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An evaluation of Digital Chisel 3.0 as a multimedia authoring tool in a year seven classroom

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as a

Multimedia Authoring Tool

in a

Year Seven Classroom

By Robert Richardson

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USE OF THESIS

The Use of Thesis statement is not included in this version of the thesis.

ABSTRACT

Most commercial interactive multimedia authoring packages are designed to be used by teachers and trainers to build commercial training or classroom teaching applications (Handler, Dana, Peters & Moor, 1995; Magel, 1997). The evolution of interactive multimedia technologies however, has made it possible for students to become actively involved in creating their own interactive multimedia projects, and in so doing, gain considerable learning benefit (Lehrer 1993).

Facilitating this in the classroom and particularly at the Year Seven level, requires the use of a cost-effective, purpose-built authoring tool. Digital Chisel 3.0 (DC3), was developed by Pierian Spring Software (1997), as just such a product.

This study was a summative product evaluation, utilising qualitative methodology that assessed the effectiveness of DC3, as a multimedia authoring tool for student use in a Year Seven classroom. Two adult expert reviewers and four Year Seven students assisted with the evaluation. The sources of evidence for this study included the use of participant observation, conversational and semi-structured interview, video recording, questionnaire and anecdotal field notes. The process of analysis was inductive, using the Analytic Framework suggested by Le Compte, Millroy & Preissle, (1992, pp. 763-766).

Digital Chisel 3.0 was packaged with an easy to read printed manual and a useful audio/visual library on CD-ROM. With WYSIWYG display and drag-and-drop visual programming environments, the students found the component routines in DC3 relatively easy to learn. The use of the Microsoft style of interface and edit conventions

allowed the previous learning of the students to be readily transferred to this product. The students also found constructing complex interactions in the Workbench relatively easy to master, as no scripting was required. DC3 was also customisable to three learning/school levels.

Probably the most outstanding problem with this application was the amount of RAM it required to run efficiently. In it's former configuration, it did not allow 'room' for multi-tasking and definitely did not run smoothly at the recommended 32 Megabytes of RAM. This both lowered the efficiency of operation, and severely challenged the motivation of all the users. The Table facility was almost totally unusable, as it failed to hold inserted elements and remained unstable through all attempts to use it.

Although the intention for DC3 was to allow for cross-platform application, this function was not evident at the time it was evaluated. However, despite its shortcomings, Digital Chisel 3.0 proved to be well received by the students. They expressed enthusiasm for the extra freedom that this product's features provided.

DECLARATION

I certify that this thesis does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any institution of higher education; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text.

Signature.

Date.....28-1-2000.....

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CHAPTER I

INTRODUCTION

Overview

This study was an evaluation of a new multimedia development software product, Digital Chisel 3.0 (Pierian Spring Software, 1997). Digital Chisel 3.0 was designed for use by school children, who wish to produce multimedia or interactive multimedia presentations.

Prior to the advent of computers, school projects traditionally involved hand writing a story and possibly adding pictures. This could be described as a simple form of multimedia (the simultaneous use of more than one type of media or information type). As computer technology developed, presentation software, such as PowerPoint (Microsoft, 1993), allowed the use of other media types such as sound, animation and possibly video, but only in a linear slideshow format. User interactivity and scoring of responses are further elements available in today's multimedia authoring tools, an example of which is Authorware by Macromedia (Botto, 1996). The inclusion of interactivity generally leads to the term interactive multimedia (IMM) being used. In this study, the term 'multimedia' will refer to interactive multimedia, which is computer based.

Interactive multimedia tools are especially suited to education and training applications, as learning can be individual or collaborative and progress monitored as learning proceeds. Approximately 80% of these tools today (see Appendix D), are used in training and education (Magel, 1997) with the educators themselves producing

classroom applications that assist in the training of their students (Handler, Dana, Peters & Moor, 1995).

Background

Computers can have many uses in the classroom. For instance they may be used to teach a child. This is referred to as computer assisted instruction (CAI). However, Papert (1992) rejects this approach because he sees this as the computer "being used to program the child" (p. 5), whereas he envisages that, "the child programs the computer" (p. 5). An example of this is children developing their own multimedia products. The learning opportunities that can occur when students author their own multimedia, have been recognised and explored at high school level for over a decade (Franklin & Kinnel, 1990; Papert, 1980; Papert, 1992). Using student authoring of multimedia in West Australian schools is at present being encouraged through the Applied Information Technology, Digital Media and Interactive Media courses (Curriculum Council of Western Ausralia, 1995, p. 1), as well as the draft courses under discussion at the lower secondary level (Gartner, Lightbody & Newhouse, 1995).

Although no substantial survey has been undertaken, it appears that professional products such as Macromedia Authorware and commercial presentation software such as PowerPoint and Claris Impact (Martinez, 1996) are among the products presently being used for multimedia development by school students. Although these products are well established and accepted in the commercial arena, there is a case to be made for identifying products that are specifically developed for K-7 student use.
Digital Chisel 3.0, is claimed by the developers as being an "all-in-one" package (Pierian Spring Software, 1997) that is designed to meet the multimedia authoring requirements of both high school and primary school children.

Significance

The use of interactive multimedia, has grown rapidly in recent years (McGovern, 1995). The Cutler Report recommended that the Government "build an 'on-line' IMM literate community, starting with the K-12 school..." (Cutler &Co 1994a [on-line] n.p.). Local and Federal Governments are encouraging the implementation of this (Crean, 1995, p.1; G. Strickland, personal communication, January 2, 1998).

Although current initiatives cater for the upper levels of the K-12 school, a review of education policy statements, available research and discussion with a university faculty member (P. Newhouse, personal communication, August 8, 1997), showed that there did not appear to be any unit development, or student multimedia authoring policy for the K-7 school. As Digital Chisel 3.0 was released in early October 1997, evaluating it at that time provided valuable information for those seeking to work with student multimedia authoring in the upper primary school, or for those who were looking to purchase an authoring tool.

Purpose

From the survey of multimedia authoring packages conducted for this study (Appendix D), one product, Digital Chisel 3.0 (DC3), showed evidence of being technologically up-to-date, purpose built for student use in the Year Seven classroom, and most importantly for schools, cost effective (i.e. providing the features needed at this level for a reasonable price). This product had not been on the market long enough to be independently evaluated. The purpose of this study was therefore to assess the effectiveness of DC3 as a multimedia authoring tool for use by students specifically at the Year Seven level.

The Research Question

How effective as a multimedia authoring tool is Digital Chisel 3.0, when used by year seven students?

The Subsidiary Questions

The effectiveness of DC3 was evaluated using the following guidelines: (adapted from Zimmerman & Luaski, 1995; Conyer, 1995).

1. *How easily can the students learn to use the product?*

   This question sought to identify how intuitive the interface was to the user.

2. *How efficiently can the students carry out a range of tasks fundamental to IMM production?*

   This question sought to assess how economical and accessible the component routines of the application were.

3. *How easily do the students remember component routines in the program?*

   This question focused on the structure of the software and whether it encouraged the recall of how component routines were used.

4. *What problems are encountered while using the product?*

   The objective of this was to identify any interface design or technical difficulties that hindered user progress.

5. *How did the participants react (affectively) to the experience of using Digital Chisel 3.0?*

This question sought to ascertain what emotional reactions would result from the experience of using this software?

Definition of Terms

1. **Applet** is a mini-program, written in Java.
2. **Artifacts** are documents created by the author.
2. **Authoring** is the constructing of a multimedia presentation.
3. **Java Bean** is a reusable software component or control for navigation and interactivity.
4. **Event Driven** is a software result that is only initiated by a user intervention, such as a keyboard or mouse action.
5. **Hypermedia** is a catch-all phrase that encompasses the different kinds of elements used in multimedia, that is the different kinds of elements that can be triggered by user action.
6. **Multimedia** refers to the combination of a number of different media elements, into one artifact or presentation.
7. **Tools** are the individual software packages included with the product that extend the product's capabilities.
8. **Scripting** is writing the programming code for an event or characteristic, directly into the presentation, without using a construction interface item such as a button or a dialogue box.
9. **Live** refers to the state that an on-screen component is in when an associated action or link is functional or active.
10. **JDK** refers to Java Development Kit – used to facilitate Java compatibility on a platform.

Overview of Chapters

In the next chapter, an examination is made of the issues relevant to children creating their own IMM presentations. The positions taken by federal and local governments on the matter, as well as educational aspects are reviewed. The chapter concludes with a focus on Digital Chisel 3.0 which includes why it was chosen, a brief description of the software and how Digital Chisel 3.0 as a developing product, has been reviewed. The choice of methodology and rationale for the study is outlined in chapter 3. The evaluation findings are given in Chapter 4, with a discussion of these follows in Chapter 5. The conclusions and recommendations drawn from the findings are presented in the final chapter.

CHAPTER II

LITERATURE REVIEW

Introduction

This chapter surveys educational papers, multimedia industry reports and reviews of multimedia authoring software. It investigates some of the reasons given for students to use interactive multimedia tools in the classroom. Attention has been given to some of the benefits resulting from students authoring their own multimedia documents, as well as the reasons for selecting Digital Chisel 3.0 as the product to evaluate. Finally, a description of Digital Chisel 3.0 is provided.

Why Interactive Multimedia in the Classroom?

There is research evidence to support the notion that there are benefits derived from students using interactive multimedia (IMM) as an authoring tool. Hay, Guzdial, Jackson, Boyle & Saloway (1994), for example, suggest that multimedia can assist students in cognitive and metacognitive tasks. The metacognitive benefits of IMM can be seen as the learner develops the ability to transfer concepts from one situation to another, although in some cases, this may have limited application (Clark & Saloman, 1985; Stuhlmann 1997). Kozma (1994) suggests that IMM may stimulate transfer of concepts through its recursive and interactivity characteristics, by focussing the student's attention on the links between ideas. Hay et al.(1994), contend that multimedia construction tools may promote concept transfer by encouraging the student to think about and express the same concepts in different media. They also comment that authoring systems "that allow easy composition of multimedia

documents" (p. 303), encourage the transition from abstract to concrete, and from one concept to another.

Clark and Salomon, (1985), in their Media Attributes theory, propose that student learning is encouraged as convergence occurs between the student's own representations and that which the media offers. Hofstetter (cited in McGovern, 1995, p.1) explains that the greater the number of a learner's faculties that are involved in the learning process, the more effective can be the memory of the experience. Gardner (1983) proposes that an individual has multiple intelligences, and that traditionally, schools focus on only a few of these. Construction of multimedia artifacts however, can draw on many of them, and involve students of differing dominant intelligences. Lehrer (1993) studied students authoring multimedia in a constructionist environment. One year later, he found that the students demonstrated long term recall of their subject that was, "richer, better connected and more applicable to subsequent learning events" (p. 221).

Other positive effects of students producing their own IMM documents include increased "computer fluency" (Gouzonasis, 1994, p.282) and positive motivational effects toward learning (Bransford, Sherwood, Hasselbring, Kinzer & Williamsl, 1990; Farrow, 1993; Cohen & Holzman-Benshalom, 1997). Agnew, Kellerman & Mayer (1996) report that, "Creating multimedia projects motivates students to work in a quality manner harder and longer than in many other activities, because the resulting projects are more attractive and interesting than most" (p.15). Since the students have an opportunity to use their individual creativity in multimedia authoring, they are likely to develop a strong sense of ownership of the resulting content and presentation.

McGrath, Cumaranatange, Ji, Chen, Broce & Wright (1997) saw the wider audience possibilities presented in multimedia project design, contributing here to the motivation and creative enterprise of the author.

Shields (1996) points out that students who are creating multimedia presentations are still learning research skills, developing an argument, presenting evidence and drawing a conclusion. They are also encouraged to anticipate reader reaction, offer multiple points of entry for information, and to explore a diversity of paths through their topic. As multimedia authoring limits presentation space, students learn to focus on the most important information, and become more sophisticated about how sounds, images and text can together, influence the viewer.

Government Support for Classroom IMM Authoring

The Creative Nation statement (1994) highlighted the immense earning potential for Australia, which exists in the multimedia industry. The starting point for realising this potential, was suggested to be the development of a pool of talent with multimedia skills, and it was suggested that this would be located in "...young people in education" (p. 57). The Cutler Report (1994a) acknowledged the value of beginning this development in the K-12 school.

Literacy Development

The Western Australian State Government currently supports developing multimedia literacy in the early school years (G.Strikland, personal communication, 2 January 1998). Lehrer (1993) aptly describes multimedia construction as the new literacy, as

each of the media being used requires it's own standard of competency. Visual literacy is an important part of this. Handler, Dana & Peters Moor, (1995) for example include in their description of visual literacy; the ability to think, learn and communicate through visual images. Multimedia authoring encourages that ability. Okolo & Ferretti (1998) also point out that students with poor verbal literacy skills are not so disadvantaged when given the extra dimension of a visual means of communicating their ideas

Using the Internet

There are over 200 Western Australian schools on the Internet (Mawson, 1996). Many use the Internet as a publishing medium for classroom-authored multimedia projects. An example of this from a class of eight year olds in Victoria (Appendix G), included hypertext, graphics, an interactive sound icon and an e-mail comments line. This approach allows the viewer to not only interact with the multimedia production, but also to contact the authors and interact with them.

Communication and Collaborative Learning

The prime purpose for interactive multimedia has been identified as "people communicating with people, aided by machines" (Cutler & Co, 1994a, [on-line]). The recently promulgated Curriculum Framework Consultation Draft from the Curriculum Council of Western Australia (Curriculum Council of Western Australia, 1997), puts a strong emphasis on communication and collaborative learning, in it's Major Learning Outcomes, especially Outcomes 1, 3, 9, 10 and 12 (see Table 1). These outcomes and many of the other Curriculum Framework requirements can be promoted though the appropriate use of multimedia authoring tools such as Digital Chisel 3.0.

Table 1

Multimedia authoring tools and the Curriculum Framework.

	Major Learning Outcomes	IMM Authoring Contribution
1	*Students use language to understand, develop and communicate ideas and information and interact with others.*	Both written and oral language can be used in IMM, to increase learning opportunities (Agnew et al., 1996). Constructing hyper-text/media creates interaction opportunities about the ideas communicated.
2	*Students select, integrate and apply numericel and spacial concepts and techniques.*	Spacial concepts are enhanced as the student creates graphics and learns screen design principles. Visual literacy (interpreting visual messages) is encouraged through hypermedia construction (Handler et al., 1995).
3	*Students recognise when and what information is needed, locate and obtain it from a range of sources and evaluate, use and share it with others*	Multi-media presentations require care in the sourcing and sequencing of information. A variety of media will be used from a range of sources. Each choice is made with the end-user in mind. (Harel, 1991, in Handler et al., 1995).
4	*Students select, use and adapt technologies.*	Using a variety of media in the communication will encourage selection and appropriate use of various technologies.
6	*Students visualise consequences, think laterally, recognise opportunity and potential and are prepared to test options.*	The process of constructing an IMM communication, especially using storyboards, will encourage a pragmatic and creative approach to the work. The interactive feed back will provide a test for the choices made.
9	*Students interact with people and cultures other than their own and are equipped to contribute to the global community.*	In sharing multimedia projects on the Internet, either with a predetermined or random participant, the student has an opportunity to communicate with other cultures.
10	*Students participate in creative activity of their own, and understand and engage with the artistic, cultural and intellectual work of others*	Hypermedia design is a highly creative activity for the individual student. Students also frequently work in collaborative groups (Handler, 1995; Abrams 1996).
12	*Students are self-motivated and confident in their approach to learning and are able to work individually and collaboratively*	A larger potential audience can motivate the student (Agnew, 1996). Authoring tools are ideally suited for use in either a collaborative or individual production (Handler et al., 1995), and the document produced is more attractive and interesting, with the many media forms used. The feed-back from the many forms of publication is also a strong reinforcer.

Note. Learning Outcomes from Curriculum Council of W.A. (1997, 16-17). Contributions constructed from researcher's reading and observations.

Why Digital Chisel 3.0?

With the recent phenomenal growth of multimedia (McGovern, 1995), has come a proliferation of authoring software titles (Appendix D). To assist in the selection of an appropriate authoring product to be evaluated in this study, the researcher compiled from classroom experience and the literature search, a checklist of basic requirements. A short-list of possible authoring tools for K-7 use (Table 2) was compiled from the

Products Survey (Appendix D), using the Authoring software requirements set out below as criteria. The suggested K-7 Authoring Software requirements are:

1. The product should be platform independent ('X' Table 2).

It should be possible for most schools to purchase the software and run it on whatever computer types they have. The student should be able to work on one platform at school (e.g. Apple Macintosh) and another at home (e.g. IBM PC). Digital Box Office, Cocoa (Stafford, 1997) and Hypercard (Apple Media Corp., 1997) for example, were not suitable because they were limited to the Macintosh platform only.

2. It should be purpose-built for school children ('K-7' Table 2).

The interface should make the program easy to use and the features should be appropriate to school related activities. Authorware (Abrams, 1996) and Toolbook (Magel, 1997) were designed more for commercial than educational use and so did not qualify.

3. It should be considered an 'entry level' product ('Entry' Table 2).

The structure of the program should meet the entry skill level of the user, and should only require a basic computer literacy.

4. The product should include Internet facilities.('Web' Table 2).

Access to the Web from within the application, and a facility to create links to Web-sites should be available. Special Delivery (Interactive Media Corporation, 1995) and Digital Box Office (PowerProduction Software, 1996) did not meet these requirements.

5. The site license should include free copies to give to teachers and students to take home and use ('Home' Table 2).

This facility should allow the user to work on the hypercomposition (Lehrer, 1996), at home or at school and thus provide maximum work time. Microsoft Powerpoint for example did not allow this.

6. *The product reviews should confirm use at school level ('Reviews' Table 2).* That a product is shown to be suitable by a recognised authority should give confidence to a user or purchaser.

Of the products most likely to suit the Year Seven classroom (Table 2), Digital Chisel 3.0 and Hyperstudio (Roger Wagner Publishing, 1997), presented the most suitable features for evaluation.

Table 2:

Possible Multimedia Authoring Tools for K-7 Use.

Product	Platform			Level		Details		Reviews
	Mac	Win	X	K-7	Entry	Web	Home	
Cocoa 1.1	Y	N	N	Y	Y	Y	N	Best Kids software: Macworld Expo 1997
Digital Box Office 1.5	Y	N	Y	N	Y	N	N	Awkward interface and some bugs: (Heid 1996). **3.9 (Heid 1996) Superseded by WebBurst
Digital Chisel 3.0	Y	Y	Y	Y	Y	Y	Y	New release (October 1997)
Hyperstudio 3.1	Y	Y	Y	Y	Y	Y	Y	MacUser UK *Five mouse* **** 7.0(Heid 1996) Windows version not reviewed
Special Delivery 2.1	Y	N	N	N	Y	N	N	****7.0(Heid 1996) Lacks hypertext

KEY TO RATINGS: Macworld rates only final shipping products, not prototypes. The following is a guide to the above ratings: *****/ 9.0-10.0 = Outstanding; ****/ 7.0-8.9 = Very Good; ***/ 5.0-6.9 = Good; **/ 3.0-4.9 = Flawed; */ 0-2.9 = Unacceptable

KEY: Y = Yes N = No Note: Data on product features based on developer marketing statements.

Cocoa (Apple, 1996), Digital Box Office (Power Production Software, 1996) and Special Delivery (Interactive Media, 1995) ran on a Macintosh platform only, and thus

would be limited to Apple equipped classrooms. Digital Box Office and Special Delivery were not purpose-built for the classroom and did not have features suitable for Internet publishing.

Digital Chisel 3.0 was therefore chosen for evaluation, as it appeared to meet all the above Authoring Software Requirements. It also had not been independently evaluated at the time of writing as, unlike Hyperstudio 3.1, it was a new product to the market.

The Authoring Software Context for Digital Chisel 3.0

Digital Chisel 3.0 is one of literally dozens of multimedia authoring products (Appendix D), that are designed to basically perform the same function. They are designed to combine a variety of media elements in the one communication artifact. However, not all these products are designed to handle the many uses to which authoring of multimedia is put – some examples of use are sales and information kiosks, commercial in-house training, and classroom learning. To help with the authoring process, the developers of authoring tools have integrated into the screen layout of their particular program, a format that resembles a familiar work environment outside the computer. Multimedia authoring systems are produced in three main formats or systems. However, no standard terminology exists, that labels them consistently (Beekman, 1997), as the sampling of reviewers (Table 3) shows. The terms used by Beekman (1997), and Cagle (1995) have been adopted for this review.

Table 3

A sample of reviewer labels for multimedia metaphors

Reviewer	Movie/Scripted	Page/Book	Icon
Beekman,G.	Score	Screen Based	Mapping
Cagle, K	Scripted	Book	Icon Based
Magel, M.	Movie-making	Page	Icon Flow
Siglar, J	Cast/Score	Card	Icon Flow
Suh, M.	Time Based	Card/Page	Icon Based

All multimedia authoring packages are basically designed as tools for developing multimedia presentations. However, each metaphor has a specific set of features, and tends to be more suited to a particular area of multimedia application, for example, the Digital Chisel 3.0 metaphor (Page/Book), has appropriate features for education use. The three main metaphors which are in use are score-based, screen-based and icon-based.

Firstly, score-based or scripted packages (Figure 1) allow precise timing of the presentation. The construction window is set out like an orchestral score, which progresses to the right in keeping with playing time. Probably the most well known example here is Macromedia Director (Heid, 1996).

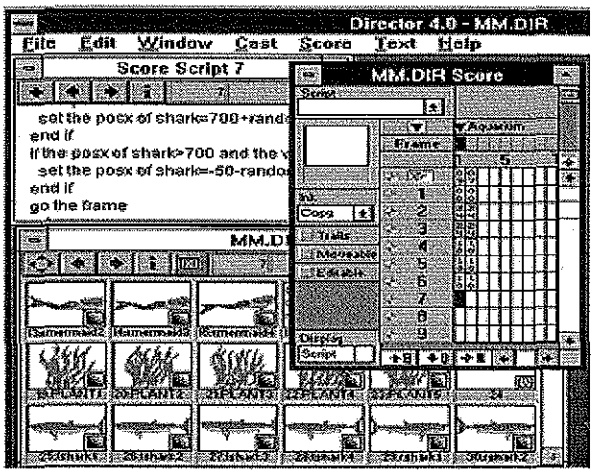

Figure 1. Score/Scripted Director
An example of a Score Based or Scripted package as illustrated by a window from Macromedia director.

