CAN ONE SIZE FIT ALL? THE CASE STUDY OF A CD ROM IN TEACHER EDUCATION

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Abstract

In 2001, a video-based interactive CD ROM entitled BUILT ('Building Understandings in Literacy and Teaching', an ASCILITE award winner) was developed for use in teacher education at the University of Melbourne, in a mass education, cost effective context. BUILT was designed to address concerns about pre-service teachers' knowledge about language and literacy across the school curriculum and year levels. This paper focuses on the challenges in designing, implementing, evaluating, redeveloping and re-evaluating BUILT, now that it has been used with 2 large cohorts (approx 1,000 each) of pre-service teachers from widely divergent disciplinary backgrounds. The key principles underpinning the design of the CD within a constructivist model will first be outlined, followed by an outline of how BUILT was evaluated and integrated into pre-service teaching programs in its first iteration in 2001, and its subsequent re-development into its second edition. Finally, a brief overview of the second evaluation of BUILT and its implementation will be outlined, highlighting key reasons for the marked improvement in student perceptions of the effectiveness of BUILT's design and outlining challenges that face those responsible for teaching with it in 2003.

Background and Context

The use of multimedia to support learning is now imperative in pre-service teacher education. In an environment of diminishing budgets and worsening staff-student ratios in university faculties of Education, innovative, authentic, and cost-effective ways are required of 'apprenticing' pre-service teachers into teaching in the ICT-rich context of contemporary society. One component of pre-service teacher education programs identified as central to the successful transition of novice teachers to competent practitioners is that concerned with developing teachers' knowledge about language and literacy and the pedagogical principles for their teaching (see Christie et al, 1991, Vol 1: 98). The subject 'Language in Education' is a core subject in pre-service programs in the Faculty of Education at the University of Melbourne, undertaken by all students in the Diploma of Education and Bachelor of Teaching courses, regardless of which discipline or age group they are preparing to teach. Various text-book and video-based programs had been trialled in this compulsory subject over a decade and found wanting in their capacity to fully engage pre-service teachers in building their understandings about language, literacy and teaching across the curriculum. A particular challenge was to make vivid for these pre-service teachers, the classroom contexts in which their developing knowledge about language and its

relationship to learning could be applied. This challenge was compounded by the fact that only 18 contact hours in total were available for a subject in which nearly 1000 students were enrolled annually.

In this context, the CD ROM, 'Building Understandings in Literacy and Teaching' (BUILT) was designed (with the assistance of an internal grant) to engage a wide range of students and maximise their learning in two unfamiliar areas simultaneously (pedagogy and language) in an environment of mass education, of time-restricted face to face teaching, and of diminishing resources in a period of economic restraint, an environment currently typical of the tertiary sector as a whole (Sheely, Veness & Rankine, 2001). The multi-media resource had to provide engaging, innovative video-based and interactive materials displaying authentic learning of, and through, language and literacy that would be flexible enough to be used in a variety of contexts, including lectures, workshops and independently by students. The designers believed strongly in the value of 'active learning', where users learn best by 'actively making sense of new knowledge - making meaning from it and mapping it into their existing knowledge schema' (Gipps, 1994, p.22). They thus avoided simply creating an 'electronic textbook' (Herrington & Standen, 2000, p.197) which may have been cheaper and conceptually easier to develop, but would have cast the user as the passive recipient of instruction and relied on the linear transmission of knowledge (Reeves & Okey, 1996). A CD ROM format was also selected as one which allowed students to view an extensive range of QTV clips, capturing authentic unscripted classroom teaching and learning episodes, across the early primary to upper secondary years and across the various discipline areas.

