaluation

In the following questions mark with an X the answer that best matches with your opinion. Consider the following example:

Mobile phones are helpful devices.
Strongly disagree | 1 | 2 | 3 | 4 | 5 | Strongly agree

- mark "1" if you **strongly disagree**
- mark "2" if you **disagree**
- mark "3" if you **neither agree or disagree**
- mark "4" if you **agree**
- mark "5" if you **strongly agree**

- mark "0" if you **don't know**

For the following questions, please consider the workshops as a whole. This includes the combination of on-line material, and workshop supervisor assistance and presentations.

12. The workshops were helpful for my learning.

Strongly disagree	1	2	3	4	5	Strongly agree	0	Don't know
-------------------	---	---	---	---	---	----------------	---	------------

13. The workshops provided variety and sustained my interest.

Strongly disagree	1	2	3	4	5	Strongly agree	0	Don't know
-------------------	---	---	---	---	---	----------------	---	------------

14. The workshops were more interesting than **workshops** I have attended for other courses.

Strongly disagree	1	2	3	4	5	Strongly agree	0	Don't know
-------------------	---	---	---	---	---	----------------	---	------------

15. It was always clear what skills were being taught.

Strongly disagree	1	2	3	4	5	Strongly agree	0	Don't know
-------------------	---	---	---	---	---	----------------	---	------------

16. The skills being taught were relevant to the assessments for the course.

Strongly disagree	1	2	3	4	5	Strongly agree	0	Don't know
-------------------	---	---	---	---	---	----------------	---	------------

17. The hands-on exercises helped me confirm that I understood the material.

Strongly disagree	1	2	3	4	5	Strongly agree	0	Don't know
-------------------	---	---	---	---	---	----------------	---	------------

18. The hands-on exercises provided an opportunity to practice the skills being taught.

Strongly disagree	1	2	3	4	5	Strongly agree	0	Don't know
-------------------	---	---	---	---	---	----------------	---	------------

19. The concept checks helped me confirm that I understood the material.

Strongly disagree	1	2	3	4	5	Strongly agree	0	Don't know
-------------------	---	---	---	---	---	----------------	---	------------

20. I think it is important to be able to review the material in my own time.

Strongly disagree | 1 | 2 | 3 | 4 | 5 | Strongly agree | 0 | Don't know

21. The **workshop** sessions moved too fast for me.

Strongly disagree | 1 | 2 | 3 | 4 | 5 | Strongly agree | 0 | Don't know

22. I would prefer to work by myself with no instructor presentations.

Strongly disagree | 1 | 2 | 3 | 4 | 5 | Strongly agree | 0 | Don't know

23. I received assistance from my classmates in **workshop** sessions.

Strongly disagree | 1 | 2 | 3 | 4 | 5 | Strongly agree | 0 | Don't know

24. I offered assistance to my classmates in **workshop** sessions.

Strongly disagree | 1 | 2 | 3 | 4 | 5 | Strongly agree | 0 | Don't know

For the next questions, please consider just the on-line workshop material

25. The on-line material was presented in a consistent manner.

Strongly disagree | 1 | 2 | 3 | 4 | 5 | Strongly agree | 0 | Don't know

26. I found the online **workshop** site well structured and easy to navigate.

Strongly disagree | 1 | 2 | 3 | 4 | 5 | Strongly agree | 0 | Don't know

For the next questions, please consider the interaction you had with your workshop supervisors.

27. My **workshop** supervisors provided positive feedback.

Strongly disagree | 1 | 2 | 3 | 4 | 5 | Strongly agree | 0 | Don't know

28. I found my **workshop** supervisors approachable.

Strongly disagree | 1 | 2 | 3 | 4 | 5 | Strongly agree | 0 | Don't know

29. My **workshop** supervisors were responsive to my specific problem.

Strongly disagree | 1 | 2 | 3 | 4 | 5 | Strongly agree | 0 | Don't know

30. My **workshop** supervisors would go over concepts I did not understand and explain them in another way.

Strongly disagree | 1 | 2 | 3 | 4 | 5 | Strongly agree | 0 | Don't know

31. My **workshop** supervisors stimulated my interest in the subject.

Strongly disagree | 1 | 2 | 3 | 4 | 5 | Strongly agree | 0 | Don't know

Section 3: Macromedia Products

For the following questions please consider the definitions below when rating your use and experience of Macromedia Products.

- Complete beginner – I had/havenever used this product before.
- Basic – I had/have used the product and can perform a few functions.
- Intermediate – I can perform most of this product's functions.
- Advanced – I was/am confident with a wide range of product functions.
- Expert – I could/can develop complex commercial websites.

32. **Before** taking ELCM 201, I would rate my level of knowledge of Macromedia Fireworks as:

complete beginner basic intermediate advanced expert

33. **Now**, after taking ELCM 201, I would rate my level of knowledge of Macromedia Fireworks as:

complete beginner basic intermediate advanced expert

34. **Before** taking ELCM 201, I would rate my level of knowledge of Macromedia Dreamweaver as:

complete beginner basic intermediate advanced expert

35. **Now**, after taking ELCM 201, I would rate my level of knowledge of Macromedia Dreamweaver as:

complete beginner basic intermediate advanced expert

36. Please check the box that best describes how you have access to Macromedia products.

- I used Macromedia products in the labs only.
- At home: I installed the 30 trial version.
- At home: I own a copy, purchased it because I was doing this course.
- At home I own a copy, purchased it before enrolling in ELCM 201.
- At home I have a pirated/cracked copy, because I was doing this course.
- At home I have a pirated/cracked copy, obtained it before enrolling in ELCM 201.

Thank you for your participation

COPYRIGHT

Mary Tate, Mark Wilson-Munro, Marco Zhang, Beverly Hope, Eusebio Scornavacca © 2003. The authors assign to ACIS and educational and non-profit institutions a non-exclusive licence to use this document for personal use and in courses of instruction provided that the article is used in full and this copyright statement is reproduced. The authors also grant a non-exclusive licence to ACIS to publish this document in full in the Conference Papers and Proceedings. Those documents may be published on the World Wide Web, CD-ROM, in printed form, and on mirror sites on the World Wide Web. Any other usage is prohibited without the express permission of the authors.