Secondly, screen based or book based authoring tools of which Toolbook (Figure 2) by Asymetrix (Magel, 1997), is an example, as well as all the entry level/education products listed in Appendix D. They are constructed on a page-by-page basis, with the links to make a 'book' added later.

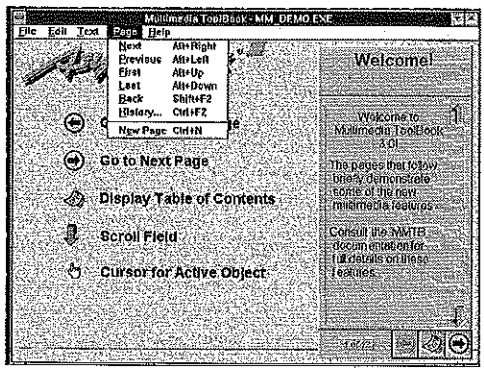

Figure 2. Screen or Book Based: Toolbook
An example of a Screen Based or Book Based authoring tool as illustrated by a window from Toolbook by Asymetrix.

Thirdly, icon based or mapping packages which begin with the placement of indicator icons on a flowchart or road map of the product under construction (Figure 3), and then the screens are individually developed from these. The most prominent example here is Authorware, by Macromedia (Botto, 1996).

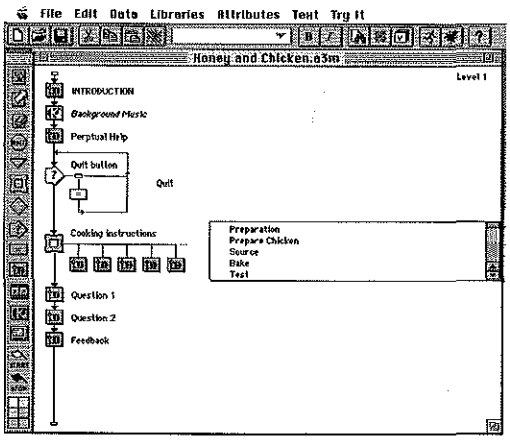

Figure 3. Icon based/Mapping Authorware
An example of an Icon Based or Mapping authoring tool as illustrated by a window from Authorware by Macromedia.

Description of Digital Chisel 3.0

DC3 was a multimedia authoring tool, designed specifically for use by teachers and students at primary and secondary school (Pierian Spring Software, 1997). It enabled the user to combine text, graphics images sound and animation, into projects that can be published as web pages and stand-alone applications. DC3 was presented in a Page/Book metaphor. This meant that the main input screen was designed to look like a page from a book into which the user entered whatever was to be communicated. Each new page was added to the 'story' in book fashion.

There were three separate work areas (refer to Appendix B): (1) The Page Manager, where each individual page is constructed, (2) The Workbench, which is a visual programming environment, where Java (Sun Microsystems, 1997)'applets' or mini-programs are made to produce interactivity and navigation; and, (3) The Project Overview, where the whole construction could be viewed in an icon map mode and adjustments made to the flow of the presentation.

The interface could be customised to suit three levels within the K-12 school, Elementary, Middle and Secondary (Appendix A). There was also a choice of three levels of difficulty. Included with the package was a full tutorial, an integrated Internet browser, a range of page layout templates and a library of sample media clips.

Reviews of Digital Chisel

Early versions of Digital Chisel received mixed reviews. From the outset, it had been designed for use in education, and had been consistently recognised for its quality layout templates, testing and database functions (Schorr, 1995; Landau, 1995; Murie, 1995; Heid, 1996). Version 3.0 added integration with the power of external databases, which offered enhanced student tracking.

In an apparent effort to produce an individual feel to the earlier Macintosh-only products, Pierian Spring Software opted for what Schorr (1995), referred to as "a decidedly non-Mac interface"(p.1) and non-standard tool operation, e.g., text and paint input could only be placed in a dragged box (p. 1). Schorr (1995) considered that these characteristics could make designing presentations awkward and confusing. Landau (1995) considered the same version, "surprisingly simple to learn and use" (p.1). This could have been in part due to the developers, opting to avoid the need for scripting by including the use of pop-up menus. Landau (1995) did acknowledge however, that some functions were unnecessarily complicated with too many steps.

A seeming contradiction in reviews also occurred when Heid (1996) did not rank version 2.0.1c as highly as Hyperstudio, because the latter appeared more powerful, even though he acknowledged that Digital Chisel had superior educational features. Abrams (1995) compared these two products and concluded that "Digital Chisel is a little more sophisticated than Hyperstudio in its look and feel, and offers better testing and database facilities" (p. 213). This contradiction may have resulted as the reviewers assessed only what they were personally looking for in the product, such as professionally focussed attributes, rather than what the manufacturers intended. This

may also account for the fact that the earlier reviewers appraised Digital Chisel as a teacher's tool rather than a possible student operated learning aid (Landau, 1995; Schorr, 1995; Murie, 1995).

Developments in Digital Chisel have come swiftly. Digital Chisel 1.2 had two user levels (Schorr 1995) and Digital Chisel 3.0 (1997) has three. All versions prior to DC3, were written in Supercard, which led to version 2.1.3 in particular, being criticised for not publishing easily to the Internet (Schorr, 1997). Digital Chisel 3.0 has been completely rewritten in Java to overcome this, and consequently is now seen as "...positioned well to take advantage of the network-centric future that many predict is coming..."(Willis, 1997). Some features were removed, such as laser disc controls and video/movie playback, as much of the development for the product was dependent on the parallel development of Java. At present therefore, DC3 can only import JPEG and GIFF graphics files and AU sound files. Pierian was at the time of this study, planning feature improvements that would appear in forthcoming versions – including MPG layer video (B. Olsen, personal communication, 19 December, 1997).

Summative Evaluation Research

Summative evaluation research is conducted after a product has been developed and completed. It serves the purpose of rendering an "...overall judgement about the effectiveness of the ...product" (Patton, 1990, p. 155). Anderson (1991) sees effectiveness as the extent to which a product has achieved its objectives. Pierian Spring Software (1997) describes Digital Chisel 3.0 as an "...easy-to-use authoring program, written especially for students of all ages" (Pierian Spring Software, 1997).

This study then (Figure 4), will focus on how well the features of DC3 meet the "intended use by intended users" (Patton, 1990, p. 122).

After an extensive literature and Internet search, a generic list of features for a multimedia authoring tool that would be suitable for the middle school was not found. Hinerman (1994) when referring to an ideal authoring program for the classroom, points out that, "it is important to select an authoring system that is easy to use and understand"(p. 38). Although this may sound rather obvious, the vast majority of authoring tools on the market are designed for commercial use, and are by no means easy to use, a point overlooked by some reviewers who tend to look for commercial features, in authoring programs more suited for students. Magel (1997) for example, lists a number of scripting features that would no doubt add power to a commercial application but in a middle school authoring package would be either wasted, or possibly intimidating. The language needed for scripting might not be easily understood by the students for example, the use of Lingo with Macromedia Director, (Moore, 1997).

Many authors have produced features lists that have been referred to when compiling the authoring features inventory used for the Features Evaluation Questionnaire in this study (Appendix F). Magel (1997) and Nordenhake (1996) for instance, have compiled comprehensive lists of features for authoring tools that they have grouped under major program function headings. Oeftering (1996) and Cagle (1995) offer advice on metaphor based features, while Heid (1997) has approached a review of authoring software features from a product difficulty perspective, which allows a better understanding of the products that are more appropriate to this study.

CHAPTER III

EVALUATION METHODOLOGY

Introduction

This study was a summative, product evaluation. It was conducted after the development of the product was complete and is what Sprinthall, Schutte & Sirois (1991 p.105), call an "outcome evaluation". It aimed at establishing how effective the product was in the classroom,. The evaluation focused on the features of Digital Chisel 3.0 as set out in Appendix F and Table 6, and proceeded using the processes as presented in Figure 4. These processes will be discussed in detail later in this chapter.

The interaction between a computer software program and its user can be seen as having subjective elements and implications that are not easily studied using quantitative methodology. For example, the user's initial perception of how easy a software package is to use, or even its perceived relevance, could influence how effective it ends up being for that user (Anjaneyulu, Singer & Harding, 1998). Qualitative methods of data gathering and analysis were employed.

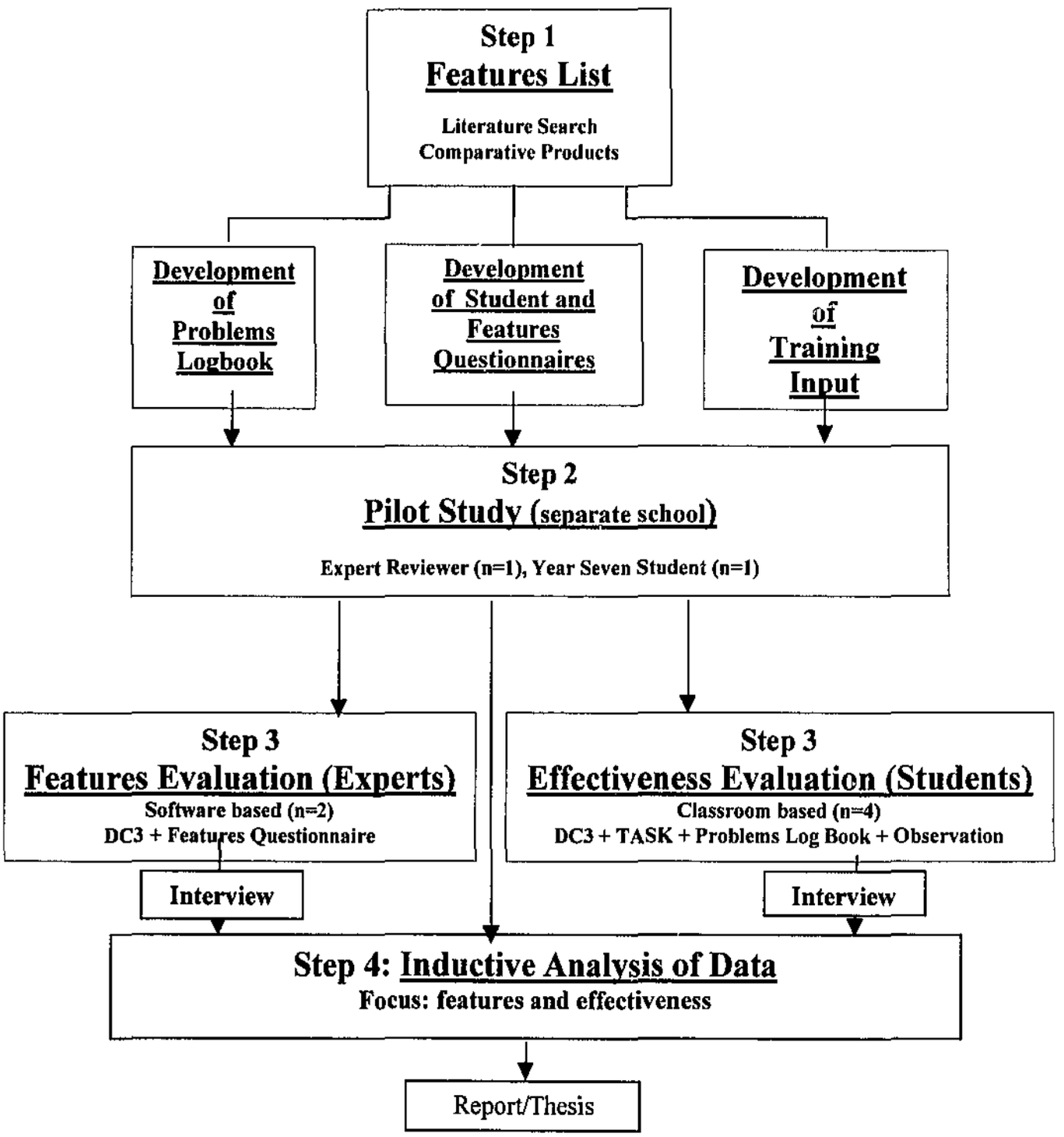

Figure 4 Research model showing processes used in evaluating Digital Chisel 3.0.

The main evaluation participants included two expert reviewers who were experienced teachers familiar with multimedia and four Year Seven students using the product to produce an interactive multimedia report from a specified task. A Year Seven Student from a separate school was used in a pilot study preceding the main evaluation.

Data Gathering Methods

The qualitative approach to research has the intention of revealing the 'multiple realities' (Burns, 1997) experienced by the participants, as seen from their perspective. The sources of evidence intended for this study (Tables 4 and 5), initially included observation and semi-structured interview, audio recording, questionnaire, a problem log and a field journal (see Appendix S) supported by anecdotal notes. Prior to the main study, the Problem Log proved to be impractical and video rather than audio was chosen as a more efficient recording medium.

To help maximise the credibility of data collected, and reduce bias, two triangulation strategies were used in this study; triangulating data resources (Patton, 1990) and participant review triangulation. Triangulating data sources, uses a combination of data types which "... increases validity as the strengths of one approach can compensate for the weaknesses of another approach" (Marhall & Rossman cited in Patton, 1990, p. 244). For example, the features related data collected by the researcher from video recordings, and observation were compared with the features related data from the final interviews (Tables 4 and 5). In participant review triangulation, data and conclusions gathered while observing or interviewing participants were submitted to the participants for comment on accuracy and fairness – a process that results in what Patton (1990) calls "face validity" (pp 468-469).

Bogdan and Biklen (1992) consider this kind of feedback as an essential qualitative research strategy. They state that "Since one purpose of the research is to construct the multiple realities participants experience, the researcher needs to find ways to reflect the world as they see it" (p. 211).

Table 4.

Data gathering matrix for each Step of the research model.

DataGathering Methods	Stages of the Study				
	Step 1		Step 2		Step 3
	Features List	Competitive Products	Pilot Study	Expert	Students
Features Questionnaire	●		●	●	
Student Questionnaire			●		●
Interview			●	●	●
Observation			●		●
Audio Recording				●	●
Lit / Doc Review	●	●			●
Problems Log			●		●
Task Report			●		●

Table 5.

Data gathering matrix for Effectiveness Guidelines.

Data Gathering Methods	Effectiveness Guidelines				
	Easy to Learn?	Efficient to Use	Remembers Routines?	Problems?	Affective Reactions?
Features Questionnaire	Researcher Use				
Student Questionnaire	●	●	●	●	●
Interview	●	●	●	●	●
Observation	●	●	●	●	●
Audio Recording	●	●	●	●	●
Lit / Document Review	●	●	●	●	●
Problems Log			●	●	
Task Report				●	●

As can be observed from Table 4, the evaluation (Step 3) had multiple sources of data. For example to determine how easily students were able to use the features of Digital Chisel 3.0, a comparison was made between the video evidence, comments made in the final interviews, observations during participation and a review of the final multimedia artifact.

Each of the Steps used in the study (Figure 4) will now be discussed in terms of the sources of data.

Step 1.

The Authoring Features List, Questionnaire

The general format for the Features Evaluation of Digital Chisel 3.0 questionnaire was modelled on the User Interface Rating Tool for Interactive Multimedia (Reeves & Harmon, 1997). The authors included a rating scale and an option to add comments either related to or instead of the scale. For this study, the rating scale was simplified to 5 choices, as suggested by Nordenhake (1996), yet still with a space available for amplifying with brief comments, (Appendix F). An extensive search was conducted of Web sites, educational and industry journals and books, to establish a sample of products available and what features these had. The resulting list included features desirable at Year Seven level (Appendices E and F). The items were chosen from the survey of product reviews and articles that identified desirable development and support features, of an authoring tool (Nordenhake, 1996; Magel, 1997). The Features Evaluation Questionnaire (Appendix F) was also used as a reference in the data analysis phase.

Development of the Problem Log Book

From the features list, a Problems Log Book (Appendix C) was constructed, which was modelled on a similar instrument used by Hu (1996). It was intended to be used to assist feedback while the students were working with Digital Chisel 3.0. It consisted of two sections and included three questions identifying any problem while using the software and a fourth question was included giving the participant the opportunity to express affective reaction to that problem.

Development of the Training Input Lessons

The training input lessons were intended to give the children an initial understanding of multimedia authoring. Pierian Spring's (1997) presumption was that before using DC3, the user should have at least entry level computer skills such as "...saving text, launching applications, typing text and double clicking etc..."(S. Bryant, Personal communication, October 6, 1997).

There were 3 lessons intended, with the following content:

Lesson 1. Multimedia introduction using DC3 (Digital Chisel 3.0)

Lesson 2. Page layout - templates, and importing pictures - DC3 Page Screen

Lesson 3. Links and interactivity - Project Screen, Workbench

Each lesson was designed to run for approximately 30 minutes duration and utilised the resources and tutorial supplied with Digital Chisel 3.0.

Step 2

Pilot Study

During March/April 1998, the researcher worked with one year seven student, Valary, from a private K-12 school (Appendix S). The objective of this pilot study was primarily to trial the instruments to be used in the main evaluation of Digital Chisel 3.0, but also to note any relevant DC3 features related events. This pilot study was approached in the context of a multimedia authoring task. Valery chose the topic and a conversational interview format was used. The pilot study was conducted in the computer lab at the school during a regular Year Eleven and Twelve rostered time. DC3 was loaded onto one Pentium 133 computer with 16 Megabytes of RAM. This machine was used during each successive visit. The noise level in this location was high, and as Valery was a quietly spoken person, communication was not easy.

The Senior Teacher in charge of computing at the student's school, also offered comments on the Features Questionnaire and Problem Log.

As a result of the Pilot Study, three main changes were made. Firstly, after observing Valerys reluctance to use the Problem Log and discussing this with the senior teacher, it was decided that the Problem Log as a means of student feedback be discontinued in favour of a personal interview at the commencement of each new evaluation session. Secondly, in an effort to reduce possible conflict between the dual roles of data recorder and observer, the researcher opted to video record each session and concentrate on the observation. Thirdly, it was observed that Valery had difficulty organising her project and therefore to assist with student planning, Task, Guideline and individual page-design sheets were constructed (Appendices I,L). Also, a DC3

organisation help (Appendix M) was constructed and loaded on the computer for ongoing reference.

Step 3.

The Expert Evaluators

Two technology teachers familiar with multimedia were engaged to evaluate Digital Chisel 3.0 from a professional/theoretical perspective. Expert 1 was a well qualified teacher with a Graduate Diploma in Computer Studies and was an Advanced Skills Teacher. He was a senior teacher/lecturer in the Computing Department of a Secondary College who presented Digital and Interactive Media to all levels, and had twenty-two years teaching experience.

Expert 2 was an Advanced Skills Teacher holding a senior level three position at a Primary School. He had extensive experience in teaching classroom technology and had also served with the State's Education Board Central Office, in both curriculum and technology advisory capacities. He had also served on a number of technology boards, as well as three years in a senior position with a computing association. Expert 2 had had several articles written about his classroom work and had many of his own papers published.

They were asked to evaluate features of Digital Chisel 3.0 from a technical/professional perspective. They were each given the product and the Features Questionnaire (Appendix F), and asked to rate each feature with optional comments. This was followed up with an interview to validate their written evaluation (see Appendix T).

Evaluation with Students (Step 3)

The Year Seven teacher of a private primary school, was asked to choose four children as a stratified purposeful sample (Patton, 1990; Kumar, 1996), from volunteers in his class. This class level was chosen as it was the upper level of the K-7 school, and yet has relevance to multimedia work undertaken in High School. Students at this level were also more likely to have developed the basic skills required for multimedia activity (Okolo & Ferretti, 1996). The group was representative of a typical class at the school.

Student Attributes Questionnaire

The teacher was asked to include in this group, two boys and two girls and to try to spread in his sample, a variety of personal attitude to and familiarity with, computers. The parents of each student were informed of the study, and asked to register their permission using the consent form provided (Appendix H). Before commencing the multimedia task, the students were given a questionnaire (Appendix N) that addressed background relevant to computer skills and attitudes to computer use. The main objective was to identify influences the participants brought to the evaluation. The first part of the questionnaire was constructed by the researcher to help reveal previous experience relevant to this study and the second part incorporated attitude evaluation items used by Hu (1996).

Tammy and Sally, Leon and Antony were chosen. Tammy, was the youngest at 11 years ten months at the beginning of the evaluation and Leon the oldest at 12 years 6 months. The original interviews and questionnaires revealed that Antony and Sally used computers often at home and school and confidently used the Internet. Leon

handled the technology well but did not enthuse about it's use, while Tammy, though coming from a strong home technology background was not confident, and tended to shy away from computer use in the classroom. All the students were familiar with basic word-processing protocols and the Windows work environment.

Training Input Lessons

Despite each student having a basic entry level in computer literacy, it was necessary to precede the evaluation with an introduction to multimedia computing. Training Input lessons were provided, beginning with a discussion of the general concept of multimedia, building a page using various media forms and the idea of planning a presentation that has pages linked in a branching form like a tree. Each element of a procedure was demonstrated, discussed and then each student in turn practised it (McConnell & Sprouse, 1998). The researcher worked with the evaluation group and the class teacher presented the lessons to the remainder of the class. The evaluation students then acted as 'experts' and offered peer tutoring to any other student needing help.

The lessons proceeded over three successive weeks during which time the participant students, at the teachers discretion, had access to Digital Chisel 3.0, to explore further the skills covered in the lessons. As Milton and Spradley (1996) experienced difficulty in maintaining attention with year 9 students when presenting the training input, the lessons were given in an overview form only with the bulk of the valuable teaching being done during small group demonstrations and via peer tutoring.

Multimedia Authoring Task

The participants were given the multimedia authoring task (Appendix L) and used DC3 as the authoring tool. The Social Sciences current theme on disasters and how to overcome them, was chosen as the subject of the task. The two girls and Antony chose the *Titanic* as their topic, Leon opted for the *Sinking of the Bismark.*

The objective of the task was to produce a multimedia report from this work. It was intended that the task be given to the whole class, in order to encourage as normal an environment as possible but that only the student participants were to be studied intensively. The student's exercise was modelled on a similar work conducted by Milton & Spradley (1996). Each stage of construction of the multimedia report was given a deadline in order to more easily identify the efficiency of individual features of DC3. The report included a requested minimum of:

1 Four screens.

2 A graphic on each screen and including text.

3 Inserting one sound with an access button.

4 Navigation between screens.

5 A question segment with at least two questions (optional).

The participants were timetabled for a weekly one-to-one participant observation, (the girls worked as a cooperative group), for approximately 30 minutes. During this time they developed their multimedia presentations using the media collection supplied with DC3 plus sounds and graphics the teacher or researcher could generate with other resources available.