BUILT was thus designed to be principled in its model of language and literacy, authentic in its representation of teaching and learning with language, and coherent in its means of guiding developing teachers through unfamiliar disciplinary content while using an essentially constructivist pedagogy. BUILT is structured into four Units, entitled respectively 'Texts in Context'; 'Oral Language'; 'Writing'; and 'Reading'. These units are each divided into two topics, the first being an examination of the structures and functions of language in the written and spoken modes and the second being an examination of teachers applying their own knowledge about language as they effectively scaffold student learning in each mode. Thus, two related 'content' (and consequently 'theory') bases underpin BUILT: substantively, the explicit focus on language and literacy; secondarily, a more pedagogical focus - the influence of issues related to language and literacy for effective learning and teaching. BUILT's designers faced a number of challenges in structuring the content within this general framework such that they provided both guidance for those new to these disciplines and autonomy for individual users with individual needs. These design challenges will be discussed below.

Design principles underpinning the development of BUILT

The design of BUILT is underpinned by a number of social constructivist principles about the nature and process of effective learning, principles which have underpinned the design and evaluation of much recent multimedia. Foremost amongst these are the key constructs of: 'situated cognition' and 'cognitive apprenticeship' (Brown, Collins & Duguid, 1989; Lave & Wengler, 1991); 'scaffolding' (Herrington & Oliver, 1997; McLoughlin, Winnips & Oliver, 2000; Winnips, Collis & Moonen, 2000); 'authentic learning and assessment contexts' (Lebow & Wager, 1994); and learner reflection and responsibility for learning (Jonassen, 1991; Herrington & Standen, 2000; Squires, 1996). In particular, Herrington and Oliver's (1995) list of criteria fundamental to the design and development of multimedia within a constructivist model (extrapolated from a review of literature on situated learning), informed the design of BUILT. At the most general level, six key principles were identified from the above bodies of social constructivist research, to guide BUILT's design. These are outlined separately below.

Authentic Context
Firstly, BUILT was designed to provide an *authentic context* that reflects the way language is used in real classrooms. Central to this process is the extensive use of QTVs of classroom teaching and learning episodes, representing interactions from the early years of primary school through to the upper years of secondary school. These interactions are unscripted and represent authentic aspects of the physical, pedagogical and interpersonal contexts into which the novice teachers will be apprenticed. The QTVs of classroom interactions are accompanied by QTVs of teacher interviews which provide clear insights into teachers' planning, teaching and assessment decisions and how these influence their students' language and literacy development. Through these QTVs, novice teachers are actively encouraged to bring to consciousness knowledge about language and literacy, and to reflect on the role of language and literacy

in their own learning and teaching. Thus, users are provided with extensive opportunities to experience virtual classroom contexts similar to those in which they will later be making their own pedagogical choices. In addition, Panoramic QuickTime Virtual Reality screens with numerous hotspots allow users to explore the written language of a number of classroom environments and consider the quality and range of resources for scaffolding students in these contexts. Visual presentations of authentic student and teacher texts present vehicles for guided analysis and interactive exercises, allowing the teaching and learning to be more practically oriented. Through such a deeply situated approach (Brown, Collins & Duguid, 1989; Lave & Wenger, 1991), novice teachers are provided with rich opportunities to systematically examine the language used in a range of classrooms as specific discourse communities.

Authentic Activities

A second design principle underpinning BUILT focused on the development of *authentic activities* which encourage deep learning within a constructivist paradigm, which have a real world relevance and which enable learners to become immersed in the language, culture and situations of communities of practice, and subsequently to truly 'see the world' as practitioners do (Herrington and Oliver, 1995: 254). BUILT explicitly reflects a cognitive apprenticeship model of teaching (Collins, Brown & Newman, 1989; Gudzial & Keogh, 1998), in that its approach embodies:

> The development of concepts out of and through continuing authentic activity…where apprentices enter the culture of practice…through "legitimate peripheral participation," where people who are not taking part directly in the activity learn a great deal from their legitimate position on the periphery (Brown, Collins & Duguid 1989, p.39-40).

An electronic notepad allows users to record reflections on this peripheral participation and respond to key questions. Interactive tasks are designed to help novice teachers learn about the structures and functions of English language, within a theoretically distinctive model of language and literacy, one which is itself functionally-oriented and concerned with how meanings are made in real social and cultural contexts where language serves a variety of purposes (Halliday, 1978, 1994; Derewianka, 1990, 1998).Within and across each of the four units and eight topics mentioned earlier, interactive tasks scaffold users as 'linguistic novices' into progressively more sophisticated understandings of the structures and functions of spoken and written texts. Activities based on animations, drag-and-drop and roll-over facilities provide opportunities for novice teachers to rehearse emerging knowledge about written and spoken language in a range of classroom contexts and learn how to apply this linguistic knowledge for effective student learning. Tools such as a Glossary button allow users to check their understanding of linguistic terminology at point of need and a Bibliography button allows them to access a list of references. All learning activities in BUILT are based exclusively on the authentic written and spoken texts of real classrooms, involving users in 'legitimate peripheral participation'. In using the QTV clips of classroom interactions and teacher reflections, in conjunction with the notepad facility, the interactive tasks and the Glossary, developing teachers are systematically apprenticed into becoming 'insiders' (Kramsch, 1998) in the discourse community of reflective professional educators (Schon, 1983). To the extent that assessment tasks were based on the authentic situations made available in BUILT as a multi-media resource, these tasks can likewise be considered as authentic.

Modelling of Expert Performance

A third principle underpinning the design of BUILT was that it should provide access to *expert performance and the modelling of processes* (Herrington and Oliver, 1995). In BUILT, modelling of the effective use of oral and written language for learning is provided by 'expert' teachers represented in everyday classroom interactions in the QTV clips. Reflective tasks and guided analysis of these QTV clips provide novice teachers with opportunities to 'freeze' these complex and often 'messy' interactions and reflect on them systematically in ways not available in the pressures of their own teaching experiences. Analysis of these 'expert performances' is further assisted through the provision of transcripts of the classroom interactions in the video clips, some transcripts also having been coded in ways that highlight key features of oral interaction, thus providing the novice teacher with a specialised reflective metalanguage. Written products, as well as interactive processes are also modelled. Still shots of model student- and teacher-written texts are available for close examination, with the wording and images of longer texts being made available through enlarged 'thumbnails'. QuickTime Virtual Reality panoramic views of classrooms allow novice teachers to click on hot spots to view close ups of the model

written and visual texts on the walls and desks. BUILT thus provides the 'window into model practice' advocated by Herrington and Oliver (1995, p.257).

Reflection

A fourth principle underpinning the design of BUILT is the centrality of *reflection* as a key to making sense of any situated learning experience. Reflection operates at two levels in BUILT. It is the concluding stage of the 5-stage learning/teaching cycle which accompanies its model of language, literacy and learning (see below). At this level of 'content knowledge development', novice teachers are guided, through using the various multimedia resources of the CD, to understand the significance to the learning process in classrooms of a stage where teacher and learner are able to review understandings, evaluate the tasks accomplished and plan future directions. Reflection also operates in BUILT at a metacognitive level where the architectural design of the CD encourages novice teachers to evaluate the effectiveness of the teaching they are experiencing through the CD ROM, the relevance of their own learning, the problems or challenges they are facing and their own teaching goals. Regular small reflective tasks are built into each topic, typically requiring users to respond to broad prompt questions in their notepads. Larger reflective tasks also occur at the end of each Unit, requiring users to review all notepad entries for that Unit, and feeding into workshop or assessment reflections. The 'hierarchical' (as opposed to 'linear' or 'referential') hypermedia design (Oliver & Herrington, 1995) allows relative freedom of access to Topics within Units, with preferred pathways which maximise users' metacognitive control over which screens or segments to view, in what order, in what depth, and for what purposes. Once at a particular place in the program, however, screen questions and related tasks provided the user with some guidance regarding focus of, and approach to, reflection. Thus, a balance between two seemingly contrasting elements is provided: the opportunity for the user to metacognitively control approach, progress and outcome, based on needs, concerns, and interests; and program structure that provides a degree of guided reflection to assist the user to make purposeful and productive progress.