Two forms of interview were conducted. A semi-structured interview was undertaken at the end of the study in which student-generated material and the participant's experiences were discussed. An interview guide (Appendix O) was used (Patton, 1990). Prior to the commencement of the post-study interview the students were asked to circle words from a prompt sheet (Appendix K) that they thought most described their experience. Their responses formed an added focus for the interview. Informal conversational interviews were also used during the participant observation time (Patton, 1990).

Work Locations

Two locations within the school were used during this phase of the study. The initial training input lessons were conducted in the classroom with the other Year Seven students, during normal class time. There was only one computer station for the class (Figure 7). Owing to occasional noise and other classroom distractions, this location was not suitable for the Digital Chisel 3.0 evaluation. The School Library was not often used during the time the individual project work was conducted, so the evaluation was moved to the Library (Figure 8).

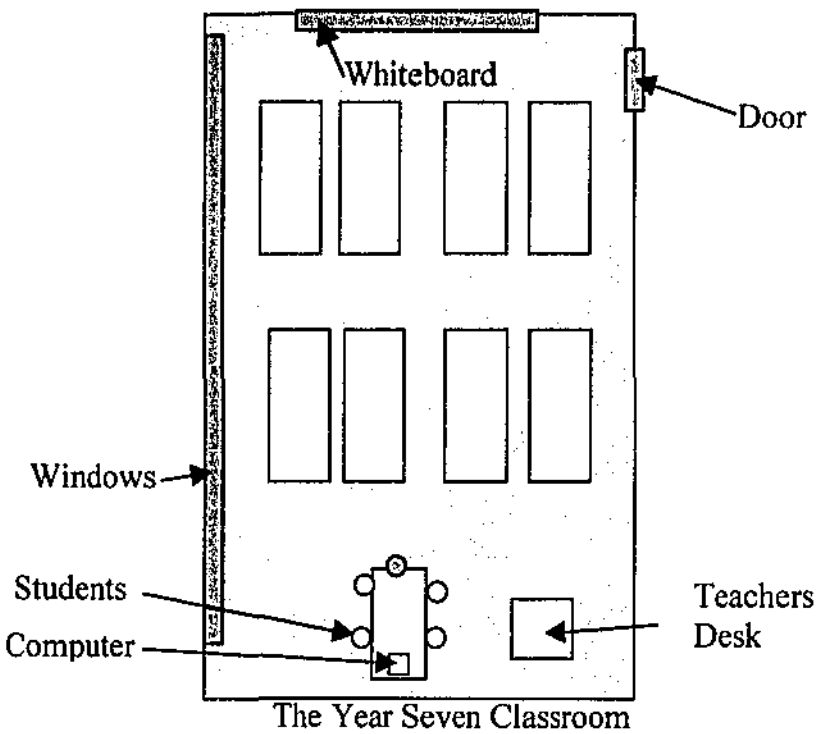

Figure 5_ The Training Input Site.

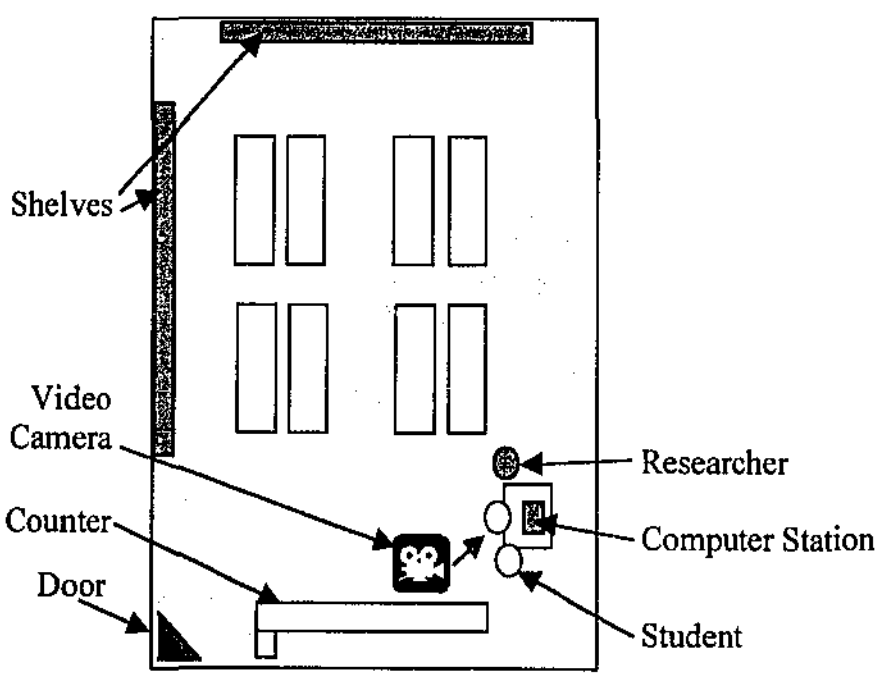

Figure 6_DC3 Evaluation Site

Hardware

Both computers used by the students were generic, locally assembled Pentium 133 desktop machines, with 250 Megabyte hard drives, and 16 Megabytes of RAM. The class room computer was connected to the Internet.

Analysis of Data (Step 4)

The analysis of Digital Chisel 3.0's features was qualitative in nature, with all data coded and processed as it was received. The interviews (Appendix T), video recordings (see Appendix Q) and observations (Appendix S) were transcribed as they were completed. The process of analysis was inductive, in that emerging trends, patterns and relationships relating to the effectiveness of Digital Chisel 3.0 were identified and noted from the data rather than being imposed on the research prior to data collection (Patton, 1990). Relevant events that may have influenced the evaluation objectives were also included. The Analytic Framework (Figure 9) was modelled on suggestions by LeCompte et al (1992).

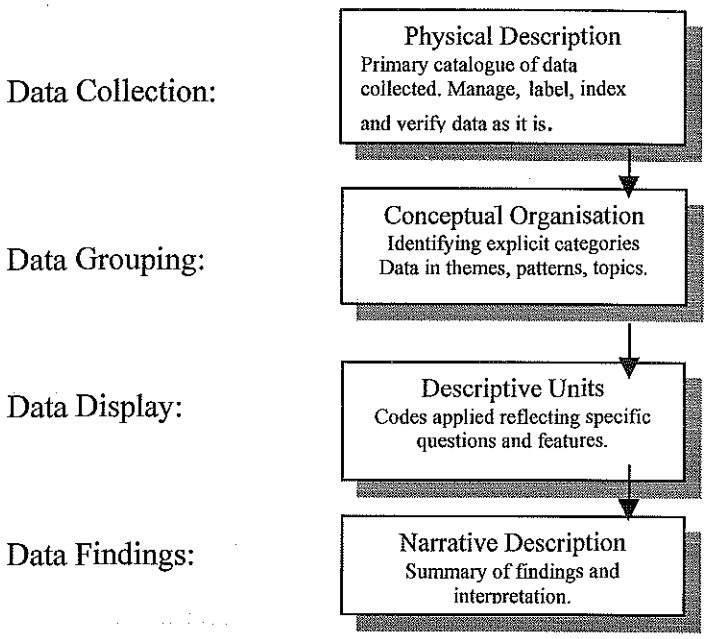

Figure 7 Analytic Framework (LeCompte et al., 1992, pp. 763-766)

This was essentially a "describe and display" format. At the *data collection* level, an inventory was kept of data collected (Appendices Q, S and T). The video recordings and interviews were transcribed verbatim. Each data type was checked by the researcher and verified by triangulation (LeCompte et al. 1992, pp 762-763). The data was then *grouped*, into DC3 features categories (see Appendices Q and R). At this stage, the analytical process moved from physical description and conceptual organisation, to *data display.* Each group was given a code relevant to the features of Digital Chisel 3.0, and the evaluation questions (see Appendix Q). This then contributed to the *data findings* stage, from which the narrative was compiled.

Summary

This study was a summative product evaluation of Digital Chisel 3.0, employing a qualitative methodology and using a combination of data types that were triangulated to improve validity. A pre-history and attitude questionnaire (Appendix N) was given to the students to determine possible external influences to their evaluation, and a features list questionnaire was supplied to the expert evaluators, as a guide for their review of the product. Training input lessons were given to the students, to introduce them to the basic concepts of multimedia, screen design and branching layout and to introduce them to the basic features of DC3. A pilot study (Step 2) was undertaken to trial the data gathering instruments for the main study. A conversational interview format was employed.

Two expert reviewers, both teachers evaluated the software from a professional perspective. Four Year Seven students, formed a stratified purposeful sample for the student evaluation (Appendix R, pp 1, 2). They were given a simple multimedia task (see Appendix L) to express the 'Disasters' study they were working on as a class. Introductory training input lessons on the concept of multimedia and how to use Digital Chisel 3.0 were conducted in the classroom prior to the students starting. The data collected, was analysed using a describe and display format (LeCompte et.al. (1992).

The following chapter outlines the results of the pilot study and the changes made as a result. This is followed by a report on the major evaluation study, in which features of Digital Chisel 3.0 were evaluated by the expert and student participants.

CHAPTER IV

FINDINGS

Introduction

As an evaluation of Digital Chisel 3.0, this study sought to establish an effectiveness profile of the product's features. These features were divided into Development or internal features, and Support or external features. These were then placed in a hierarchy (Appendix E), with all possible individual features for the Year Seven age range grouped under their appropriate sub-headings. This structure was used as a template for the features questionnaire used by the experts. The main evaluation findings in this chapter have been placed in the same order. The main evaluation was preceded by a Pilot Study.

Results from the Pilot Study

The primary purpose of the Pilot study was to test the appropriateness of the data gathering instruments to be used in the main study. Valuable observations were however recorded and incorporated in the final data analysis.

At the first visit, the researcher introduced the concept of multimedia, had Valery fill out the questionnaire (appendix F), explore DC3 and begin the project, using the Tutorial as a guide (see appendix S). She appeared to understand the questionnaire and completed it promptly. The researcher did however, need to explain the terms 'software' and 'hardware'. The urge to experiment appeared to consume Valery early in the session, as she explored the menus and navigated freely. She found the animated Gif files, the Welcome, and the Dog, was excited by them and installed them without

fuss. During her use of the Tutorial, an unrelated dialogue box indicating that the project was read only and could not be saved, kept appearing. Also the tutorial referred to the insertion point, a term that Valery had not heard before. With prompting, she wrote down any difficulties in the Problem Log (Appendix C), though the affective section at the end of the log was not easily handled.

During the hands-on time, DC3 froze three times. Also, one of the graphics libraries had numbers for all the file names, thus making it difficult to find a suitable picture. Before leaving that session, the researcher gave the program disks to Valery so that she could install DC3 on her home computer. She was not able to do this, as the computer was not a Pentium.

During the next meeting, Valery appeared to remember the start-up and entry to project routine well and progressed with editing her Dog project. While trying to add a new page, she lost all her work. The cause was not immediately apparent, although she may not have saved previously. Valery found that after inserting a background, it moved as text was being inserted over it.

The final meeting with Valery did not occur, as on arrival at the predetermined time, it was found that her class and teacher had gone on a school trip. The senior computing teacher at the school, reviewed the expert features questionnaire and considered it to be appropriate for the evaluation exercise.

Based on the experiences in and feedback from the pilot study, the main evaluation was modified to improve quality. The following adjustments were made to the Problem

Log, the method of recording observations and the method of introducing the task to the students:

Changes to The Problem Log

The Senior computing Teacher made the point that at this age, few children would be able to consistently and accurately diary their experiences and feelings while unsupervised. Although Valery did write up difficulties as they happened, this was after prompting. She made no entries while working unsupervised. For this reason, it was felt that the log would not be used sufficiently to be of value. In its place, it was decided to 'debrief' each evaluation student in conversational interview at the beginning of each session.

Changes to Recording Observation Data

Participant observation requires a high level of on-site involvement on the part of the researcher. It was found however, that too much was happening during on-screen activity and with Valery, to effectively stop mid-stream and annotate. Even if the researcher's recollections were clear and recorded directly after the observation took place, the possibility of missing important detail in this kind of endeavour was high. Burns (1997) calls this role conflict. In an effort to minimise this conflict between data recorder and observer, it was decided to introduce video recording of each authoring session and supplement this with post-session anecdotes (Appendix S).

Changes to Introducing Students to the Task

Although the researcher introduced the various features of DC3 to Valery and she appeared to master these, it was felt that she did not understand how to plan her

presentation, in this new paradigm. The Cognition and Technology Group at Vanderbilt (1992) found that their students of similar age found great difficulty in performing planning tasks without assistance. To this end, an introductory task sheet was constructed (see Appendix L) and follow up guidelines, presented as a DC3 presentation (Appendix M) was loaded on the class computer. When introducing the planning aspect of the project to the children, a Know, What, Find, Learn (KWFL) format similar to that used by Morehead (cited in Shields, 1996, n.p.) and Kalish (1997) was employed. The class teacher had independently used this approach, and so the evaluation formed a valuable support for his work. From this platform, the students drew a rough icon tree and planned each page from there, using an individual Screen Sheet (Appendix I) for each page. They were then prepared to begin the construction on-screen of the project.

Results from the Evaluation with Students and Experts

Most multimedia authoring programs possess two major feature categories (Table 6 and Appendix E). The first involves all those internal functions of the software that a multimedia author would use to produce a multimedia presentation. For the purposes of the study, this category has been labelled Development Features. This has three further sub-groups: Media Creation, the construction of the basic elements of multimedia; Media Integration, the combining of these creation elements; and Interaction, the particular functions that when inserted in a presentation, allows a user to control and or respond to the presentation. The second feature category includes mainly those aspects of a product that are external to the actual software, as well as involve the publishing capabilities of the software and the services and back-up provided, by either the

manufacturer or the marketing agents of the product. This category has been identified as Support Features.

Table 6

Features Structure for Digital Chisel 3.0

Development Features:

- Media Creation
  - Text
  - Graphics
  - Sound
  - Video
  - Animation
- Media Integration
  - Transition
  - Screen Design
  - Templates
- Interaction
  - Response Analysis
  - Navigation

Support Features:

- Distribution
  - Reproduction
  - License
- Technical
  - System
  - Software
- Productivity
  - Internal
  - External

The findings of this study will be presented with reference to the order of feature items in Table 6. However it would be relevant to begin with a review of the program and page access characteristics of Digital Chisel 3.0, before continuing with the Development Features.

Program and Page Entry

Entry to Digital Chisel 3.0 began normally by double clicking the shortcut icon on the Windows desktop. The program would load and the main menu appear (Fig 10). The user could choose from 5 options, either Open (an existing project), or Create (a new project) will open the Project View. To enter the HTML or page editor, (where the individual pages of the presentation are constructed), the user could either double click on the chosen page icon in Project view, or highlight the icon and click on the Page View button from the navigation tool bar at the top of the screen. The page interface was colourful and layed out in conventional Windows style. The edit area was blank and the non-blinking insertion point appeared by default in the top left-hand corner, at the opening of the page. The HTML editor design is customised to three age/school groups, Elementary, Middle and Advanced.

The Middle and Advanced modes exhibited the same function buttons, though the Advanced icons have a finer line-drawing artwork on the icons and fewer colours are used. The background is grey instead of the middle's blue. The elementary mode tool bars and buttons are larger than the other two modes and are more colourful. The e-mail, indent-outdent, Monospace, anchor and Insert Applet buttons were not included at this level. The Elementary background is lime.

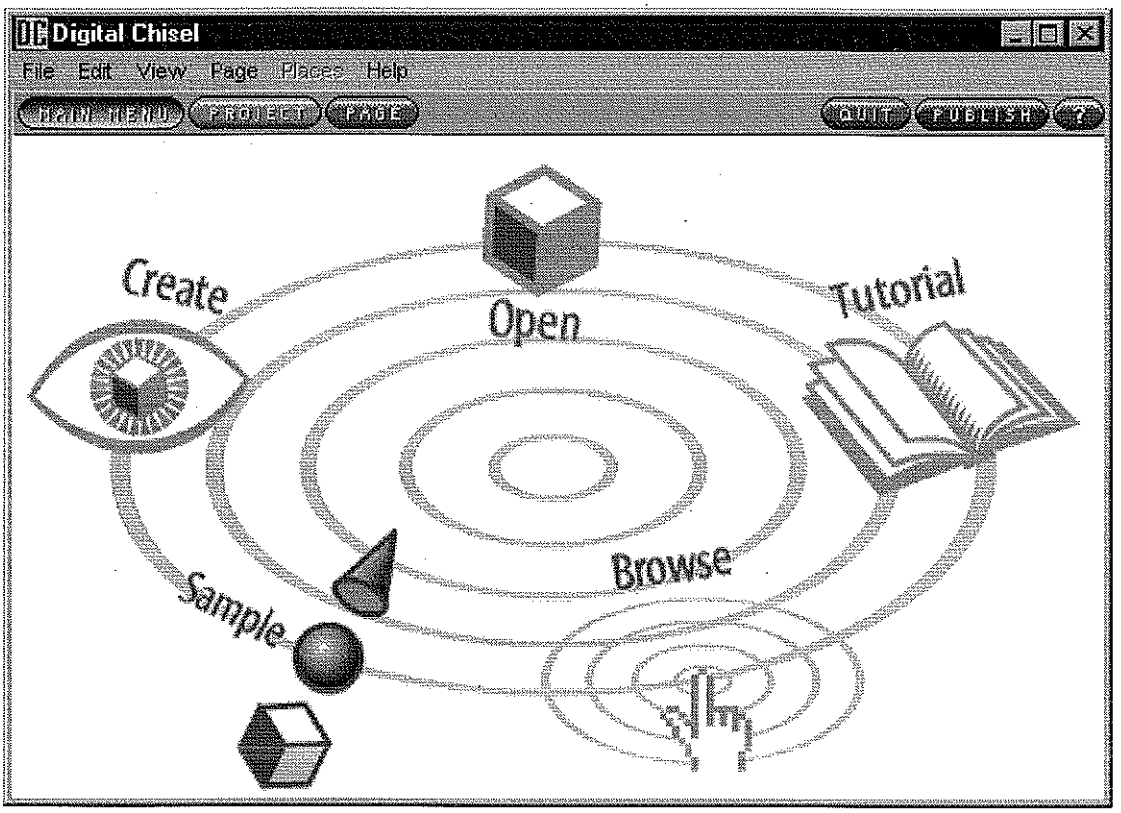

Figure 8 Main Menu for Digital Chisel 3.0

Leon mastered the program entry sequence quickly. He did not require assistance to load the software or to choose the correct project open icon and had no trouble accessing his project on each of his sessions at the computer. In the third session however, during Leon's first attempt to open the introduction page, DC3 stalled. The icon tree disappeared, and the introduction page icon remained. On his second try, the tree returned but the page remained jammed. After two more unsuccessful attempts to open the page, Leon had to apply Control-Alt-Delete to exit. He reopened with no further problems during that session. During the next session, Leon faced the same trouble, this time he tried to open the quiz page. He tried several methods to free the page, ending up with a big sigh as he took two last Ctl-Alt-Del attempts before he could exit. He asked with desperation in his voice,

"Why does it do that sometimes?" He finally managed to enter the project and was able to continue uninterrupted for the remainder of the period.

Antony was able to enter his project without incident during each of his first two sessions. However in the second session, as he double-clicked to open the Introduction page, a dialogue box appeared, indicating that the requested page could not be found. He double clicked again with the same result, prompting Antony to respond with, "What's wrong with this computer?" Highlighting the icon and trying to open from the Page button met with the same message. For the third time, Antony tried to exit and reload the program, only to find that the welcome graphic jammed. He clicked this 6 times with no effect.

"That took me ages that page, (3 hours). It had a lot of writing on it!" Antony changed tack this time, and tried to open the second page but the same error message appeared. After a further exit and restart, DC3 loaded and allowed access to the project pages. Before the end of the days work, the program jammed again, once after he had left a highlight on and tried to type over it and again after a backspace operation.

Sally and Tammy, as with the others, did not have difficulty learning to enter the program and then their individual project. On entering the project in the third session however, an unexplained error message indicated that the project had been converted to read-only. No editing could be done and DC3 finally jammed. After a Ctl-Alt-Del sequence and restart, no further problems with program stability occurred.

Media Creation

Text

Text can be imported into Digital Chisel 3 as plain text, through the cut and paste process. The text format buttons, (Figure 11) are in a central position directly above the page editing area. From left to right, the buttons allowed bullet and number listing; alignment; indent adjustment; bold and italic; font choice; size adjustment and colour. There was no facility to underline text. One obvious break from traditional text formatting appeared in the use of incremental size adjustment buttons rather than a single choice from a pull down menu.

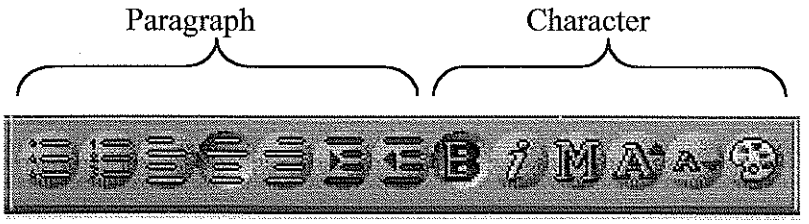

Figure. 9. Text format buttons for Digital Chisel 3.0

The students entered text carefully and comparatively slowly (Table 7). They stopped regularly to check notes and spelling, or to discuss changes, and each appeared to adapt quickly to the DC3 text edit functions.

Table 7.

Student Typing Speed Sample

Student	Words Typed	Time Taken
Antony	31 words	9 minutes 31 seconds
Leon	36 words	2 minutes 17 seconds
Tammy	35 words	5 minutes 28 seconds
Sally	30 words	4 minutes 24 seconds

Of the Paragraph Formats, the bullet and number-listing buttons have a similar design to the matching Microsoft (1994) buttons but these functions were not used during this study. The Left, Centre and Right alignment, also resemble the Microsoft standard and were recognised without prompting. Each was used frequently by each student to format blocks of text, and headings. Tammy, Sally and Antony discovered the indent and outdent buttons and used them to effectively move highlighted text horizontally to desired positions on the page.

The bold and italics buttons in the Character Formats were easily recognised by all the students and they used these functions easily to format their headings. There are three internal fonts available in DC3: Helvetica, Times Roman and Courier. They can be selected from the File/Preferences menu. Expert 2 had difficulty in finding these fonts. The Monospace button allows for that font to be used when any text represents computer code or indicates text that is needed for entering into a data field. The button is of simple design, but does not have any direct visual similarity to font selection buttons in commonly used word processors. Although the need to change fonts did not

arise during the study, Antony and Tammy did notice the Monospace button and queried its use.