Collaborative Construction of Knowledge

A fifth principle fundamental to the design of BUILT was that it should encourage *articulation of and collaborative construction of knowledge* (Herrington and Oliver (1995: 257). BUILT specifically addresses the need for collaborative enquiry and student articulation of knowledge at stages of the learning process by providing a means for students to articulate their understandings about language, literacy and learning, guided by the Notepad prompts, both in individual reflections and in workshop groups. By making explicit to their peers their tacit knowledge about language, users have the opportunity, in interactive workshops, to consolidate that knowledge, defend positions based on it and negotiate what new knowledge they need. Collaborative activity between novice teachers working in different subject areas across primary and secondary classrooms yields particularly fruitful understandings about the development of language and literacy across the school years and across the disciplines.

Scaffolding

The final and most important principle guiding the development of BUILT, central both to its instructional content and its instructional design, is that of *scaffolding*. The concept of scaffolding was originally used by Wood, Bruner & Ross (1976) to portray the temporary, but essential nature of parental support in the language development of young children. This concept has proved to be attractive in socio-cultural models of learning in general (Mercer, 1994) and of language learning in particular (Halliday, 1978, 1994). This socio-cultural model posits that cognitive development is not simply influenced by social processes, but is profoundly grounded in social and cultural processes. It is this theoretical model of learning which underpins the instructional content of BUILT. Given the 'intersubjective' foundations of learning (Bruner, 1986), teachers at all levels have a profound responsibility for organising the social processes of their classrooms to maximise learning. Wood, Bruner & Ross's (1976) concept of scaffolding has since been used extensively in the educational literature and in a variety of institutional contexts, though it is often used very loosely to refer to any sort of teaching or helping of learners. Three key factors have emerged as distinguishing scaffolding from other forms of teaching (Hammond, 2002; Maybin, Mercer & Stierer, 1992):

- the task, skill, or understanding being scaffolded is a specific learning activity with finite goals,
- the 'instructor' or 'expert' determines what skill or understandings learners currently have in order to help them build on those skills and understandings in positive and constructive ways.

Scaffolding thus requires the identification of the learner's Zone of Proximal Development (ZPD) (Vygotsky, 1978, p.86) or the 'gap' in students' understandings, and the construction of ways of helping learners bridge that gap and move into a new ZPD,

- the learner is brought closer to a state of competence which will enable them eventually to complete the task on their own. The teacher structures the learning activity such that her/his own expertise can be gradually withdrawn till the learner or 'apprentice' can complete the task independently.

These central features of scaffolding are explicitly outlined in the instructional content of BUILT to help pre-service teachers identify how structural support through language occurs in the exemplary practice represented in the QuickTime video clips and in the other authentic resources presented. These features of scaffolding also inform the five stage 'learning/teaching cycle' presented in BUILT that allows novice teachers to systematically examine the skilled language and literacy practices of experienced teachers as modelled in the video clips. This five-stage cycle (comprising Engagement, Building Knowledge, Transformation Presentation and Reflection) is graphically represented in the form of a series of pentagons, where each pentagon represents a single learning/teaching cycle which combines with others to form a cumulative curriculum. An icon of this pentagon appears on most screens in BUILT, with the relevant stage of the learning/teaching cycle indicated.

As well as underpinning the instructional content, the metaphor of scaffolding also underpins the instructional design of BUILT, such that users are themselves moved recursively through these five stages of each learning/teaching cycle, as they are: engaged in issues of language, literacy and learning; helped to build knowledge in this new area; guided into transforming that new knowledge into understanding; provided with various means of presenting that new understanding; and provided with the means of reflecting on that new understanding. Thus, while they are learning about the principles of scaffolding children into learning through language and literacy, novice teachers are themselves scaffolded into new professional understandings as they experience the sequences of learning/teaching cycles that underpin the design of the CD ROM.

The six principles of constructivist pedagogy underpinning the design of BUILT, as outlined above, would ideally scaffold pre-service teachers substantially in their learning about the central role of language and literacy in teaching, by providing authentic contexts, authentic activities, models of expert performance and opportunities for articulation of and reflection on knowledge. Designed along these lines, the expectation was that BUILT would be a valuable resource used by thousands of students in a mass teacher education program, permitting a balance between expert guidance and learner autonomy. It was important therefore to track the ways in which BUILT was used by cohorts of student teachers as it was integrated into the teaching program of the subject, 'Language in Education'.

Implementation and issues arising

BUILT was first used in semester one, 2001 at the University of Melbourne, with 800 students purchasing and using the resource in the subject 'Language in Education', where it was a major component of their preparation for and reflection on, workshops, teaching experience, and assessment. A significant minority of these pre-service teachers (the average age was 35) had little experience with computer technology in general and 75% reported having 'little' or 'no' prior experience with information based CD ROMs. For the one semester (18 hour) duration of the subject, students were encouraged to use BUILT in three separate, but integrated contexts. In workshop groups, they observed and discussed the QTVs of classroom interactions and teacher interviews, as these were selected by tutors who used data projection trolleys in specially designed 'collaborative teaching' spaces. As well as working with BUILT collaboratively, students were also encouraged to use BUILT independently as they selected QTVs relevant to their particular discipline areas and needs. The intention here was for students to rehearse specific features of their own language and literacy use before their practice teaching rounds. The majority of students used the product independently on their home computers, with about one quarter using it in faculty computer labs. A third way in which students were encouraged to use BUILT was with a peer, as a means of reviewing the pedagogical decisions they made during or after their practice teaching rounds. Such paired interactions, we hoped, would regularly occur in computer labs at the University or at the school in which teaching practice was taking place.

In each of these three contexts, a number of challenges were faced in the integration of BUILT into the teaching program, largely due to the fact that the resource was produced only two weeks before teaching, leaving insufficient time for planning for implementation and training of tutors. In the classroom context, tutors were anxious about using this new medium with large workshop groups (36 students, on average) of students from various disciplinary backgrounds, interacting in workshops of only one hour's duration. Although all tutors had access to draft versions of the CD, none had taught with a multi-media resource of this sort at tertiary level. It was necessary for the co-ordinator of the subject (who was also one of BUILT's creators) to reassure staff that the first year of implementation would be treated as a pilot year. In the context of students' independent use, we were concerned about the ability of many students with 'little' or 'no' experience with information-based CD ROMs, to organise their access to, and navigate their way successfully through, the relevant sections of the resource. These concerns were compounded by the fact that BUILT was a very substantial resource (with over 700 screens in total), and students had to learn to select a navigational path that was most relevant to their individual needs in a short course. Students regularly reported that they were enticed into pursuing one line of investigation to the exclusion of other recommended 'readings', often falling behind with weekly tasks. Other students reported having difficulty simply using computer technology, despite the fact that accessing the extensive technical support available was a condition of their enrolment in the course. The complaint, 'Why can't we just be given a reading pack? At least I can read this on the tram!' was common, especially amongst mature age students. Another complaint about access to the university's computer laboratories was well founded, given the unplanned for over-enrolment and the demand on those laboratories. In the third context of the use of BUILT, that of paired collaboration at university home and on school practicum, students reported that they simply did not have time for such interaction. Such collaboration would clearly need to be built into the program through other means.

Evaluation and redevelopment

With these concerns in mind, a systematic means of evaluating both the implementation and design of BUILT was developed. To monitor the ability of students to 'properly exploit' (Laurillard, 1993: 203) BUILT, to gain critical feedback of user perceptions of the program's quality and usability, and to carefully consider the CD ROM's integration in the core subject 'Language in Education', BUILT was evaluated in 2001 and again in 2002 through student questionnaires and follow up interviews with selected students. The evaluation process used a continuous iterative design model (Keyes, 1994), where BUILT's ongoing development would be cyclically informed by feedback from systematic evaluation. The development team acknowledged that, given the large group engaging with program, the diverse nature of these users in terms of their backgrounds and learning needs, and the unfamiliar learning/teaching contexts in which the CD ROM would be implemented, the program's design would be best served by a process of continuous or interactive evaluation (Owen, 1999) offering 'timely accurate information' that could inform a cyclical revision of BUILT in the context of its implementation (Johnson and Foa, 1989).