The font increase and decrease buttons needed only a brief explanation with no reminders thereafter. This function appears to be designed as a visually judged exercise, as there is no indication of what point size the text is or becomes. The tutorial help and manual do not contain font point-size references either. The authors have opted to name the sizes as Extra Small, Small, Medium, Large and Extra Large. Each student used this feature frequently. On one occasion however, Antony attempted to enlarge a sub-heading. After the second click of the enlarge button, the font 'exploded' to a size larger than normally possible. Rather than become frustrated with this development, he expressed excitement at the thought of being able to make any text that large and wanted to repeat the event. He began by trying to return the text to normal and start again, but it then unexpectedly changed to a different typeface, Monospace. He had to retype the sub-heading. From this point on, the 'explosion' problem did not occur again.

The use of colour is an important consideration when preparing a multimedia presentation, for either local or Internet publication. Digital Chisel 3.0 has a versatile colour selection pallet (Figure 10), that allows the user to select from an established chart, or create a custom colour using the chart as a base.

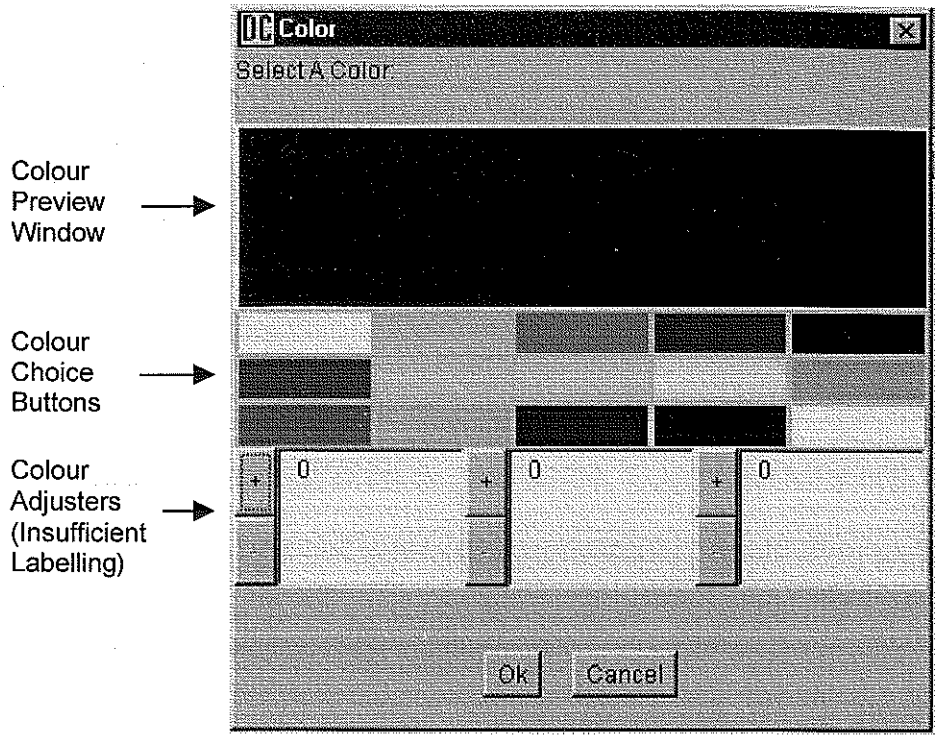

Figure. 10 Colour Selection Pallet for Digital Chisel 3.0

After a simple introduction, each of the students mastered the art of colouring text and appeared to enjoy the added facility of creating their own colours. Antony used the custom feature often. He appeared to seek out and enjoy using any such creative function. "I like this program, it's good to work on", he expressed after inserting his first custom colour.

Leon on the other hand appeared to concentrate on completing the basic elements of each page. When he opened a new page for example, he would just begin typing the text, whereas all the others would start with the entering, positioning and colouring the heading, or inserting a picture. On one occasion Leon, while labouring over creating a colour, looked as though he had settled for a lesser shade after a protracted effort to get the colour he wanted.

The colour selection pallet displayed three adjustment windows, (presumably red, green and blue), though no labelling showed which colours are represented. There were plus and minus adjusters for each. Tammy chose a base yellow and then began working with the centre adjustment box, chosen at random. She clicked the plus button 15 times, then switched to the right hand adjustment window and clicked plus 8 times, yet only achieved a minor change to the original yellow. Tammy and Sally both laughed in a frustrated way and decided to insert the partly finished result. Even so, Sally appeared happy with the colour, as she remarked "Ah that looks good".

Digital Chisel 3.0 does not have a line spacing adjustment. However, the students did not express any desire to use that facility. Expert 1 noted that there wasn't a line spacing adjustment but made no comment on its absence.

Graphics

As Digital Chisel 3.0 is written in Java, Pierian Spring Software (1997) recommends the use of two main graphics formats that are suitable for Internet and cross platform use. For those images that have 256 colours or less, the GIF file format is recommended, and for images with more than 256 colours, JPEG is favoured because of the effective compression process it uses. As Pierian Spring Software (1997) has not included a graphics conversion utility with DC3, they have recommended two shareware products that are both efficient and easy to use.

Inserting a graphic image is achieved by clicking on the Insert graphic button on the media toolbar (Figure 11). The image can be selected from either an external library or the one that accompanies DC3.

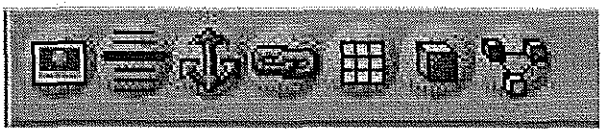

Figure. 11. Media Toolbar for Digital Chisel 3.0

The process for inserting an image into a page was familiar to each of the students. The selection window defaults to the DC3 library and initially each student chose from the list supplied. They all however, needed to be shown how to access the floppy drive, on which the researcher had placed some GIF images for their study (as time was at a premium the students did not prepare their own images).

Inserting a graphic into the Workbench is more involved than inserting one into a page. Although the same button icon is used for each, when inserting into a page, the select a picture dialogue box appears and the chosen image will only appear where the insertion point is left on the page (a detail of which Tammy and Leon needed to be reminded). A Workbench graphic can be placed at any point on the grey workbench so, after clicking the button on the Toolbox, the curser changes to a cross once over the grey and click of the mouse will fix the position. An image icon (an American coin) would appear to mark the spot. On double clicking the image icon, a 'Properties' box appears, as the new image will be a 'live' Java Bean, or program component, that will need to be configured. To choose a picture, the 'Picture' button on the 'Properties' box must be clicked. This raises the 'Select an image file' dialogue box, in which the 'Browse' button is clicked. This in turn raises the 'Select a file name' dialogue box from which the image is finally chosen. As a routine with at least six steps in it, inserting a

Workbench graphic was difficult for all the students to remember. Leon in particular needed to be coached on two occasions outside the initial training.

Leon had a specific layout in mind for his 'Birth' page (Appendix J). He wanted to place some text in between two pictures. After placing the pictures he was unable to wrap text between them and have it remain stable. He was asked to cut the text to the clipboard and open a 3x1 table. It initially appeared as a small divided box in the top left hand corner. He was concerned that it was not big enough to carry what he wanted to put into it. The researcher then encouraged him to place the first image in the left cell – which was at least big enough to take the insertion point. On completing that routine, the table cell expanded to fit the new image. Buoyed by this, he placed the second image in the right hand cell with the same result. To finish the exercise, he pasted the text into the middle cell (Fig. 12).

"Can I just keep writing or do I have to save?" Leon wanted to add more text to what he had pasted. He was assured that it was always a good idea to save and he did.

Leon shuffled his notes and began by clicking the insertion point to the end of the last line. The table suddenly jumped round the screen, then settled. He began to type.

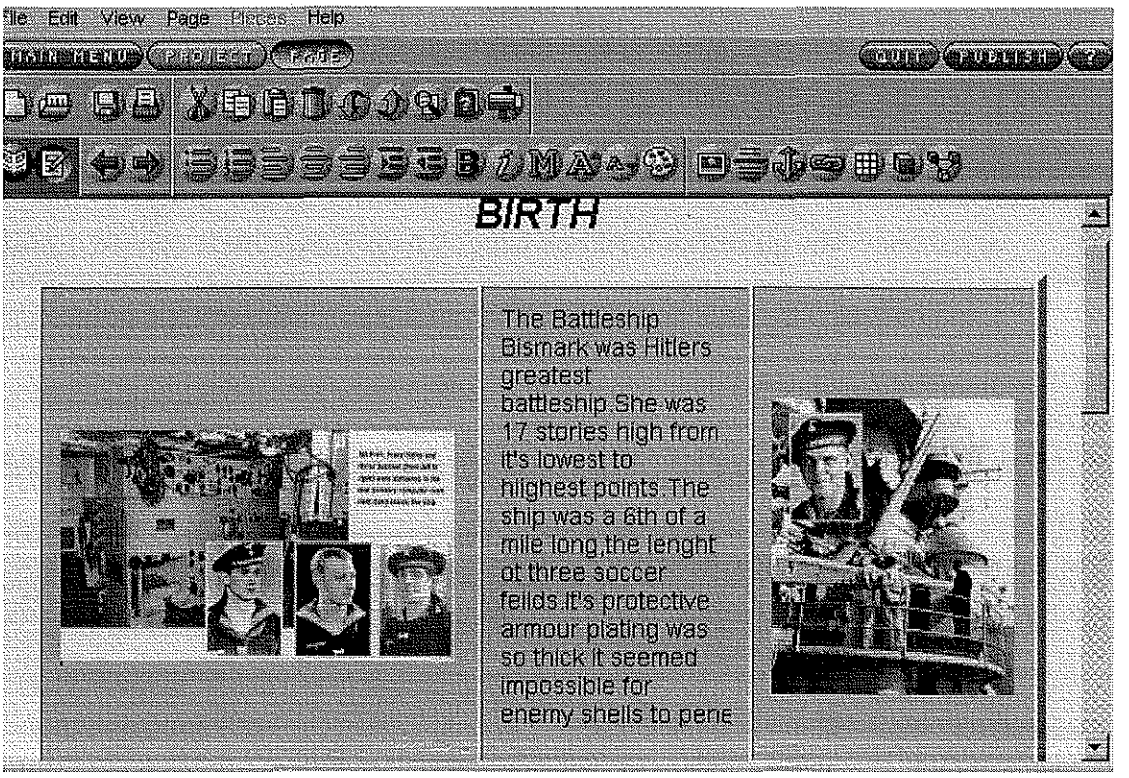

Figure. 12. "Birth", a page from the project by Leon.

After ten words where completed, they all disappeared – and then came back – then disappeared again. Leon tried to scroll the table to the middle of the screen, but it kept on jumping back to the starting point. He gave up and tried to continue typing. All this new text disappeared as well. Without warning, the right hand picture duplicated with out reason, leaving two images in the cell. Although Leon appeared calm, there was a real sense of frustration in his voice as he said,

"It appears to be an impossible task. Some of these words just are not coming up when I go down a paragraph".

He tried to restart by going to Project mode and then returning, but on trying to scroll the table, it jumped around the screen again. Leon finally saved (with an expressed mistrust of even that outcome) and exited the program.

Images placed in a DC3 page do not have a drag and drop characteristic. To move the image, it must be highlighted and positioned using either the alignment and in/outdent buttons, or repeated use of the return key for vertical placement. Expert 1 considered this to be very restrictive. Expert 2 found that DC3 locked up when he tried to reposition a graphic and that it returned to the default position after the choice.

Unlike the previous version of Digital Chisel, DC3 does not have an in-built draw package. The user can however, insert a full-page width horizontal line-graphic by clicking the button to the right of the graphic insert button (Figure 11). As with other insert features, the line will appear at the insertion point. All the students experimented with this function and used it in their presentations. Expert 1 saw this as a satisfactory feature only. Expert 2 queried why only a default line can be used.

Digital Chisel 3.0 has a quantity of images that are packaged with the application and a separate graphics library on CD. There are also instructions on how to find specific material on the Internet. Expert 1 considered the graphics library to be an excellent facility. Expert 2 saw the content as good, but 'Americanised', and cited the inclusion of US map, coin and personality images, as not being so relevant in the Australian situation. The researcher also provided GIF images on floppy for Leon, (The Bismark) and for the others (The Titanic). During the training phase, each student used the DC3 images, especially when working with the tutorial but relied heavily on scanned and Internet images for their projects.

Sound

Sounds could be linked to DC3 using the Workbench and played through the browser. Pierian Spring Software (1997) had opted to support only the Sun AU format, because in their view, it was the most common Internet format, (Pierian Spring Software, 1997). It was only 8 bits and uses Java which was the language DC3 is written in. Digital Chisel 3.0 did not have a sound capture or edit utility but two shareware products that could be used to make and store sounds in the AU file format were recommended.

To add a sound through the Workbench, the students inserted a button bean and a sound bean to it's right, from the ToolBox (Figure 15), and then connected them. To select a sound file, the sound bean was double clicked, to bring up the Properties box. 'Browse' was clicked to reveal the Sound file name dialogue box. The sound file was chosen and the 'Open' button clicked followed by the 'Done' buttons. The chosen sound file was then in place.

As with the graphics insert routine, the number of steps required appeared to make a sound insert more difficult to remember. It required two clicks to place a sound icon, and between seven and twelve separate clicks to embed a sound into the icon. Microsoft PowerPoint however, only required a three-click sequence to embed a sound into a document, and the visible icon that activates the sound was automatically placed on the page. Under this comparison, entering a sound in a Digital Chisel 3.0 document appeared to be unnecessarily complicated. The technical process involved in placing a sound in DC3 was however stable and in all cases observed, was completed without software failure. Although Antony appeared very comfortable with the routine, both Tammy (twice) and Leon (once) needed support.

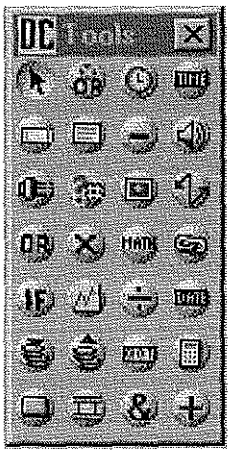

Figure 13. The Digital Chisel 3.0 Toolbox

On her first try, Tammy took twenty seconds to find the sound icon in the ToolBox, while using the yellow pop-up labels to identify each icon. Leon also initially forgot how to enter a sound. After some help from the researcher, he clicked on the icon in the Tool Box and proceeded without further difficulty. Tammy forgot what to do next, once she had clicked on the sound icon and Sally coached her to click on the Workbench to place the sound bean. Tammy then needed further help to insert the sound file link into the bean.

Expert 1 found the sound features satisfactory, but queried the support for the AU file format only and found it limiting that support software, (eg. sound editing), normally found in programs such as FrontPage, was not present. Expert 2 rated the sound facility in DC3 as poor. He tried to link WAV files to the sound bean, without success, and commented that there was no facility to trial sounds, before linking.

Video

The previous version of Digital Chisel allowed for the import store and display of Quicktime movies and control of up to two videodisc players. Video capability

however, has not been included in the current version. This omission is significant in that video capability is an expected feature in interactive multimedia authoring software today, especially that designed for school use. Pierian Spring Software however, (B. Olsen, personal communication, 19 December, 1997), have indicated that they intend to include MPG layer video in their next feature release. Both Experts queried the absence of a video facility in DC3

Animation

Animation is a technique in which an object, or series of objects changes shape or moves on the screen. In the Workbench of Digital Chisel 3.0, it is possible to link either a frame animation, (separate pictures in each step), or path animation, (a single picture moved along a path). An AVI file can also be broken down and reconstituted as a GIF animation, and though laborious, does go some of the way to providing a movies option. DC3 does not have an 'on-board' animation editor and so recommends using GifAnimator, a Shareware program. There are a number of animated GIFs supplied with DC3 in the media CD and in the graphics library. Expert 2 considered that the existing library was adequate and rated the animation options as poor. All the students inserted library animations, and were excited with the results. None however, had the time to use the GifAnimator to produce their own.

Media Integration

Transition

Transitions are special effects that make the passage from one screen to another more interesting and may possibly add meaning to the change. Digital Chisel 3.0 does not have a transition effects facility.

Screen Design: Digital Chisel 3.0

The interface of DC3 is consistent throughout, in placement of menu bars, button icons and use of colour. An effort has been made to custom the style of button to the user level selected, and the level settings are saved with the individual project.

Screen Design: User Created Projects

A multimedia authoring application should support the user in the process of designing a screen, by including such elements as: availability of background images; and flexibility in choice of colours.

There is a good selection of background GIF images that are supplied in the DC3 library, and accompanying media CD. The backgrounds are created by tiling the chosen image. Antony discovered this feature while in the Page Properties dialogue box. He wanted to experiment, and found inserting the 'Water' background so rewarding, that he immediately followed that up by inserting another in a second page. Leon did not place any backgrounds until late in his study. Tammy, wanted to remove a background but did not know how. Sally coached her through the task and helped her to insert a

different background. Expert 2 found it easy to insert a background but queried the effort needed to find the insert utility.

Colours can be inserted as a page background in DC3. The same procedure and pallet that is used for colouring text, is used to add a background colour. Leon found the layout of the pallet hard to understand and needed to be guided when entering a coloured background. All the students experienced frustration that resulted from having to click the colour adjusters seemingly endlessly in order to achieve their desired shade. Expert 1 considered the availability of colours and backgrounds to be excellent, and commented on the good range. Expert 2 found the backgrounds useful, and the colour facility adequate, but not inspiring.

Templates

Digital Chisel 3.0 has three page templates that can be accessed through the Page/New menu. There is also the facility to save a page and it's links from other projects or the Internet, however the imported links can only remain live if their destinations are included. The students in this evaluation had chosen topics for which the DC3 templates were not relevant, and so they were not used. Expert 1 saw these templates however, as an excellent feature for this class level. Expert 2 on the other hand thought the range available with DC3 was poor and although conceding that more may be available on-line, thought it limiting that they be only useable if supplied in DC3 supported format.

Interaction

Response Analysis

When constructing interactive multimedia in DC3, the author can encourage an active understanding of the project content through various questioning techniques and track progress of user responses made. There are a large number of questioning technique alternatives in DC3 from which to choose including short text answer; multi-choice; matching; true/false; essay and more. With the use of the Workbench, buttons can trigger sounds or cause display of graphics or text; or a graphic can be used as a trigger. There are also a number of mathematics and time/date Beans that can be included in interaction segments. The DC3 user can add any number of extra Beans, obtained either from the Internet or elsewhere. All responses can be recorded in external databases, which are Object Data Box Compliant (ODBC) compliant. These include: ASCII delimited, dBASE, FoxPro, Microsoft Access, Microsoft Excel and SQL (Pierian Spring Software p.102).

In keeping with the recommendations of McConnell and Sprouse (1998), these questioning technique skills were separated, demonstrated and then the students attempted to implement them.

Antony began his quiz by constructing two true/false questions. In the first, although he entered the Beans correctly, he appeared to have difficulty distinguishing between the two types of text boxes. Although he had not completed the first text entry question he began a second. This time he included a sound reinforcer. While testing the second question in browse mode Antony discovered that the text display (correct answer) box connected to the If Bean, remained visible. He appeared to not know what to do next. It

was suggested he go back to edit and change the properties to make it invisible. This he did. Antony followed this up by inserting a three-choice multi choice question. He appeared to have no trouble with the concept of linking the answers to the appropriate sound responses.

Leon inserted a multi-choice first. He appeared to understand the construction of the question, but needed to go through and test the question later to understand that the visual edit characteristics would not necessarily be evident in Browse. Leon also appeared to have initial difficulty distinguishing between the entry and display text Beans.

Sally and Tammy began by constructing a multi-choice question. When testing it they found they had forgotten to link a sound file to the sound Bean. After finishing the question they decided to 'house-keep' the Workbench, i.e. make it tighter on the page. "Are these in millimetres?" they asked (the size increments aren't identified). After approximately four minutes rearranging the Beans, and adjusting the Workbench dimensions, Sally noticed that the Workbench was still visible in Browse if a background was inserted and questions, "Oh, so is that going to have a big white patch in the middle of our page now?" They continue editing. Tammy resizes the button, using the drag handles. After seven minutes editing they were pleased with the position of the button but still want to eliminate the Workbench background. They tried to reduce the Workbench to the same size as the button. After a total of 15 minutes resizing the Workbench, they ended up making it too small and were unable to continue.

The Toolbox that appeared with the Workbench, had not been given the customisable properties accorded many of the other features of DC3. There are twenty-eight buttons placed on a pallet, that on a fifteen inch screen, covers approximately 18.4% of the screen area. The students often had to point to each icon with the curser, and wait for the yellow flag to identify the button. To improve efficient use of these, it may have been valuable to offer an option to display the Toolbox with larger buttons, either in a rectangle, or as a toolbar. Expert 2 suggested a sizing option be provided for toolbars. Adding to this, the documentation supporting the Toolbox buttons was incomplete. For example, the path animation button was mentioned in the tutorial accompanying DC3, but does not appear in the manual. The placement of the buttons in the Toolbox did not have an easily recognised logic. They had been placed in ascending alphabetical order, but, as the Year Seven students all found identifying the buttons difficult anyway, it may have helped to arrange the buttons in groupings according to function, e.g. boolean, arithmetic, media insert, text. The students found that they needed to switch regularly to Browse mode to test the functionality of their work. They often found that they were impeded during this, as when the Workbench was opened, the Toolbox appeared by default over the Browse/Edit navigation buttons and needed to be shifted each time to expose them.

The Experts both found the visual programming in the Workbench uncomplicated. Although Expert 2 did not have success with the display of the database, he found the links and anchors particularly straightforward to use. He also commented that he saw the Workbench as the strongest aspect of Digital Chisel 3.0.

Navigation: Digital Chisel Interface

There are three main zones of focus in Digital Chisel 3.0; the Main menu, Project View and Page view. The Main Menu provides access to all the major features of the application, with each selection highlighting as the curser pauses over it. The Project View and Page View options contain a navigation bar with an access button for each of the three zones as well as a Quit, Publish and Help button (Figure 12). Each button is simply designed and most appear intuitive. The class teacher commented on the ease with which the students were able to navigate between Project and Page Views, using these buttons. While in Page View, the user of DC3 could navigate through the project pages by using the forward and backward arrows (Figure 16). Antony in particular used this feature to switch pages during editing.