In the first cycle of evaluation in 2001, the development team sought both statistically viable quantitative feedback and qualitative descriptions of user experiences and insights. From a total cohort of 800 students enrolled in 'Language in Education' in 2001, 514 students completed a questionnaire administered in the final weeks of this single semester subject. Participants were asked to indicate on a four-point scale (with 4 indicting high level of approval to 1 indicating a low level of approval) their impressions of BUILT in terms of the effectiveness of the program's design features and the use of the CD ROM in workshop, lecture and independent learning environments. They were also invited to provide descriptive accounts of their interaction with BUILT through open-ended questions. Thus, comprehensive quantitative and qualitative data was available which reflected the range of student thoughts and experiences within the mass education context in which BUILT was used. From the analysis of the written questionnaires, a number of issues were identified as crucial to the redevelopment of the program and its implementation, thus requiring further investigation. These issues were pursued through follow-up interviews with 20 students, selected to represent the range of discipline backgrounds of students enrolled in the subject (Science/Maths; Social Science; Visual and performing Arts; Language Arts; Health) and the range of attitudes towards BUILT (positive and negative) expressed in questionnaires. These interviews offered particularly useful 'thick description' of students' experiences with the CD ROM. The qualitative data was scrutinized to uncover thematic connections or linkages with other participant responses (Guber and Lincoln, 1981, 1985), and synthesized to represent the attitudes and experiences of the first cohort of

student users of BUILT. A selective summary of these themes, examples of user comments, and details of the scaled responses are discussed below.

Users' Understanding of Program Purposes

While there were clearly shortcomings in the first iteration of BUILT, student feedback revealed the program nevertheless enjoyed a largely successful first year in 2001. Over 75% of questionnaire respondents indicated there were strengths to be found in using the CD ROM, and for a majority of students, interaction with BUILT was a dynamic and interactive experience where students could infer, reflect on and refine their understandings of the role of language and literacy in teaching. Having completed their period of subject based interaction with BUILT, some 88% of questionnaire respondents felt their own knowledge about language would be 'reasonably important' or 'very important' to their professional development. This was an especially positive result when juxtaposed against data revealing 70% of participants had undertaken 'little' or 'no' prior academic studies in the general area of language and/or literacy. Many students indicated BUILT had effectively 'introduced literacy' into their understanding of quality learning and teaching, providing a strongly theorised framework in which to develop conceptual understandings of literacy while also demonstrating practical teaching strategies for supporting literacy in student learning. Respondents also reported that BUILT had made them aware of the importance of scaffolding the language used by students in all key learning areas, including those not traditionally associated with literacy learning (eg. Maths).

Modelling, Authenticity, Experience

A strong focal point of student approbation was the perceived authenticity and quality of the video sequences featured throughout the program. Survey and interview participants voiced their approval of being exposed to a wide range of classroom scenarios from early primary to upper secondary, indicating this interaction had 'got you into the classroom without being there', which in turn provided 'invaluable experience (that) can only be bettered by hands-on experience'. Respondents affectionately described teachers participating in the video sequences as role models and mentors, and greatly valued the opportunity to see how literacy strategies were actually received by primary and high school students in a variety of contexts and key learning areas. Participants reported that viewing 'good examples of teachers in action' helped them reflect on appropriate methods for questioning students, for developing the technical language used by students, for analysing classroom texts, and for setting assignments and activities. The inclusion of interviews with teachers was similarly seen to provide valuable opportunities for deconstructing authentic pedagogical practices, broadening students' own repertoires of effective teaching strategies (eg. 'Marie showed what good teaching is').

Interactivity and Functionality

Two thirds of respondents (on a four point scale, mean = 2.73, SD = 0.92, mode = 3) indicated BUILT's interactive activities were 'very effective' or 'reasonably effective' in scaffolding their knowledge of language and literacy and in providing authentic activities with real world relevance. Interactive features such as the animations, transcripts (used in conjunction with video footage), the drag-and-drop activities, roll-over facilities, and the Glossary were all highly valued as various means of helping students rehearse what for many were unfamiliar features of language. Many students commented that the drag and drop provided opportunities to have 'practical attempts at concepts', gave users a forum for 'self-testing' and to 'review and make me realise how much I understand the topic'. For other students these activities, the graphics and animations were simply 'kinda fun', or added another dimension to BUILT's use of text and video which 'maintained my attention'. 66% of students indicated the Glossary was 'very effective' or 'reasonably effective' in helping them learn about language and literacy, providing a valued level of functionality that helped clarify understandings, and minimized the disruption of having to look up terms in a dictionary.

Technical problems

One of the major concerns expressed in student descriptive responses were technical problems, with 45% of respondents experiencing some form of technical difficulty when using the CD ROM. The BUILT program, which requires 32MB of available Ram for smooth running, could be used on all university computers and 75% of student home computers. However, on some older computers QuickTime clips appeared disjointed and users reported experiencing sound dropout. Difficulties reported by students using older generation computers were also often compounded by basic computer illiteracy, where small technical glitches became, for some students, unsolvable conundrums that consumed time, created

feelings of inadequacy, and soured impressions of even the most practicable of programs. The Education Faculty at the University of Melbourne provided extensive technical educational support thorough program induction and accessible support networks, but such support was often not exploited by the very students who needed it most. While computers may still have an irresistible desire 'to conspire to defeat human users' (Herrington and Oliver, 1996), many technical problems reported by students in 2001 were in fact minor. Indications from the 2002 questionnaires indicate that subsequent generations of more computer literate users are experiencing fewer of these technical complications.

The vast majority of technical concerns, however, revolved around a fault in the programming of the notepad tool, affecting the smooth running of the notepad on some computers, and negatively influencing student perceptions of the program's design. This error appears to be a consequence of the development and testing of BUILT in a largely Macintosh environment when the majority of the CD ROM's audience have personal computers with Microsoft Windows operating systems. Nearly two thirds of students (63%) reported that the notepad operated too slowly to warrant using, this fault being a serious impediment in the functionality of the program. Given that the notepad was the key tool for reflecting on and articulating emerging understandings, and for collaborating with other students in workshops and out-of-class assessment, this was a major problem to be addressed in the redevelopment of BUILT.

Navigation

As both Laurillard (1993) and Elin note (2001), a key challenge in the design of instructional and educational multimedia is to ensure that, while users are provided with quality content that supports learning processes, they are also provided with transparent control over how they investigate, interact with and interpret the domain knowledge of a multimedia application (Elin, 2001). BUILT's 700 screens, many with multiple QTV sequences and interactive features, provided a comprehensive resource from which a range of novices being apprenticed into teaching in a wide variety of teaching contexts could choose. The questionnaire and interview feedback from 2001 however, indicated a widespread negative perception of the length of topic areas, with many respondents reporting they felt the size of units within BUILT were 'too long', overly 'time consuming', and presented them with content that was 'too dense', and 'too much information at once'. Users seemed compelled to work through the various units and topics of the CD ROM in a linear, rather than hierarchical fashion (Oliver & Herrington, 1995). In the absence of sufficient planning and preparation time, tutors were themselves uncertain of how to advise students to move between associated nodes of information and chart a path that met both their individual learning needs while meeting assessment requirements. Many students thus reported being unable to quickly locate and select information pertinent to their learning needs, with many comments expressing the desire for a 'clearer, more thorough index', a 'hypertext contents index', and a 'go-to-the-page tool'. Given the established importance of navigation control for effective usability (Nielson 1994, Elin, 2001), these user demands would clearly be incorporated into subsequent redevelopment of BUILT.