Figure 14. Navigation Arrows in Page View from Digital Chisel 3.0

Navigation: User Created Projects

Digital Chisel 3.0 gives the student author options for inserting a range of passive, active and interactive elements, (Baker & King, 1993, p.315) into their presentation, and ways to monitor the resultant activity.

Students using Digital Chisel 3.0 to construct a project, can encourage action from viewers, by encouraging them to respond to two main aspects, the lay-out, (how the pages are connected) and the content.

Prior to the advent of interactive classroom technology, projects were presented in a linear form, that is, the pages would be collated into one straight path from beginning to end. With a multimedia project, the student author can branch the path, so that the viewer can make choices based on interest. As page 'B' of a project is created for example, it can be linked to page 'A' in Project View of DC3, by dragging it's page icon over the other and dropping it. One click and the link will appear. All of the students began by setting out their projects using this feature, while working from their own preliminary diagrams.

Pages can be inserted from the floating buttons, or from the Page/Insert New pull-down menu (Pierian Spring Software, 1997). Antony found initially, that unless his mouse technique was exact, unnecessary page duplication or linking would occur when using the floating buttons. On returning to this task later, he mastered the insert and had no further trouble. Leon preferred to insert pages from the pull down menu and found it a stable method. He had no trouble dragging the pages for linking, but appeared to have to concentrate on *not* duplicating pages.

After the link was made in Project View, a live 'hyperlink' appeared at the bottom of each page. Each link bears the title of the target page and was coloured to identify it as a link. On testing these links, all the students, found them to be active and reliable.

Hypertext (navigation links embedded in words that when selected, immediately display related information), can be created in DC3 using the Link and Anchor buttons, from the Media tool bar. Following the step-by-step instructions in the manual (Pierian Spring Software, p.80), Leon created an 'Anchor', (the place the link will jump to - in this case, an explanation of the source word) and then created the link back to the source word. On testing this he found that by clicking the hypertext link, DC3 jumped to the anchor he created. He appeared encouraged by this success. Leon was the only individual in the evaluation to install this type of navigation. Links can also be made to other pages, files, web pages, e-mail addresses or multimedia files. Owing to time constraints, none of these other navigation options were explored during the evaluation.

To create any other navigation or interactivity function, the Workbench was inserted into the page. This provided a visual programming drag-and-drop environment, in which the individual Java Beans, (Sun Microsystems, 1997) are placed and linked. The Java Beans that have been supplied with DC3 are displayed on a pallet called the ToolBox, (Figure 15).

The Workbench is inserted onto a page by clicking on the Workbench button located on the media toolbar, (Figure 13). The active area appears as a rectangular grey patch. During the evaluation, the load time for this varied from eight to nineteen seconds. Antony and Leon had no trouble remembering the Workbench insert routine. Tammy and Sally, having forgotten what the button looked like, took fourteen seconds, on one occasion, reading each pop-up yellow label trying to locate it. The class teacher commented that the Workbench icon did not appear logical, that is, he thought the icon, did not seem to clearly communicate its use.

Expert 1 found the Java Beans easy to insert but commented that little theory was introduced to assist the process. Expert 2 judged the facility to create text fill, multi-choice, matching and true/false questions in the Workbench as satisfactory, citing limited options in most of the applets. The database and drag and drop features he rated as satisfactory, the latter he had some difficulty mastering. The students however, varied in their comprehension of the abstract logic associated with constructing the more complicated interactions. Antony for example, tried to link a sound response to a text display box. After finding that the text was not 'live' in browse mode he realised, with the researcher's help, that a button was needed. Tammy and Sally inserted a sound but forgot that it needed to be activated by some event, in this case a button that is pressed. The Workbench was easy to initiate but the concepts behind each constructed interaction were difficult for this age group to understand. The students often needed to learn through trial and error, as the documentation, both printed and on-line was not adequate for the level of understanding required.

Support Features

The Support features of DC3 will now be reviewed.

Distribution

Reproduction

Digital Chisel Projects can be published to the users' own computer, intranet or to the Internet, provided that the browser used to view them supports the Java Development Kit 1.1 (JDK) functionality (eg. Netscape Navigator, Microsoft Internet Explorer). If the target environment is not JDK compliant, for example when publishing to a Compact Disk, the project can be viewed by including the Digital Chisel Player, which

provides a JDK browser. Owing to the technical and time limitations, the evaluation students did not publish their projects during the evaluation time. Expert 1 had trouble creating Welcome.htm (The lead page in the 'Dogs' sample project included with DC3) , as it didn't convert to HTML. Although it worked well in DC3, it did not work in the Browser. Expert 2 had difficulty configuring the browser, and commented on the lack of detail for this in the help and manual. He also queried the need for a DC3 specific player, suggesting the need for a more universal one.

License

A single copy of Digital Chisel 3.0 can be purchased for US$129.00, and a site license at US$995.00. This allows the owner to install to an unlimited number of school machines. Students and teachers associated with the classroom activity, are permitted to copy the program and place it on one home machine to allow work off-campus. Expert 1 confirmed that there are no licence details in the product documentation. Expert 2, quoting from promotional material, considered that Digital Chisel 3.0 was expensive, as the EDWA Microsoft pricing of FrontPage was, by comparison, $30.00 per user.

Technical

System

Digital Chisel 3.0 was written in Java, which allows it and DC3 projects to be run on any platform that supports a JDK environment. Included here are PC, Macintosh, and Unix environments. The advantage that Java has over earlier languages used for the Internet is that it lends itself to more highly interactive material (Bork, 1997). Expert 2 pointed out that DC3 couldn't run on an Acorn, and saw it as confusing that DC3 (developed for Internet and Windows), and DC2.1.4 (for Mac and limited Internet

publishing), were marketed together, with different pricing. He suggested that they both be cross platform.

Although the index in the DC3 manual indicated that system requirements for DC3, would be listed on page 2, that page carried no such detail. At the time of evaluation, the Digital Chisel Web Site did not carry any system requirements either. Late in 1998 however, the appropriate information was posted. The recommended system includes a Pentium computer with Windows 95+, with a minimum of 16MB of memory however 32MB or more is prefered, as well as 20-80 MB of hard disc space. Expert 1 tested DC3 on a Pentium 133 with 96MB . He found it allowed some multitasking, but was slow on occasions, especially while loading projects. He also found a long delay between typing, and the letters appearing on the screen. During his evaluation, he did not have any problem with the program freezing or crashing. Expert 2 was able to run the application on a low end Pentium, (16 MB of memory and 256 colours), a similarly specified machine to that used in the student evaluation, and he did have some trouble with the program stalling.

Software

Digital Chisel 3.0 is presented in a Windows/Card metaphor, with WYSIWYG editing. The editing mode is separate from the browse mode. This feature Expert 2 saw as an older style, (having to change between modes). He suggested that it needed to be more transparent. It has been designed so that the user does not have to use scripting.

Productivity

Internal support

Digital Chisel 3.0 has a comprehensive help and tutorial facility presented in a library style metaphor. There are five categories in book metaphor which are: Users Guide, Index, Tutorial, Samples and On-line Help. The Users Guide and Index, have the same content. The former has a simplified content listing with headings only, the latter has an additional indented level of sub-headings. There is no facility for the user to search the help files using key words.

Expert 1 rated the in-house help as excellent, but could not access the Internet on-line help. Expert 2 could not access either the in-house help or the on-line help, citing the difficulty he had with configuring the browser. The evaluation students also had difficulty accessing the help files. There are three student generated project samples that illustrate what can be done with Digital Chisel 3.0, and Expert 1 gave these an excellent rating.

The Tutorial was written in a simple style for the middle level, and consisted of four lessons. It was presented as a non-interactive scrolling slide show, which relied heavily on screen shots of DC3 to illustrate the steps in the lesson. Again Expert 1 rated the tutorial as excellent. There are no independent interactive mini-tutorials, or wizards in DC3.

External Support

Digital Chisel 3.0 had a comprehensive manual that had some helpful explanations, especially relating to the Internet. It also had a full reproduction of the DC3 tutorial and a helpful glossary. Expert 1 gave this the highest rating while Expert 2 found it easy to read and follow. The DC3 Web site, supplied by Pierian Spring Software (1997), was well designed and easy to navigate. It had extra help files, samples and contained some links, especially those relating to availability of Java applets. There was a free service for hosting school web pages and facilities for contacting other classroom authors. Expert 2 considered that the samples were very simple, and the FAQ's and game poor. Pierian Spring Software (1997) had not established a phone based technical support locally in America or in Australia, though recently they have appointed a Sydney agent for sales support. Expert 2 pointed out that the current phone support would anyway be impractical owing to international time differences. Technical help for Digital Chisel 3.0, remained via e-mail but he did not see this as being of the same standard as that offered by Microsoft for their products.

Summary

The Pilot Study was conducted in the computer laboratory of a private Secondary College, with one Year Seven Student. The Questionnaire, Training Input Lessons, and Interview Schedule, appeared to be appropriate for the study, but Valery needed to be prompted to enter problems in the Log Book. As a result of the Pilot Study, the researcher decided to not persevere with the Problem Log Book, and to use Video recording instead. Also, it was decided to use video recording instead of audio recording and intra-session note taking, as the on-screen activity was intense and the

possibility of missing detail, high. After observing Valery's difficulty with planning her project, the researcher set up some planning aids for the evaluation students to use.

The main evaluation involved 2 boys and 2 girls from Year Seven, and two expert evaluators. It focussed on how effective the features of DC3 were at this level. The Features Questionnaire was used as a guide for the evaluation and for the writing of this report. After the lessons, the students were able to enter the program, set up a project and re-enter it again later without assistance.

The interface design for DC3 was simple and promoted easy navigation between work and help areas. The media creation features were easily recognised by the students and the routines generally easy to remember. An exception to this was the relatively complicated process the user had to go though to insert a graphic and the extra steps when inserting into a Workbench. The colour selection pallet, especially the custom facility, used for both page backgrounds and colouring text was an innovative and worthwhile feature, that was to some extent spoiled by a seemingly unfinished and clumsy interface. This version of DC was a departure from similar products and it's previous version, in that it had no media create-and-edit utilities for sound or graphics, and had no support what so ever for video which was an outstanding omission for a multimedia authoring tool. Having no transition effects, DC3 also was deficient on media integration features.

The Workbench proved in the study to be an extremely powerful and easy to use feature of DC3. That advanced Java applications could be created by just using a visual drag and drop process, was a significant benefit for students at the Year Seven

level, where scripting demands could exclude many. All the students in this evaluation however, found the Workbench easy to use and appeared to be motivated by the possibilities for creating user interaction. The Toolbox however, appeared to carry too many features on too small a space. This led to the students having to rely on the yellow pop-up windows, for identifying the individual buttons.

This version of Digital Chisel 3.0 appeared to have been released without having the capacity to handle the memory demands of multimedia construction, thus producing annoying and demotivating system freezes. This may also have been exacerbated by limitations present in the early version of the Java language used to write DC3. Limited local support from Pierian Spring Software, and the relatively high price for the product, may have limited the product's appeal to the Australian home or school software purchaser.

In the next chapter, discussion will be drawn from the findings if this study, with particular reference to the subsidiary evaluation questions.

CHAPTER V

DISCUSSION

Introduction

This study involved a qualitative evaluation of the effectiveness of Digital Chisel 3.0 when used by Year Seven Students. Four student participants were observed using the product while two adult experts evaluated the features of the product as set out in Table 6. For this evaluation, effectiveness was defined by the subsidiary research questions. The findings are therefore summarised in this chapter, with reference to these.

The Subsidiary Evaluation Questions

Question 1. How easily can the students learn to use the product?

In previous versions, Digital Chisel gained a reputation for having original functionality and design that has been considered quirky (Schorr, 1997). This 'quirkyness' may have hindered a user's ability to learn the routines. However, version 3.0 has a presentation that appears to have matured from this, in that, although some new ideas are present in the new Page interface, the style remains consistent with the Microsoft standard. In a familiar environment then, the students seldom needed help.

To open a project, the students had to negotiate three levels of entry. Although this caused initial confusion, they quickly mastered access to their own project work. This process however, could be even easier if project access was limited to one level, e.g. direct access to the project file via a clickable icon.

Visually programming the sequence of events by using icons in the project view, was thought by the adult experts to be a very useful aspect of Digital Chisel 3.0. The students showed a clear understanding of the practical implications of each link made. They also appeared to have no trouble transferring their rough storyboard planning to an icon representation.

Although the students quickly mastered the text and page formatting in DC3, inserting sounds and graphics was not as easy to learn. The routines were familiar, but the number of actions to complete the task meant that some students needed reminding of the steps especially when accessing external libraries.

The students found that they could learn to insert colours into text and backgrounds relatively easily. However, customising a colour, though in itself an innovative feature, was neither an intuitive procedure nor easy to learn. The tutorial gave no specific instructions as to the logic of the Colour Pallet layout. The pallet itself was not well labelled. As a result, inserted colours were often half finished.

The mechanics of inserting a Workbench and constructing interactive questions was surprisingly straightforward for the students to learn. However, as pointed out by the class teacher, the icon design on the Workbench button was not intuitive. Once the Workbench was opened, the students found the drag and drop visual programming very easy to master. The tutorial documentation for the basic placing and linking of Beans was adequate and generally the buttons on the Toolbox were intuitive, though they needed to be placed in a more logical grouping. The placement and linking of the applets were simple procedures that the students picked up after their first exposure.

The students however, varied in their comprehension of the abstract logic associated with constructing the more complicated interactions.

The help facility in DC3 was comprehensive and written to suit the custom level chosen. Although the students were introduced to the help and tutorial in the introduction to Digital Chisel 3.0, they did not use it when they wanted answers during their project construction. There may be at least two reasons for this.

Firstly, the specific information required, was probably hard to access. The user had to scroll through the headings and sub-headings until an appropriate section was reached. This process may have been too convoluted for a Year Seven student and this aspect of DC3 could have been improved by inserting a word search function, to allow speedier access to answers. Although the tutorial was easy to follow, it was a static linear presentation. If the student wished to implement the tutorial section by section, he or she would have to go to the construction windows then return to the tutorial again for the next instalment, and so on. This process could slow progress and dampen enthusiasm. An interactive tutorial, using a DC3 simulation could have helped the user to develop an understanding of the software quickly and minimise loss of concentration.

Question 2. How efficiently can the students carry out a range of tasks fundamental to the IMM production?

The students were able to import text into their IMM documents and edit the text with moderate efficiency. The text resize tool, proved to be a very efficient innovation for Internet documents, as the HTML editor was WYSIWYG, or what you see is what you

get. The students especially Antony and the girl evaluators, were able to quickly and confidently adjust highlighted text larger or smaller until it appeared at the required size. Their final document would have appeared exactly as edited. Although not observed during this observation, confusion may occur if any page is printed from a DC3 document as the text size on screen may not appear the same on paper.

Inserting media files into a project page was an efficient process consisting initially of three keystrokes, but lost efficiency as the keystrokes increased. It was not efficient however to have to edit and convert the file to either GIF or JPG using a program outside DC3, and then have to import it into DC3. This function should be available within the program. As the graphics could not be easily moved around the page or easily edited outside the Workbench, the efficiency with which a page could be edited was minimised.

Inserting a colour, either into a text or a background, did not prove to be as efficient a process as it had the potential to be owing to the number of mouse-actions required and the incompleteness of the Colour Pallet design.

It was not possible to format the Workbench background with colour, graphics or transparency. This restricted efficient and creative use of the page formatting facilities available, as the Workbench appeared on a colourful background as a white patch. The Toolbox also slowed efficient monitoring of work in progress as it appeared by default over the browse/edit buttons, and needed to be moved as these buttons were required.

Question 3. How easily did the students remember component routines in the Program?

As previously stated, Pierian Spring Software appear to have based the screen interface of Digital Chisel 3.0 on the standard adopted by Microsoft for its products. The general layout of the work areas, the button design and logic of the component routines such as text entry, graphic and sound insert and basic navigation appeared to be familiar to all the students particularly in the evaluation. All the students easily remembered the process of booting DC3 and accessing the appropriate project. They easily remembered the task of inserting a graphic into a page. However, inserting graphics and sounds from external sources into the Workbench, required extra assistance as the keystroke count in these cases increased. The students appeared to have little difficulty remembering how to create a relatively complex branching presentation. Such a routine is currently not introduced into the curriculum until Year 12 (Interactive Media Year 12 – E237. 1998). This may have been assisted by the relative simplicity of the drag-and-drop process used.

Question 4. What problems were encountered while using the product?

Digital Chisel 3.0 underwent an extensive Beta testing period of approximately eighteen months. During that period, copies of the program were distributed to those interested who visited the DC3 web site and a meticulous reporting mechanism was maintained. Following this process, DC3 was released commercially in late 1997. The initial reaction to the new look and feel of the product was favourable and in 1998 it won several awards (Appendix P).

There were some problems encountered by all the evaluation participants. Digital Chisel 3.0 displayed problems associated with the available RAM memory on the machine running the software. This resulted mainly in pages freezing, and unexplained loss of blocks of text. Program function slowed significantly during DC3 use, even when running on a machine loaded with 96MB of memory. The recommendation from Pierian Spring Software was that DC3 would run but with 32 megabyte of available RAM or more, but would run on a minimum of 16. They recognised nevertheless, that in relation to the memory issue they still had issues that were unresolved, (S. Buben, Personal communication, 20 October, 1998). The class teacher and the school librarian, also commented that after using Digital Chisel 3.0 on their machines, the processing speed for general use had dropped significantly. It appeared that DC3's memory management had in some way interfered with the general availability of RAM.

Digital Chisel 3.0 has a Table Insert function that when operating properly, not only provides for easy tabulating of lists, but also is a useful aid for page layout. The inserted tables however appeared to be very unstable and lost many of the elements inserted. Again, Pierian Spring Software acknowledged that they were working on solutions (S. Buben, 19 October, 1998).

Unexplained dialogue boxes often appeared, especially one that indicated that the project had been converted to read-only. Within DC3, there wasn't any reference to this problem or any mechanism to rectify it so a DOS 'attrib' command had to be used to rectify this.

The first time Digital Chisel 3.0 was loaded, the main menu appeared in full screen presentation, however, subsequently, when opened for further edit of projects, it opened in minimised mode at the bottom of the screen. No set-up or preferences entry could rectify this. The buttons especially on the Toolbox were too small and complex for the students to find easily and the order of display was not logical. The instructions on how to configure the browser to access the on-line help and create web links were incomplete.

The Manual was generally easy to read and helpful, however it did appear to have been printed before all the refinements to the DC3 release version were completed. For instance, the Main Menu depicted in the manual is a development screen not in the final product and, as previously mentioned, the path animation button in the Toolbar was not explained, possibly as it may have been a late inclusion.

Question 5. How did the participants react (affectively) to using DC3?

The students in this study, showed an enthusiastic reaction to the authoring activity, consistent with the findings of Kwajewski (1997) and many others such as Milton & Spradley (1996); Shields (1996); Lehrer (1993); Hinerman (1994). The suggestion could be made that enthusiasm demonstrated in this context is merely a reaction to the novelty of the medium (Kuechle, 1990). However, the possibility of having the larger audience that may result from publishing to the Internet, or to Compact Disk, may have contributed to students being motivated and demonstrating a pride of ownership, as the work with Digital Chisel 3.0 progressed.

At the completion of the evaluation, the students generally concluded that Digital Chisel 3.0 was fun to work with, especially when compared with the normal pen and paper project method but found frustration in the constant program freezes of DC3. They appeared to enjoy the freedom associated with placing their own sounds, pictures and customised colours. This confirmed similar findings of Okolo & Ferretti (1996).

Both the experts were enthusiastic about the ease with which the user could produce relatively advanced Java applets, without scripting. Expert 1 also appeared impressed with the Internet capabilities and the bundled media libraries, whereas Expert 2 did not feel the product was priced well or was sufficiently compatible with the current software in use in Australia, to warrant the investment required.

CHAPTER VI

CONCLUSIONS AND RECOMMENDATIONS

"I like this program, it's good to work on", said Antony. The consensus from the other students appeared to support this feeling. The freedom to express one's own ideas and concepts using personalised colours, pictures, sounds and words, visibly motivated the students in this study (Appendix U), even when technical difficulties appeared. In this version of Digital Chisel, the design focus appeared to have been placed on achieving a no-fuss interface for creating student designed interactivity (e.g. the Workbench) and easy publishing options, especially to the Internet. The findings of this study appear to confirm that Pierian Spring Software had gone a long way toward achieving a result in those areas. The two Experts however, highlighted areas that appear to still require significant attention, especially media management and editing. This chapter provides a summary of the findings based, where appropriate, on the assessment criteria proposed by Barker and King (1993).

Quality of User Interface

The screen design and layout for DC3 had matured from previous versions. The menus and basic navigation buttons were in a constant configuration for each of the three main activity areas, and the use of colour was consistent within each level. Most of the buttons carried icons that were easily recognisable, as they were similar to those in the Windows interface model, thus promoting transfer of skills from previous windows applications. Although the buttons on the toolbars were of a sensible size, the Toolbox buttons were crammed and difficult for the students to find and use. The two Experts suggested that an interchangeable toolbar and sizing option may have been an

advantage here. Expert 2 commented that some of the routines e.g. linking, although valuable were not intuitive and could not therefore be accomplished without training. They also considered that although the interface of Digital Chisel 3.0 carried a strong Microsoft identity, it was deficient in not being able to integrate technically with the Microsoft browser.

Style and Quality of Interaction

The interaction style was multimodal. Hot keys were provided for Open Local, Print, Quit and Find and a choice of button or menu was provided for all the File/Edit functions and colour inserts. These were easily understood and utilised by the students, but the "local" functions of save and open were obscure and little explanation given, as to why they differed from the "non-local" functions. The user interactions were generally well defined. A yellow flag was attached to each button, labelling any button the user hesitated over. All the students used this function to help find buttons on the Toolbox. Overall, the style appeared appropriate to the needs and previous experience of the participants. The Project View provided the user with a clear picture of the structure of the project and all the students easily managed navigation to and from this view. Some of the routines were unnecessarily convoluted (e.g. insert sound), which appeared to suggest limited change from the previous observations of Landau (1995).

Talorability

Digital Chisel 3.0 had been written for three school/reading levels, elementary, middle school and advanced, or upper school/university. Each level had its own customised colour scheme, button design, tutorial/ help and text reading levels. The user could choose which font and font size was displayed and also choose which pallets and

toolbars are displayed automatically in the workspace. However the students did not use these features. These settings would have allowed some flexibility for the user to individualise the work environment and were able to be saved with the project. The Digital Chisel 3.0 colour-customising tool was well used by the students and although it seemed to be a motivating influence, it lacked finish.