Implementation Issues

Questionnaire and interview responses confirmed concerns about how effectively BUILT was integrated into lectures, workshops and assessment tasks in its first iteration. Over half of respondents (57%) indicated the use of the CD ROM in workshops to demonstrate important aspects of language, literacy and learning was 'not effective' or only 'somewhat effective'. Students felt that workshop classes, which were only one hour in length, did not provide enough time to warrant a shared viewing of video sequences ('wasted time'), and expressed concern over a 'doubling-up' of material covered in the home, workshop, and lecture use of the CD ROM. Students also indicated they were aware some tutors were uncomfortable using the CD ROM in workshops, and expressed frustration at technical difficulties which further eroded class time. While tutors were enthusiastic about the qualitative enrichment of the teaching program, using BUILT as a new resource at the same time as using unfamiliar projection trolleys in unfamiliar collaborative teaching spaces presented considerable challenges for all. Such feedback highlights the importance of continuous support for tutors before, during and after teaching with new multimedia resources. Ongoing and systematic feedback from staff as well as students, will be a feature of future evaluations of BUILT as it is integrated into a subject that runs with 28 workshops per week. A key concern expressed by students in the 2001 evaluation related to the integration of the CD ROM with the assessment tasks and with the amount of work required in an 18-hour subject. Particular concern was expressed about the need for clearer guidelines and more finely focussed tasks that were proportionate to required word limits. Students indicated existing assessment questions were perceived as ambiguous, required coverage of too great a number of areas, and would generally benefit from being simplified.

These initial problems resulted largely from an attempt to make assessment authentic while reflecting novice teachers' understanding of a new technical discipline. The 2001 evaluation provides challenging insights for the co-ordinator of 'Language in Education' and the team of tutors working with the CD ROM within that subject.

The second iteration

The data collected in 2001 was subsequently used to significantly enhance the functionality of the CD ROM and to further inform the assimilation of BUILT in the subject Language in Education in 2002. Working with recommendations arising from the 2001 evaluation, the second edition of BUILT (2002) incorporated, amongst other refinements, the following features:

- A hyperlinked Table of Contents, which makes explicit the hierarchical nature of the hypermedia linking structure (Oliver & Herrington, 1995) and provides users with a 'map' of the contents.
- A 'Go To' function which allows users with different levels of prior knowledge and different needs to explore the resource for specific information at point of need, either prior to, during or after practice teaching.
- A back-referenced Glossary, which allows users to check the meanings of technical linguistic terms and refer back to the screens on which those terms are illustrated.
- The correction of small errors such as misplaced videos, broken hyperlinks and typos.
- The smoother and speedier functioning of the Notepad facility.

In the closing weeks of semester 1, 2002, a second student evaluation was initiated to investigate the effectiveness of these changes, and to lay the groundwork for future revision. Although results from this investigation were being compiled during the writing of this paper, preliminary results from the comparable questionnaire indicate substantial improvements in user perceptions of the program, specifically:

- Strong positive feedback on the additional navigation features, and improved student impressions of the structure of BUILT.
- Strong increase in the number of students who felt there were strengths in the program (86%)
- A 14% reduction in the number of students who felt there were shortcomings in the program
- A strong positive increase in student perceptions of the use of the CD ROM in the subject Language in Education, with 73% of respondents indicating the use of BUILT to demonstrate important aspects of language, literacy and learning had been used 'reasonable effective' or 'very effective'.

Clearly, the changes to the design of BUILT were beneficial in realising more effectively the design challenges outlined in the first part of this article. However, substantial challenges remain in the effective integration of the resource into a program which attempts to introduce pre-service teachers from a wide range of disciplinary backgrounds to understandings about their roles as teachers of language and literacy. The alterations to the program in which BUILT was used in 2002 represent an improvement on its delivery in 2001. The remaining challenges can be best addressed by attending to the voices of the tutors as well as the students in the next round of evaluations.

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