Adequacy of Ancilliary Support Tools

The program had a comprehensive index and tutorial that was easy to read and easy to understand. They were virtually reprints however, of the hard copy manual did not provide for a specific word or subject search facility. Both Experts expressed difficulty in accessing the on-line version of the help facilities. The text edit functions were adequate for the level, although a spell checker had not been included.

The designers of DC3 had restricted internal software support to only those graphic and sound file types that were completely compatible with the Internet. This appeared to be a decision based on Internet requirements. However, both experts queried why many of the file types the user would want to utilise eg WAV sound files, were not supported by DC3. The user was also restricted in that there were no graphics or sound edit utilities included with DC3 that could be used for converting such imported files to a supported file type. Expert 1 specifically highlighted this omission. Built-in utilities to do this would be an essential next step in the development of the product, as would video capability.

Availability in Terms of Cost and Delivery Platforms

Digital Chisel 3.0 was being sold to schools for US$129.00 and US$995.00 for a site license that allowed unlimited installation on school machines, as well as home copies for the school's teachers and students. At the same time in Australia, at least two products that potentially target the same market were being offered free, as later versions had been launched. These products were Authorware 2.0 (Fuller, 1998), and Dazzler Delux 3.1 (Meehan, 1999). With restricted budgets in most schools decision makers were likely to opt for the cheaper alternatives. Expert 2 pointed out, that this would include the extremely competitive Microsoft select to schools pricing.

The prime objective of multimedia is communication (Cutler & Co., 1994a). As such, it should be available to as many publishing platforms as possible. The intention of Pierian Spring Software was to use Java as the medium for achieving this end. At the time of this study, Java had been developed for WINTEL compatible machines and was easily integrated with the Internet. Sun Microsystems however, had not perfected the Apple runtime engine. Apple's own version of it, the MRJ2.1 (Bryant, 1999) was at that stage not complete and so Java applications such as DC3 could not be run on Apple machines. This rendered the claim of Pierian Spring Software that DC3 was cross platform (Table 2), incomplete. This point was not an issue during the study, as PC machines were used exclusively. Expert 2 did however point out that DC3's limited browser compatibility further restricted the use of its documents.

Outstanding Strengths and Attractive Features of DC3

All the participants found Digital Chisel 3.0 easy to load. It had a simple yet business-like screen design and allowed the students' easy and effective navigation between

work areas. A strong feature was it's ability to be customised to the needs of three distinct user levels, although only the middle level was used in this study. DC3 carried the general publishing options of similar products and was purpose built for integration with the Internet. It did not however require the added plug-ins or processes often required by others.

Digital Chisel 3.0 did not require any scripting. The WYSIWYG HTML page editor had the look and functionality of a Microsoft word-processor interface, with all the resulting work automatically converted to HTML.

The Workbench was an outstanding example of an object-oriented Java applet construction environment. The students in this study, had no difficulty with the drag and drop action and constructed advanced interaction segments with little more than a connect-the-dots skill level. Both Experts found this aspect of DC3 to be it's strongest feature.

The Project View in DC3 allowed the students to easily construct linear or branching presentations. Access to and from each page editing environment was easily effected by the students, with only one click, or double click needed.

Outstanding Limitations and Weaknesses

Much of what Digital Chisel 3.0 promised, in terms of leading edge interface design and functionality, was delivered. However, technical imperfections and some design omissions in this new version prevented it from being a successful advance on the previously well respected product.

The most outstanding limitation that the participants found, was its inability to accommodate multimedia processing within the RAM available on the machines used. As a result, work momentum was too often broken with program 'freezes' and loss of screen elements. The Year Seven class teacher commented that during his observation, this and the slowing of processing caused by DC3, translated to a student's effective work-time that approached only tw ..ty-five percent of that possible. DC3 is an application designed initially for a Pentium environment. Although running the program on a machine with 96 megabytes of RAM contributed to a smoother use of the product (Expert 1), it should have been able to function without difficulty at the recommended 32 megabytes of RAM, as this was well within that recommended for Pentium machines.

Only Leon used the table facility and found it to be very unstable. It had tremendous potential as a presentation utility, but appeared underdeveloped in this version. The design of the Colour Insert Pallet appeared to be incomplete. Although the students used it without the software showing a fault, the interface was not intuitive as the action areas were not labelled and caused the students some confusion. The appropriate Help segment did not contain adequate explanation on the customising process either. Even after the researcher helped the students to understand the action, it was too cumbersome for efficient colour application. Rather than plus and minus clicks, a series of sliders would have made the colour adjustments easier.

Graphics sound and video are central elements in the multimedia mix. It was surprising then, that Digital Chisel 3.0 did not incorporate graphics and sound import and edit

utilities. Expert 1 pointed out that it is important for a graphic, once placed in a page, to be able have a drag and drop and resize capability. That DC3 did not allow this inhibited ease of page editing.

Even more surprising was that no support was given to video at all, considering the increasing use of video in schools and on the Internet today. In mitigation of this however, is the understanding that video segments occupy significant disk space and take time to load, especially those from a Web site, and that very successful presentations are possible without including video.

Limitations of the Study

The student participants chosen were limited to one Year Seven class at a local private school. These students were also preparing for a trip to Thailand. The level of classroom activity required for the trip preparation did not leave much time for editing the Digital Chisel documents, outside the scheduled evaluation times. The Evaluation was also limited to an eight week period of approximately 18 hours. McGrath et al (1997) found that a similar age group attempting a similar task required approximately eight months to complete their projects. The relatively limited time possible for this study therefore, did not allow for an evaluation of all the features of Digital Chisel 3.0. Some of the features available in Digital Chisel 3.0 were more comprehensive or advanced than would be appropriate for a short term Year Seven multimedia construction exercise. The hardware available was of a common specification for schools at the time, yet was at the lower end of the recommended range for Digital Chisel 3.0 (Pierian Spring Software, 1997).

Implications for Further Research

Ongoing studies of this nature are important (Anjaneyulu, Singer & Harding, 1998), as recent technological developments and in particular the accessibility of multimedia authoring, have enhanced an environment conducive to constructivist learning (Colangelo & Shelton-Colangelo, 1998). Pierian Spring Software (1997) has made the claim that Digital Chisel 3.0 is purpose built for students from eight years of age to university level. As this study has focussed on a small group of Year Seven students, an evaluation that includes a wider age range would be helpful in assessing how effective the product would be. As many of the features of DC3 were not investigated. A more comprehensive study that involved evaluating all the features, over a greater time scale, could be appropriate.

The technical difficulties encountered by the evaluation participants significantly hindered their creative progress. Pierian Spring Software has recently released Digital Chisel version 3.1, which is purported to have overcome these difficulties. It has also had some new features included. A study of the more technically stable DC3 would allow a more complete assessment.

Notwithstanding the technical shortcomings of Digital Chisel 3.0, the students in this study, confirmed that there is foundation for the widely held enthusiasm for student authored multimedia communication. There are however, possible obstacles to seeing the obvious potential of this medium realised. Riley & Brown (1998) alluded to some of these as presented by a parent from their study, "this is great, but what happens on Monday?" (p.24). From Monday to Friday, influences other than those present in this study could impact on the process of student authoring of multimedia artifacts. This

study was conducted under intensive/small group rather than normal classroom conditions. Research could therefore be undertaken to see how such issues as, policies or resources in schools and the skills or attitudes of teachers, would influence the effectiveness of Digital Chisel 3.0, especially in a full class rather than intensive classroom environment.

Conclusion

Multimedia authoring can be a powerful means of collaborative expression, especially if the editing tool is user-friendly, meets the technical requirements of the process and very importantly is 'bug'-free. Digital Chisel 3.0 proved to be very easy to use especially when attempting construction of advanced forms of interactivity through the Workbench. Some of the routines however could be simplified to maintain efficiency of production. As the product was modelled on the familiar Microsoft work environment and involved an object oriented no-scripting process, the students had little difficulty remembering the major component routines. Any problems that appeared during the evaluation seemed to relate more to an incompleteness in the development of DC3, rather than any perceived ineptness of design. The students throughout the evaluation appeared to enjoy their experience and demonstrated a pride of ownership in the work they produced.

The overall impression then of Digital Chisel 3.0 is that as a developing product, it is effective and well situated to meet the technical demands of the current curriculum environment and learning needs of Year Seven students.

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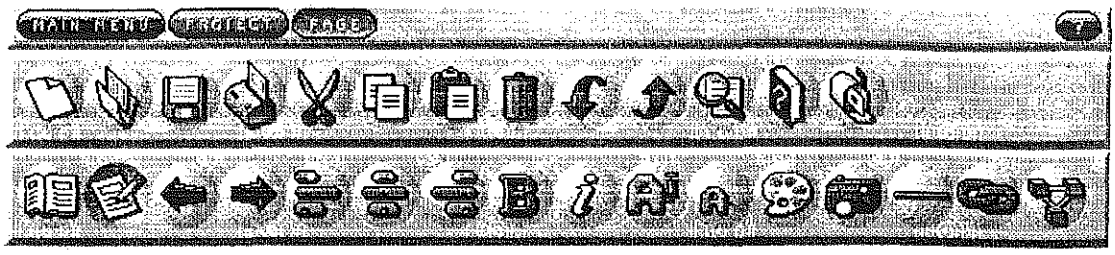
APPENDICES

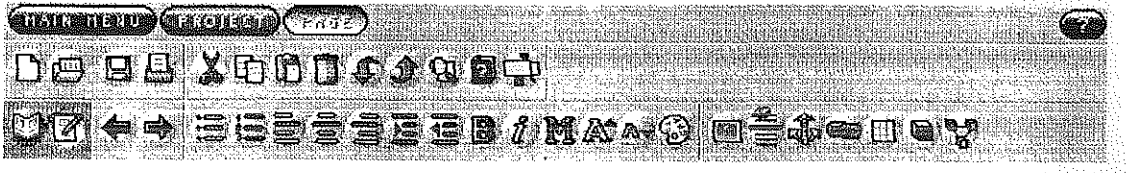
Appendix A

The Three learning levels of Digital Chisel 3.0

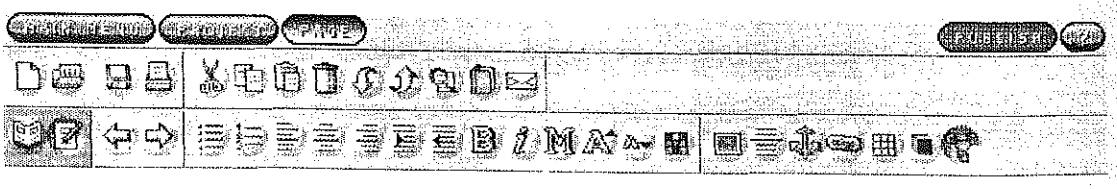
Elementary Toolbar



Middle Toolbar



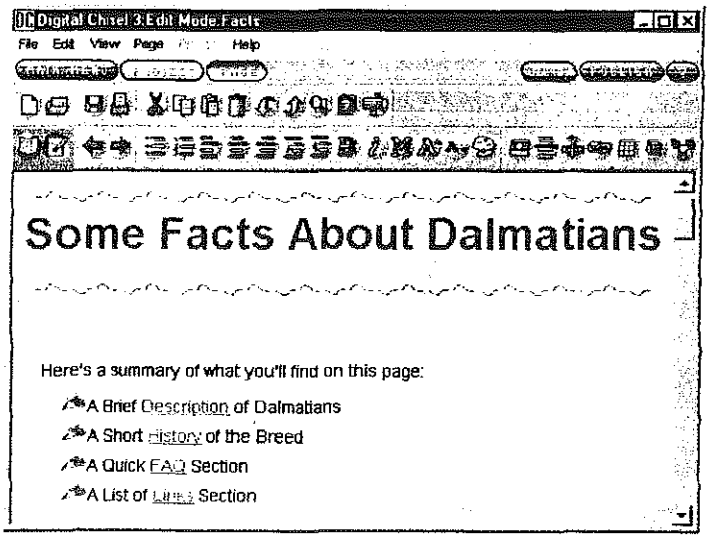
Advanced Toolbar



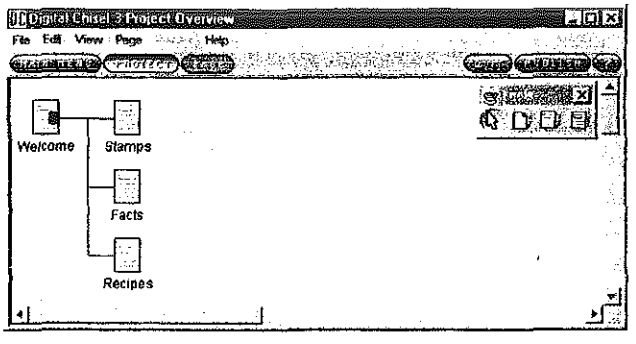
Appendix B

The Three Work Areas of Digital Chisel 3.0

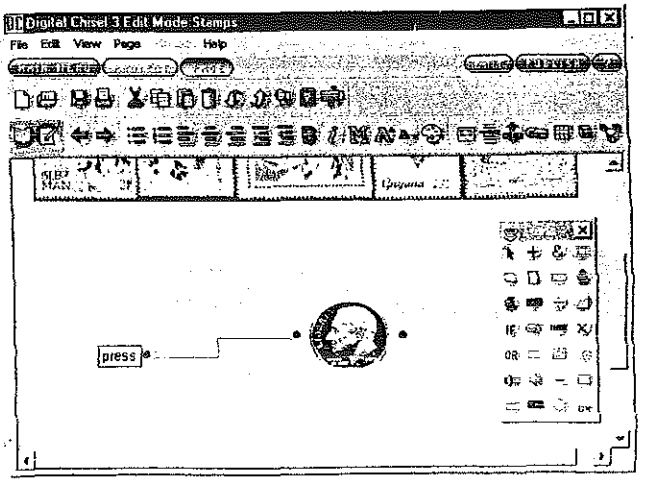
The HTML Page Manager Edit View



The Project Overview



The Workbench



Appendix C

The Problem Log Book

Problems Logbook

Date:_____
This is my no. ☐
Problem

When you have a problem, write it down in the log book, so that we can work on fixing it

Name_____

1. **What I was trying to do:**_____

2. **What seemed to go wrong:**_____

3. **Was it solved:** **Yes** ☐ **No** ☐
Any comments:_____

4. **How I felt at the end of my time on the computer:** Circle the nearest number to the way you felt:

Upset **OK** **Really Happy**

0 1 2 3 4 5 6 7 8 9 10

Any comments:

Any other comments:

Current Multimedia Authoring Products: *a sample*

Scripted/Time:*

MM elements or events are presented and organised along a timeline

Director	Macromedia
ImageQ	Image North Tech.
Premier Pro	
Clickworks	Pitango
Producer Pro	Passport
Media Shop 1.0	Motion Works
GIpro	G-media
ShowBasic	MikSoftware
STDemo	PC Wholeware
X Power	Paul Mac Software
Astound	Gold Disk
Mockingbird	Warren Forthought
Net MC	NEC Systems Lab
Action	Macromedia
Media Blitz!	

Presentation Graphics:

Persuasion	Aldus
Power Point	Microsoft
Impact	Claris

Icon Based:

Visual programming approach to sequencing events - can present visually the logical flow. (Villamil et al 1997)

Demo Shield 3.x	Starking Technology
Interactive 2.0	HSC Software Corp
MediaMaster Pro	Advanced Media
Authorware	Macromedia
Icon Author	AimTech
Multimedia 2.1.	Innovis
Media Verse 2.0	Looking Glass Sw
mTropolis 1.1	mFatory
Course Builder	Discovery Syst. Int
HyperGasp	Caliban Mindware

Unclassified:

Magpie	Longman Logotron
Genesis	Oak Solutions
Portfolio	Kudlian Soft
Ultima	Serinae
Kid Pix	Broderbund
Pro PS	Learning Sys. Grp
CourseWorks	Iprax Training Sol
mBed Interactor	mBed
LinkwayLive	IBM

Card or Screen Based:

Simple and intuitive. Users branch easily from page to page. (Villamil et al 1997)

Toolbook	Asymetrix
Apple Media Tool	Apple
Quest 5.0	Allen Com.
Everest	Intersystem
Special Delivery	Interactive Media
Hypercard	Apple Media Corp
Digital Box Office	Power Prod.Softw
Supercard	Allegent
Media Objects	Oracle
Digital Chisel	Pierian Spring Sw
Hyperstudio	Rodger Wagner P
Media Verse	
Compel	Asymetrix
Cocoa	Apple
TenCore	Comp. Teach. Co
Quark Immedia	Quark
StorySpace	Eastgate Systems
Hypersense	Thoughtful Sense
Mediacard	Metacard
Illuminatus	Digital Workshop
Click & Create	Corel
Scala	Scala
Hypergasp	Caliban Mindwear
Multimedia S/Bk	Alchemedia
Media Text	HiCE Group

The above list has been compiled from magazine articles, software reviews, and web sites. The products underlined and in italics, appear to be most suited to upper primary use, as they are considered to be either entry level, or are purpose built for education use. From these, Digital Chisel has been chosen for evaluation.

* *Villamil et al (1997) Separates the "Time Based" from "Theatrical (Director), because of the latter's strong individual metaphor.*

Features of Digital Chisel 3.0
Digital Chisel 3.0
Development Features
Support Features
Media Creation
Media Integration
Interaction
Distribution
Technical
Productivity
Transition
Screen Design
Templates
response Analysis
Navigation
Reproduction
License
System
Software
Internal
External
Text
Graphics
Sound
Video
Animation

Appendix F

Features Evaluation Questionnaire

Features Evaluation of Digital Chisel 3.0

Name of Reviewer:_____

Instructions for use: Please install and thoroughly review the product. Each of the features below, can be evaluated in two ways, using the rating scale: (**1=Non-existent, 2=Poor, 3=Satisfactory, 4=Good, 5=Exellent.**), and the comments box provided for each sub-category. Please feel free to use both, to enable a fuller evaluation. Obviously, the comments need only be brief. If there are any other features or comments, please include those as well.

Display Features

Media Creation:

Text	1	2	3	4	5	Comments:
Sizing						
Fonts						
Attributes (B,I,U,)						
Line Spacing						
File Formats Support						
File Formats Imported						

Graphics:	1	2	3	4	5	Comments:
Positioning / moving						
Shapes						
Lines						
Fills						
Gradients						
3D						
360VR						
File Formats Support						
File Formats Imported						
Graphics Library						

Sound:	1	2	3	4	5	Comments:
Record / Playback						
Editing						
Formats Supported						
Formats imported						

Media Creation:

KEY for Rating Scale: 1=Non-existent, 2=Poor, 3=Satisfactory, 4=Good, 5=Exellent. 1

Navigation:	1	2	3	4	5	Comments:
Buttons						
Buttons Library						
Hot Spots						
Text to Text						
Text to Sound						
Text to graphics						
Text to Video						
Graphics to Text						
Continuous looping						
Transp./hidden pages						
Ease of Use						

Support Features:

Distribution:

Reproduction:	1	2	3	4	5	Comments:
Web Publish						
Runtime Player						
Internet Tools						
Royalties						

License:	1	2	3	4	5	Comments:
Individual						
Site						

Technical:

System	1	2	3	4	5	Comments:
Platforms						
System Requirements						

Video:	1	2	3	4	5	Comments:
Import / Playback						
Editing						
Window Sizes						
Formats Imported						

Animation:	1	2	3	4	5	Comments:
Straight In-between						
Curved In-between						
3D						
Formats Imported						

Media Integration:

Transition:	1	2	3	4	5	Comments:
Types						
Timing						

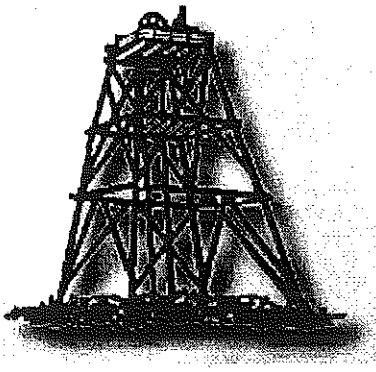
Screen Design:	1	2	3	4	5	Comments:
Templates						
Backgrounds						
Colours						

Interaction:

Response Analysis:	1	2	3	4	5	Comments:
Text Fill						
Multiple-choice						
Student Registration						
Student Tracking						
Matching						
True/False						
Drag'n'drop						
Essay						

Appendix G

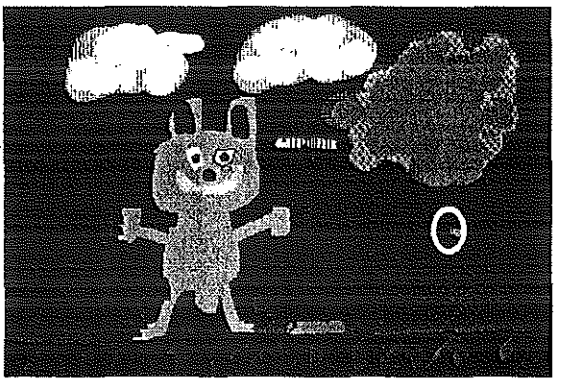
Out-of-State Class Example



Anderson's Creek Primary School

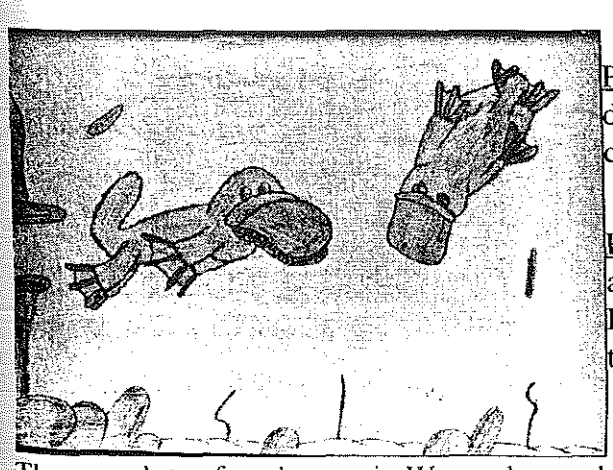
Warrandyte, Victoria, Australia

ANIMALS IN WARRANDYTE



They're are more than 100 animals of each kind in Warrandyte!
Koalas like Warrandyte, because there are lots of gum trees. Koalas look like a bear and like to eat gum leaves.
There are kangaroos in Warrandyte. Kangaroos are mammals like us, but unlike us the babies look nothing like their parents. After they are born, they grow in a pouch outside their mother's belly. Pouched mammals are known as Marsupials. Kangaroos and wallabies are made for hopping on two legs and not for walking or running.
All members of Kangaroo family live in Australia and the islands nearby. The babies of most marsupials roam inside their mother's pouch, until they are fully formed.
Kangaroos live in groups called mobs.
Swamp wallabies need to be more cautious than kangaroos. Swamp wallabies spend most of there day in shade. They can be hit by cars if they are not careful. by Adam and Stephen

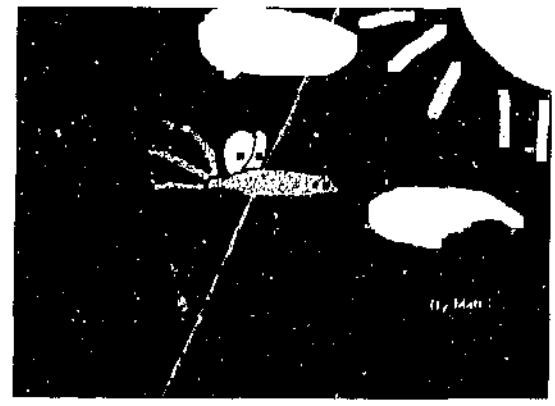
Wombats are found in our State Park, but you don't see them often. Wombats are fat, little, and furry. They have sharp claws to dig burrows. There are burrows which wombats live in the State Park and around the Yarra River.



Platypus live in the Yarra river, they have bills like ducks. Platypus can range from 40-50 cm long. To colour your own platypus click here.

Ring tailed possums make their nests out of twigs and bark. The possums live in tall trees in our State Parks, even in people's houses! It is hard to see them in the day.

There are lots of cockatoos in Warrandyte and also rosellas. Sulphur crested Cockatoos are birds that eat leaves.



Kookaburras are birds that like to laugh at you! They have a laughing call and often laugh to one another.

If you would like to hear them press the sound icon.

Emus are not seen in Warrandyte, but they are in many outback areas of Australia.

The Rainbow Lorikeet is an Australian Parrot that lives in Warrandyte and eats berries and nuts off the local trees. It's feathers are Rainbow in colour.

The Echidna has spikes on it's back. It has a long nose, to suck up ant's to it's mouth. We often see them walking along the roads and in the Parks of Warrandyte.

by Matt, Thomas, Adam S. Jarrad.

If you would like to Email us, click on the icon

Appendix H

Consent Form

Consent Form

Dear Parent,

The school is to be a part of a study to determine the effectiveness of a new computer software program designed to be used by school aged students. The study will involve volunteers from the Year Seven student body using the program to construct a presentation from classroom study that includes sounds, text, graphics and ways to involve the viewer, such as questions, buttons to click etc. It should be possible to play the end result on the Internet and share it with others at school and at home.

The students will be observed using the product, and later interviewed to discuss their reactions to the features of the program and how easy or otherwise it was to use. As they work, the students will discuss their reactions and this will be audio taped, and later transcribed. They will also write down on a specially prepared form, any difficulties they encounter with the program. From the data collected in this way, an assessment of how well the product meets the use it was designed for will be made. This study will therefore be of assistance to teachers or parents wishing to encourage "multimedia" production by students.

All transcripts and assessments will be shown to the students so that they can tell us whether they are accurate and fair. All material gathered will remain confidential. Should you or your child wish to withdraw from participating in the study at any time, you will be free to do so.

If you are happy for your child to be involved in this study, please indicate below.

I give consent for _____ to paricipate in the study entitled "An evaluation of Digital Chisel 3.0 as a Multimedia Authoring Tool in a Year Seven Classroom", which is being conducted by Bob Richardson, as part of a Bachelor of Education with Honours degree at Edith Cowan University. I understand that this participation is entirely voluntary and can be withdrawn at any time.

Signed _____ (Parent/ Guardian).

Signed _____ (Student).

Signed _____ (Bob Richardson, researcher)

Appendix I

Screen Sheet

Screen Sheet

Screen no.

_____

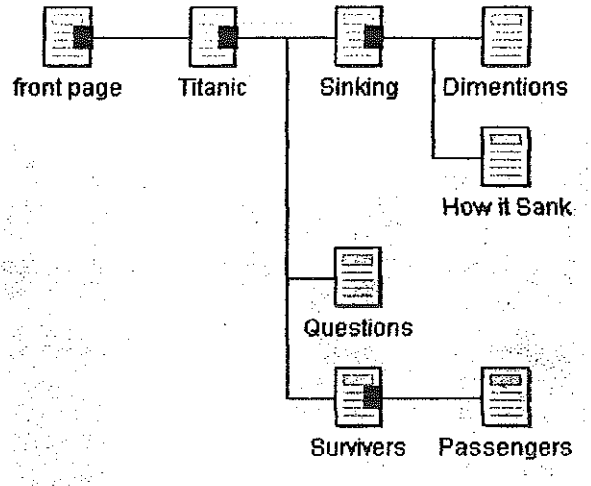
Screen Layout

Text

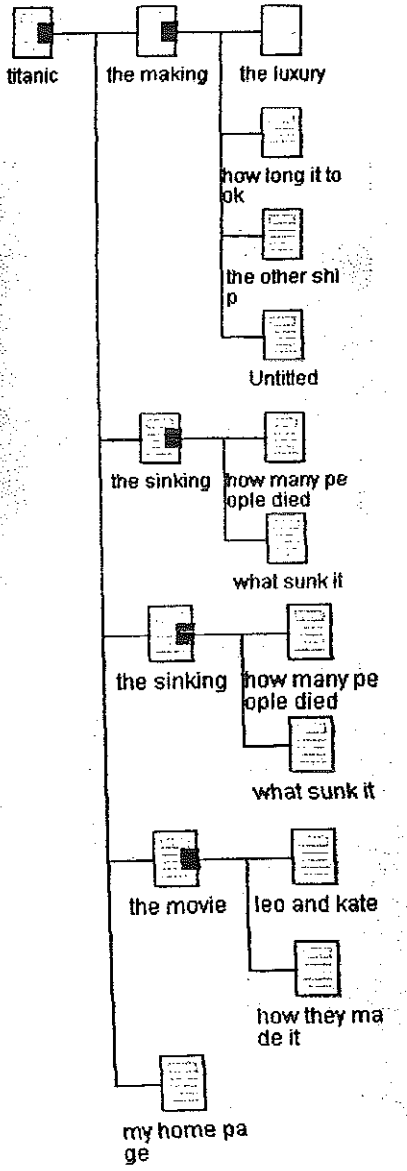
Appendix J

Icon Layouts

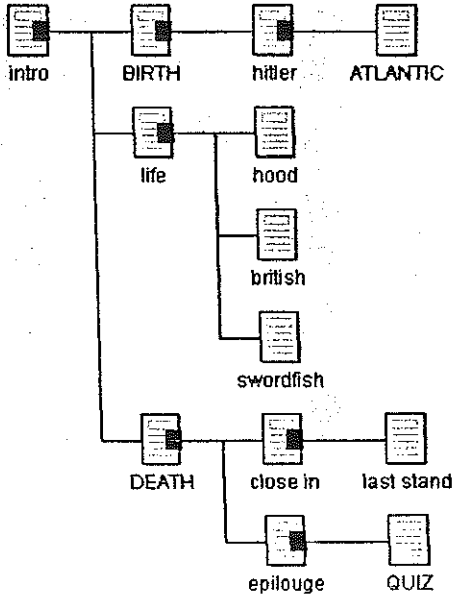
Sally and Tammy's Project



Antony's Project



Leon's Project



Appendix K

Interview Word List

frustrating

interesting

irritating

easy

bogus

helpful

enjoyable

confusing

annoying

cool

fun

difficult

Appendix L

Multimedia Authoring Task

When you normally work on a project, you will probably present the subject to the reader using written words (text), and pictures. When you put together a *multimedia* project however, you can also put in animation, sounds and links to the Internet, as well as exciting puzzles, and things for the viewer to do.

Using your present class study as the topic, produce a multimedia project that includes the following:

1. A title page that has coloured text.
2. Three information pages.
3. Links between all the pages.
4. Insert pictures, and at least one sound.
5. A quiz section.

As you put your project together, check it. Test the links by going back to the beginning and clicking on the icons that lead the other pages. If they have problems, check with the tutorial, to see if what you have done is correct. Make any changes and try again.

Appendix M

DC3 Training Presentation Main Menu.

Doing a Multimedia Project

Here are some easy steps to help with putting your project together

Follow each step carefully, by clicking on the heading

---

1. Choose your topic
2. Choose your partner
3. Do your research
4. Plan your project
5. Proof read
6. Test and Publish

Appendix N

Initial Student Questionnaire

ABOUT COMPUTERS AND ME.

This questionnaire is being used to find out what experience you have had with computers and how you feel about them now. All the information collected will remain confidential, and completing the questionnaire is not compulsory.

Thank you for taking the time to complete the questionnaire with care and thought.

MY EXPERIENCE WITH COMPUTERS

Most people have seen or used a computer in some way or another. Computers can be used to do variety of different tasks for us. Use this section to show how you have used computers.

Tick the box that most describes a correct answer for you. e.g. ☐ ✓

1. ***I am a male*** ☐ ***female*** ☐
2. ***I have a computer at home.*** *Yes* ☐ *No* ☐
3. ***Our computer at home is on the Internet.*** *Yes* ☐ *No* ☐
4. ***I use a computer at home:***

Not at all	*2*	*3*	*4*	*5*	*6*	*Regularly*
☐	☐	☐	☐	☐	☐	☐

5. ***I use a computer at school:***

Not at all ☐ *2* ☐ *3* ☐ *4* ☐ *5* ☐ *6* ☐ *Regularly* ☐

6. ***I have used computers for:*** *(you can answer more than one)*

Playing games	☐	*Typing assignments*	☐
Making cards	☐	*Surfing the "Net"*	☐
Music	☐	*Chat*	☐
Sending E-mail	☐	*Drawing*	☐

List any other ways you have used computers:

_____

_____

_____

7. ***I have been able to do the following to a computer:***

Fix a software problem	☐	*Install a card*	☐
Install a new printer etc	☐	*Change the screen to suite me*	☐
Fix a hardware problem	☐	*Something else(list below):*	

_____

_____

_____

_____

HOW I FEEL ABOUT USING COMPUTERS

Your answers in this section will describe how you most feel about using computers.

Put a circle round the answer that most describes how you feel e.g. 

	Agree	Undecided	Disagree
1. Computers don't scare me at all	●	●	●
2. I'm no good with computers.	●	●	●
3. Computers make me feel uncomfortable.	●	●	●
4. I don't think I would enjoy doing advanced computer work.	●	●	●
5. Once I start to work with a computer, I find it hard to stop.	●	●	●
6. I do not enjoy talking to others about computers.	●	●	●
7. Figuring out computer problems does not appeal to me.	●	●	●

Appendix O

Student Interview Guide

Introduction:

Hi. How is your project going?
Have you got far to go before you finish?

What do you think of the idea of using multimedia as a way to do a project?
Any really good / not so good points?

Did you enjoy using DC3?

Have you enjoyed working with Digital Chisel so far?
Were you looking forward to the next time you could use it?
Did anything really annoy / please you

How easily did you learn to use DC3?

Was there anything about DC3 that you found hard to understand?
Were the buttons easy to see?
Were the pictures on the buttons easy to understand?
Did you try to use the tutorial? How was it?
Were there any things you tried to do that were really difficult – why?
Was there anything that you tried to do but couldn't for some reason?

How easy was it to ....?

Type in text
Put pictures in
Set up a button
Link pages
Set up a quiz
Put in a sound

How easily did you remember how to ...?

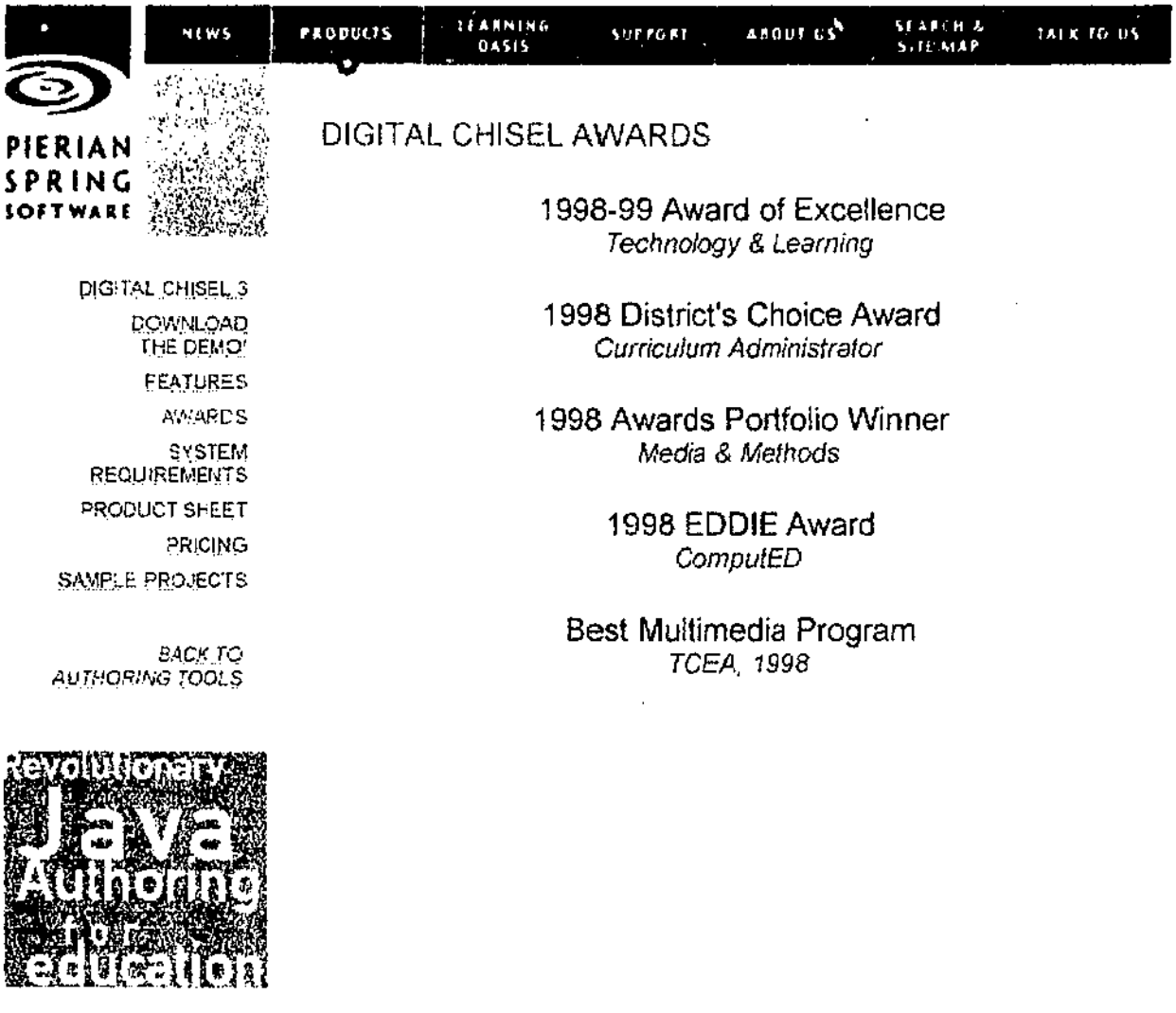
Put pictures in
Put sounds in
Set up a quiz
Link pages

What problems did you face while using DC3?

Time?
Resources?
Understanding...?
What did DC3 do that was annoying?
What about the really good points?
How would you change the program if you could? – What would you put in / leave out?
Would you like one of these at home – why?

Appendix P

Awards for Digital Chisel 3.0



Appendix Q

Sample Video Transcriptions

Time	Code	Activity	Method	Result	Comment
		Antony			
00.00.46	**M**	**Bob:** are you going to work on that page or are we going to load the other pages as well?	*Project page in edit mode*		**Antony** opened DC3 and entered the project section correctly.
	V	**Antony:** I'm going to start out putting all the pages in first			
	Ii	**Bob** Good, where do you get the pages from?	Clicks on correct button for inserting a new page	Page appears on the work area when A, clicks on it	
00.00.50	**II X**	Drags new page to existing	Drag and drop	Before he is able to link the 2nd page, he lets go of it.The page duplicates and, as soon as he tries to click on, it links the second page to the new duplicate.	No explanation to this
00.00.57	**II**	Links the 2nd page to the 1st.	Drags it over the 1st and clicks on to it.	The link is established. There are now 3 pages chain linked	
00.01.10	**II X**	I prompt him to disconnect the duplicate	Click- on and drag away	The duplicate is removed from the links	
00.01.30	**P**	Opens first page, and saves	Page/page info – names the page and click OK	The new page name appears at the top of the screen	
00.02.10-	**PT**	Back to first page – inserts title for the page.	Types Titanic, highlights resizes and italicises, then saves project – enters name for Project, and clicks done.	OK Project saved under new name	I explained to A. that once the insert page button is clicked, a new page is generated each time the curser is clicked on the screen.
00.04.16	**I**	Delete unwanted pages	Highlight and press delete button on keyboard	Pages removed	
00.04.34	**PTk**	Open page 2 title and save	Types in '*the Making*", resizes and italicises using edit buttons, then saves using page/page info typing in page name	As expected.	Teacher and year 1 students heard in background. A. appears to not be affected by them

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Time	Code	Activity	Method	Result	Comment
00.05.50	Il	**Bob:** What next? **Antony** I'm going to put the little things In so that I can come straight to this page	Went back to project view. The page icons are linked. So when the *titanic* page is opened the colour coded link appears at the bottom.	The link is established Links established	
	C				Noise in background of furniture being bumped around
00.06.07	P	Discuss why the placement of the link high on the page	ie – because there isn't anything in-between Tries to use return to push the link to the bottom of the page. But the heading follows it down. To solve it A. places the curser between the heading and the links and uses enter to separate them	The heading makes its way to the top of the page, leaving the link at the bottm.	A teacher asks A. if he has a pencil – negative response
00.07.51	Ii P Ptbis	A. inserts another page opens the page Titles the page	Clicks on the insert page tool button and inserts to the right of existing pages. Double clicks to open page Types in *the movie* Highlights sizes and italicise. Follows this by saving the project – File/save project	Page created Page opened Title type and edit OK Save OK	
00.10.28	Il	Link 3rd page to first	Disconnect from the second by clicking on and dragging away, then place over the 1st page and click on top of the 2.	I guided him through it Process sucessful	
00.10.38	P	Check that the links are sucessful	Go to the main page – *Titanic* and check links listed at bottom of the page	Links appear to be installed	
00.10.45	PI	Test the links	First have to go to browse mode (had to be reminded of this)	Links in place. Saw them but didn't try them	

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Time	Code	Activity	Method	Result	Comment
	E	Loud chair noise in background		Did not appear to disturb A.	
00.10.48	C	**Antony:** Have you tried putting a button on yet? **Bob:** yep, at home **Antony:** did it work? **Bob:** yep			Appears to be very interested in the mechanical aspect of the program
00.11.01	I DC	Goes to project mode	Clicks on the p/m button	Project edit appears, but the main page only appears, with the link inactive (link square black)	
00.11.13	PI	Goes back to page view of titanic page – checks the links at the bottom of the page	Double clicks on the page icon Scrolls to the bottom	P1 appears The links are there	
00.11.23	I	Returns to project mode to check structure	Clicks project mode button	1st page still only one – link black	
		I instruct him to go back to titanic	He double clicks to achieve this	just before the change the other two pages appear	
00.12.11	N	I instruct him to shift through the pages by using the right	He uses the arrows to change pages	This works	
	I	and left arrows then to go back to project mode	He then goes back to project mode	On arrival, all the pages are displayed and the links appear OK	
00.12.30	Ii	Creates new page and	Double click on icon to open.	OK	
	T	creates a heading	Type in heading *The Sinking* Size heading highlight	OK	
	Pk	Save the new page	Page/page info	Entered name	
	AT	Discovers the other options on the Page menu:			
00.13.25		**Antony:** Can I try a background colour?			
	P	**Bob:** Mmm (yes)	Clicks the background col button	Chooses blue	
00.13.40	PC	**Bob:** now, you see those			

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Time	Code	Activity	Method	Result	Comment
	P	blank squares there with the + and -. When you click those they will change the colour. **Antony:** Can I try? **Bob:** Mmm (yes)	Clicks the + in the 1st box round 20 x to produce a slight mauve.	He is satisfied and exits	
00.14.49	PGil	Now discovers the background image facility insert one	Uses the menu, chooses water, clicks ok	Water background appears – is happy with the effect	
00.15.48	Pgil	A. inserts a background in the movie page	Puts a yellow colour in then places a background image over that. Decides to change the pattern from paws to drops	The yellow colour does not show only the dark blue of the drops background. To keep the balance, he changes the text to yellow	
00.18.08	N	**Antony:** I like this program, it's good to work on. Changes the page to The Making	Uses the left arrow	Page change OK	At this stage he may consider that the background colour influences the background image
00.18.12	P	Edits background	Page/Page info – chooses yellow and darkens it- 15 x + on right box, then straight to the background image inventory – chose Jean – (blue stone washed look)	The look was good he liked it	
00.19.49	Ndc PT	Returns to *titanic*. Needs to reposition the heading at the top	Right arrow to change pages Deletes the heading rather than place curser and delete. Reinserts the heading.	Ok Heading shift OK	
00.20.30	AT	Discussion follows about putting a titanic picture in this page			
00.21.06	P	Edit background Chooses colour and image	Chooses a light brown colour – chooses sand background and black for the heading text	OK OK	

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Time	Code	Activity	Method	Result	Comment
00.22.55		Inserts button connected to a graphic and a sound			
	Nbi	**Bob:** where are you going to put the button first... **Antony:** I'm going to put it ...there	After the prompt from me he shows that he understand that the button will be placed where the insertion point is so places it		
00.23.30	**Nbi**	Scans along the tool bar for the button insert. Spends 14 secs b4 I tell him to look at the w/bench icon	Clicks on the w/b icon	W/b opens	
00.23.50		**Bob:** Remember this? **Antony:** oh yes	The w/b loads takes 8 secs		
00.24.10	**Ndc**	Tries to shift the tool box to a more convenient place	Drag and drop – correct procedure	Drags too quickly – the tool box keeps disappearing sucessful on 3rd attempt	Probably a symptom of low mem
00.24.25	**Nbi**	I explain that the w/b can be resized. While I am talking A. inserts a button	Clicks on button icon and then on to the work/bench	Button icon appears	
00.25.01	**Nbi**	Deletes the icon	While still highlighted, presses delete		
00.25.16	**AT**	Resizes workbench	Double clicks the w/b Changes width to 310 and depth to 250 - clicks OK	Edit dialogue box appears The work/bench resizes to the chosen dimensions	
00.26.05	**Nbi**	Replaces button on left of w/b Resizes button	Click on tool box and then on to the w/b Drags handle of button to resize	Button icon appears	
00.26.20	**Nbs**	I ask him what words he will want on the button He says "Please click here to hear a sound"	Is scanning the tool box with the curser while talking	Takes 32 secs, waiting each time to see the small label come up on each icon	

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Time	Code	Activity	Method	Result	Comment
00.26.52	**N**	**Antony:** how do you choose image? Inserts an image into the w/b	I prompt him to click once on the image icon then onto the w/b	The image icon appears	
		Without prompting, he opens the graphics menu	Double clicks on the image icon		
	Gil		Chooses an animated gif – the mermaid in a bowl	OK, but has to reposition it.	
00.28.41	**Nbg**	Links the picture to the button	Drags the button handle to the image	OK	
00.28.58	**Nbs**	Inserts a sound and links it	Clicks on the icon in the toolbox, double clicks on the sound icon in the w/b and clicks browse in the dialogue chooses sos clicks OK	Icon appears on the w/b	
			Links the sound to button	Drags the handle across to the sound	
00.31.08	**AT**	Tests the work	Goes to browse mode Clicks the button	The gif animates and the sound plays – config OK	
00.33.27	**Ik**	Save work	Click on File/save project	Project saved	

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Time	Code	Activity	Method	Result	Comment
		Antony			
To 00.01.41	C	Discussion on what progress has been made so far			
00.01.41	Mo	Opens DC3	Double clicks on the DC3 icon		
	V	**Antony:** I need to get a lot of pictures off the movie, because one whole section is going to be about the movie	MM		
	C	**Bob:** A lot of that you can get off the Internet.			
	V	**Antony:** Mmm but I can't download it of my computer. I ask the teacher but he always says... I cut him off at this point		The program booted	
00.02.23	Mo X	Opens project	Double clicks on the icon in list	Project appears in project mode	Has opened wrong one tries again
00.02.37	Mo	Opens second project	Double clicks on the next project	The project comes up in project view	
	V	**Antony:** This is mine!			
	DC x	A. tries to open the title page	Double clicks on the icon	A dialogue box appears – The requested page cannot be found	
	V	**Antony:** What's wrong with this computer!			
	Mo	A. tries to open the program again	MM- open existing project	Project opens but with same result	
00.03.20	C	I prompt A, to instead, high-light the icon and open it from the page icon on the tool bar	He does this	Same error message	
		Closes error message	Clicks OK	Message goes – DC3 welcome logo remains	
	V	**Antony:** That took me ages that page, it had a lot of writing on it	Clicks on the welcome graphic 6x	No effect the page seems to be jammed	
00.03.44	N	Returns to project view	P/v button	Returns to p/v tree in tact	
00.03.51	Po	Tries to open the second page	Double clicks on the icon	Page opens, but with same error message	Pierian admits that difficulties arise after multiple saves of the

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Time	Code	Activity	Method	Result	Comment
	V	A. growles discust			project
00.03.58	**C**	**Bob:** I wonder if someone has been playing with it since we used it last			
	V	**Antony:** they better not have! That took me about 3 hours!			
		Removes the error message	Clicks the OK	The message diappears, leaving again the DC3 intro graphic At this point the program jams – will not quit he tries exit, and the x at the top right.- no response	
	N				
00.05.06	**N**	A. tries ultimate exit unprompted	Ctl-alt-del	This works – gets back to windows desk-top	
00.05.16	**Mo**	Reopens the DC3 program	Double clicks the icon	DC3 opens	
00.05.	**N**	Opens his project	Clicks 2x on the file name	Project view loads	
	Po	Opens the first page	Double click on the page icon	Page loads without the error message	
	V	**Antony:** Finally!			
00.06.13	**N**	A. scrolls the first page	Using side bar	Page scrolls – work bench and graphic continue to load	
00.06.31	**We**	Decides to shorten the w/b	Double clicks on the w/b – the edit box appears.		
	We	Shortens top to bottom – shortens to 20	Enters that number	W/b adjusts	
00.07.47	**Pe ?**	Wants to shift the links at the bottom of the page to the centre. Does not know what	Initially chooses the indent button – this slides the top half of the h/light to the right. He		
	C	to do. I prompt him to highlight the links first then ask him to explore the buttons to see if he can find	decides against that and keeps looking. In the end he has to be told to use the c/align. He presses that		
	Te	the answer (CENTRE ALLIGN)		The links move to the centre	
	V	**Antony:** Ah there we go			

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Time	Code	Activity	Method	Result	Comment
00.08.59	N	Scrolls up to the space between the title and the w/b	Uses curser to position the insertion point	Arrives at the desired spot. The text appears – 8 words took 45 secs	
	Te	and proceeds to enter text	Types the text: " was one of the great ships in history"		
00.10.34	Te	Shifts and resizes text	Highlights the text and immediately uses the c/align to centre the text.	Centres	
	Ts	While still highlighted, he resizes	Increases with 4 clicks of the larger font button	Increases to 1 below the heading	
00.10.45	Ts X	Tries to resize the subheading 1 more time	While highlighted, clicks larger font button	The single line is too big for the screen. It 'explodes' off the screen leaving the w/b frozen in a fragmented state.	
	DC X	Tries to get the text back	Clicks text smaller font once	It returns, but in another type face and on two lines. The W/b is mended	
	Ts	Reduces the size of the sub-heading	2x click smaller font	Text goes back to original size	
00.11.03	V	**Antony:** I knew the text got big, but not that big, otherwise I would have got	Highlights the heading and		
	Ts X	this one and made it bigger	tries to click larger font	Does not resize any more	
00.11.35	,	Returns to project view	Clicks button	OK	
00.11.43	Po	Opens the *How many people died* page	Double clicks on the icon	That page opens	
00.11.46	Ts X	Tries to enlarge the heading	Highlight & larger font button	Does not enlarge	
00.11.55	Ts	Repositions insertion point	Repeats enter 4x	OK	
00.12.03	Te C	Begins to type text	Shuffles study notes, and begins to type	The type appears very small	
00.12.12	Ts	Attempts to resize type	Highlights the letters already typed in, and clicks the larger font button 2x.	OK OK	
00.12.25	Te X	Leaves highlinet on and commences to type from notes		Nothing happens	

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Time	Code	Activity	Method	Result	Comment
00.12.27	DC X	Tries to free up the page	0	No effect	
	V	**Antony:** It's jammed up!			
	C	**Bob:** Can you do anything with it at all?—		Silence	
	C	Try what I did. What did I do?		Dialogue box goes, page stays.	
			tries 2x more	Final close box appears	
	N		clicks end task	The DC3 session ends, windows desktop reappears	
00.13.26	V	**Antony:** Don't know what is wrong with it today, keeps jamming up.			
	Mo	Opens the Dc3 program again	Double clicks the DC3 icon		
	V	**Antony:** I didn't get to save it – it's all that I did		DC3 loads	
	C	B4 choosing a file, A.			
	N	maximises the screen	Max button top right	DC3 goes to full screen	
00.13.53	Io	A. chooses file to work on	Clicks open existing file/Titanic.dc3	OK OK	
00.14.09	Po	Opens *How many people died*	Double clicks on the icon	Page appears	
00.14.40	T	Begins to enter the text	Typing	OK appears in yellow	
	Te	Deletes new type	Backspaces over type	OK	
00.15.20	Te	Experimented with the highlight function	Clicked and double-clicked in the middle of the current typing	Found that a double click would highlight the whole line	
00.16.01	T X	Tries to backspace	Backspace button	As the whole line was highlighted, when A backspaced – deleted the whole line	
00.16.10	C	I prompt A. to use Edit/Undo	He tries this	No undo occurs	
		He tries again	Clicks undo	No response	
00.16.41	DC X	Tries anything	Clicking or pressing the keyboard keys	Has no effect – Program locked up again	
00.17.05	N	Tries to exit the app	Ctl-alt-del	OK	
00.17.20					

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Time	Code	Activity	Method	Result	Comment
	V	**Antony:** Why does it keep jamming up?	Double click the icon	OK	
	Mo	Opens DC3 again			
00.17.59	Mo	Reopens the project	Clicks appropriate files	OK	
	Po	Opens the *How many people died* page		OK	
00.19.23	T	Begins to enter the losses statistics beginning with First class	Clicks larger font	Ok puts in the equivalent of 8 words in 1min. On return to next line, the type went back to small – had to be resized.	
00.28.32	T	Finish text input,		9 mins 10secs to load 31 words	
	Is	Save project	File/Save Project	A. did complete this page	

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Time	Code	Activity	Method	Result	Comment
Antony					
00.45.18		**Antony** beginsthis session **Bob:** Have you organised your question page yet? **Antony:** I need to do that now			
00.45.34		A. opens his project	Clicks on the open project button from the main menu. He uses the one step higher button from the top menu bar	A. appears in good spirits – he makes working noises and hums a non-descript tune. Goes to the upper level and chooses a file that is the wrong file	
00.45.43		**Antony:** Ahhh – don't want to go there	Goes to tree menu to locate the correct file **Antony:** Titanics get mixed up Here we go…	There is more than one file with Titanic in the name – he picks the correct one	
00.46.35		Inserts a new page **Antony:** You cannot save this page the file is read only. The file name is blah-blah-blah-dot = hcm.	Clicks on the new page button in the tool box, then clicks on the position on the desk top to place it	The new page appears. With it a dialogue box that states that the page is read only and cannot be saved	
		Tries to eliminate the dialogue box, but it returns	Clicks the OK button and shows frustration each time it returns.		
00.47.08		Exits the program and enters the project again	Clicks the x in the exit box top right hand corner	The program exits	
00.47.09		Re-enters DC3	Clicks the button on t he desktop.		
00.47.15		While the program loads he picks up the graphics floppy I provided, … **Antony:** Has this got a lot of Titanic pictures on it?			
00.47.33		Main menu appears (after 25			

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Time	Code	Activity	Method	Result	Comment
		sec) A. maximises the DC3 screen	Clicks on the button on the menu bar	The screen is maximises	
00.47.45		A. opens his project	Clicks the appropriate files	The project opens	
00.47.50		Opens a new page to put the questions on	Clicks the new page button on the tool box, and clicks on the space to the right of the project tree in the project view	The new page icon appears	
00.47.55		A. opens the new page	Double clicks the new icon	The page opens	So far no read only warning
00.48.00		Types up the heading – "quize"	Type in lower case , normal size, then adds bold, italics and resizes to the largest size – highlights the word first	The word appears and the editing is successful	
00.48.26		Moves text to the centre of the page	While still highlighted, repeatedly clicks the indent button	The text moves to the middle of the page	
00.48.35		Opens a work-bench While the w/b opens A. picks up and organises his notes	Clicks the w/bench button	W/bench opens (after 19 secs)	
00.48.57		Tries to highlight the existing w/b **Antony:** yeh I want to get rid of it now, it is in the wrong spot **Bob:** Try using the indent buttons	Clicks outside the w/b and on the grey pad		Was probably looking for the highlight shadow
00.49.27		A. repositions the W/B	Repeated clicks on the Out-dent button	brings the w/b back to a more central position	
00.49.36		Repositions the tool/box	Drag and drop	OK	
00.49.44		Adjusts position of W/bench	Indent and out-dent buttons	Brings it back to almost the same place it started	
00.49.52		Inserts text display box, as first stage of text entry question	Clicks on t/b button	Window appears	
00.49.58		Brings up edit box	Double clicks on window	Edit box appears	
00.50.04		Removes existing text in edit	Goes to end and backspace/delete	Text removed	

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Time	Code	Activity	Method	Result	Comment
		window			
00.50.07		Enters new text	Types question in	4 words @ 17secs	
00.50.30		A. whispers the words he wants to put into the answer			
00.50.47		**Antony:** no, I need that If button I think Shifts the toolbox to the centre of the w/bench	Drag and drop	OK`	
00.50.58		Opens up the text edit for the new window **Antony:** Do I just leave that blank? Is that the button that they have to write in?	Double clicks on the window	Edit window appears	Referring to the new window
00.51.10		**Antony** now I get one of these then? **Bob** : Is that the If button?	Points curser to button icon		
00.51.20		**Antony:** Where is the If Button? Looks round and chooses the or button. Opens the edit menu	Clicks on the or icon in the tool/box. And clicks in an open space on the w/bench – double clicks the icon		
00.51.30		**Bob**: That's the kind of thing you do. I show the schematic for a text entry question from the manual. **Antony** deletes the or button	Highlights and deletes	Or button disappears	
00.51.40		A. inserts an If button	Std routine	Button appears	
00.51.46		**Antony:** now I'll have to join the new one to If	Drags from the blue handle to the button	Link OK	
00.51.57		A. inserts a new answer window	Inserts a text display – clicks the t/d button and clicks on the W/bench	Insertion OK	

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Time	Code	Activity	Method	Result	Comment
00.51.59		Loud work singing – no melody. Enters new question	Double clicks the window,		
00.52.03		Types in one word (1m 7sec)	Types into the edit screen, has trouble with spelling 'iceberg'		
00.53.19		Uses curser to hunt round the toobox **Bob:** What's next? **Antony:** I'm trying to find the sound – Ah there it is	Took 11secs to find sound button-places it by clicking on the work/bench	Appears OK	
00.53.27		Joins If button to sound button. More work whistle	Drags the link from the If to sound button.	Link OK	
00.53.30		Positions the tool box at the right of the w/bench	Drag and drop	Move OK	
00.53.33		Inserts a sound into the button	Double clicks the button and opens the edit dialogue box-chooses a that's correct sound clip	Chooses from the browse menu Sound clip OK	
00.53.45		**Antony:** There you go! **Bob:** OK now, try it – see if it works	Clicks on the Browse mode button	The w/b disappears, leaving the question, a text imput box and the answer displayed below	
00.53.50		A. tests the question and the sound reinforcer activates B. At this point he notices the answer window is still visible	Types in the answer	The sound plays an affirmation	
00.54.18		**Pause**: it appears that A. does not know the next step **Bob:** you will have to go back to edit. **Antony** work-whistles **Antony:** I'm going to click in that box twice, and I going to…pause	Edit box for the answer window appears – not sure what to do with the options A. sends the curser up to the		

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Time Code	Activity	Method	Result	Comment
	Bob: Look at the top, the top square	status edit window. Before I could explain what was required he had changed the status to make the text not visible		
00.54.38	Confident work-whistle – returns to browse mode.	Clicks on browse button	The answer window is hidden	
00.54.50	Tests new status	A. types in the correct answer	Question is displayed, answer not – the correct response plays	
00.55.02	**Antony:** I'll just check – umm "Car" – OK? **Bob:** Try another one – If you make it nice and tight, you can keep it on the same workbench	Types in a wrong answer	No response -	
00.55.17	**Antony:** Now, what else can I ask a question about? - - - Ah "how many people died"	Russtles work papers		Singing as he works – appears to be enjoying his work
00.55.25	Inserts and edits text display field as the beginning for a 3 choice multi-choice question Puts in new multi-choice question Text Establishes new window on w/bench	Clicks on t/d button, then clicks on w/bench. H e quickly double clicks on the new window A backspace over existing text then types in the new. Clicks done button	Window appears on w/bench Edit dialogue box appears. New text appears New window appears with text	
00.55.57	Adjusts position of new text display	Click and drag	Ok	
00.56.05	Shift in screens to the How many died page	Self talks through – Uses Back arrow from edit menu	Clicks four pages over to the correct one **Antony:** OK… he is indicating a mindset to set to work	
00.56.25	Scrolls down the page to find the	Clicks on side bar	Scrolls to information sought. Finds it	Must have forgotten the number killed

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Time Code	Activity	Method	Result	Comment
	information. **Antony:** one five one seven		at the bottom of the page. The poage becomes unstable as scrolling continues	Appears to be not enough memory to raise each picture b4 the next one arrives.
00.56.40	Returns to edit the quiz page	Uses forward arrow 4x	Arrives at Q page – takes 11 secs to load	
00.56.50	Places button under 2nd question text window.	Clicks on button tool. Then clicks on w/bench location	Highlighted button appears	
00.57.00	Writes first option onto 1st button	Double clicks the button, opening the edit window. Backspaces the existing text and types in an answer text	OK	
00.57.14	Places 2nd button and Housekeeps it into place	Repeats above routine Drag and drop	OK OK	
00.57.35	Places a 3rd button and edits it. House keeps it into allignment with the others	As for the other two Drag amd drop	OK OK	
00.58.14	Enters two sound icons	Clicks on the t/box sound icon and then on the chosen space on the W/bench, for each sound icon.	The insertion icon appears in each case	
00.58.25	Inserts a sound into the second icon	Double clicks on the icon and raises the insertion edit window – the "I'm sorry that was incorrect" sound and exits	As he chooses it by clicking onto the sound file name in the list	The sound plays and is installed
00.58.37	Inserts a sound into the first icon	Repeats the insert sound routine as above, choosing the "That's correct good job" file	OK	Appears to be very comfortable and familiar with the routine.
00.58.46	Housekeeps icons into a tighter formation	Drag and drop	OK	
00.58.51	Links the last 2 answers to the 2nd button	Drags 2nd and 3rd button handles to the sound icon	OK, links established	Ok
00.59.00	Links the fist answer to the 1st sound icon **Antony:** There you go!	As for 2,3 He says with pride	Link established	

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Time	Code	Activity	Method	Result	Comment
00.59.10		I prompt A. to test the new configuration **Antony:** yep	He changes to browse mode and clicks on to each button in turn	Each button produces the correct sound response	He says with pride
00.59.35		A. saves the project	File/Save Project	OK	
1.00.07		A. inserts another multi-choice, (2) question	Using the same construction – text display and buttons	OK	
1.04.01		He test the questions	Goes to Browse mode and clicks on each button	Each tests OK	
1.04.09		Saves project	File/Save Project	OK	

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Appendix R

Student Characteristics and Features Summary of Transcriptions

Features Evaluation Data

Collected from the teacher, questionnaires, participant interviews and observation

Details	Antony	Leon	Tammy	Sally
Chronological Age at the beginning of the study	12yrs, 3mths.	12 yrs, 6mths	11yrs 10mths	12yrs 3mths
Spelling	Spelling age: 7:6 (well below average)	Spelling age: 11:1 (average)	Spelling age: 10.7 (Average to below)	Spelling age: 13:1
Language 1 = High achiever 5 = Low achiever	On a 1-5 scale: 2.5 considered average. Can obtain information and process it , but finds difficulty presenting to a reader easily	Leon scored 2.2 on the 1-5 scale – considered average. He can speak with maturity, and has a creative writing and construction style, but has difficulty communicating clearly.	Tammy scored 3.0 which is considered average. She is a confident though quiet speaker.	Sally scored a 2 in her MIS language assessment. This is an above average rating.
Math	Uni of NSW math test: Number 52 (52) Measurement 30 (32) Space 14 (29)	Uni of NSW math test: Number 68 (52) Measurement 20 (32) Space 20 (29)	Uni of NSW math test: Number 52 (52) Measurement 20 (32) Space 14 (29)	Uni of NSW math test: Number 60 (52) Measurement 30 (32) Space 14 (29)
Problem Solving	Included in the top 50%	Leon is included in the top 25%	Tammy is included in the top 50%	Sally is placed in the top 10%
Social	Antony does not mix well with peers, has difficulty integrating in collaborative activities.	Leon is well adjusted and is popular with peers.	Tammy is a very stable and well adjusted child. She is quiet and well liked by her peers	Sally is very popular and is socially well adjusted. She is a natural leader
Home:	Is a single child. Parents are supportive, and appear to provide a stable home environment.	Comes from a stable and supportive home.	Tammy comes from a secure home – a supportive environment	Sally for her position at home with her siblings. This appears to have encouraged her quality of character
Computer use	There is a computer at home that is connected to the Internet, and Antony spends regular time on it, playing games, making cards, sending e-mail, typing assignments, 'surfing the Internet and drawing.	There is a computer at home though Leon does not use it frequently. It is not connected to the Net, and may be an older model. Leon uses the computer for typing assignments, playing games, music and drawing.	Tammy has a computer at home. It appears that it must be a recent acquisition as the teacher was not aware of this The computer is Internet ready, and Tammy uses it occasionally. She has experience playing games, making greeting cards, typing assignments, using chat and drawing. She has also used the computer to search for pictures from the Internet.	Sally has a computer at home and it is Internet ready. She uses this often, for playing games, making cards, sending e-mail, and typing assignments. She has a lot of encouragement from her father who gets her to do small typing jobs for him on the home computer.
Practical intervention	Antony has had experience installing a program from a CD, fixing software problems, customising a screen environment and installing and maintaining hardware.	He has installed a program from a CD, and customised a screen environment	Tammy has not had the confidence to manipulate the computer other than to change the screen settings.	Sally has installed a program from a CD and has customised her own screen environment.
Attitudes to computers	Antony appears to have a confident attitude to his own ability with computers. He does not find them intimidating and faces computer difficulties easily. His teacher says he enjoys any computer time he has.	Leon has a confident attitude to computers and working with them. He does not find computer problems intimidating, but is reserved about how much he likes them and is willing to discuss them.	Up to the beginning of this study, Tammy showed a reticence for computer use. She was unsure about her abilities, and needed to be coaxed to use one in the school situation.	Sally expressed prior to this study, a pronounced lack of assurance as to her feelings for, and interaction with , computers.
PERSONAL COMMENTS:	***"I like this program, it's good to work on"*** Wants to use the class computer to search for Titanic screen shots, but teacher not able to give him the class	***"I don't do much, I help them"*** this in response to being asked how he was going with planning - ***"At least they reckon I know everything"*** Teacher knocks over the camera. This does	• Tammy at the keyboard. • Second session – Sally at keyboard, Tammy on mouse • Tammy maximises the screen	Sally appears to have done the research for this session, and reads it to Tammy Sally prompts Tammy to maximise the screen

Features Evaluation Data

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Details		Antony	Leon	Tammy	Sally
		time ***"What's wrong with this computer?"*** this in response to a dialogue box coming up 3x – "requested page cannot be found" – *program jammed at the end – growls disgust* ***"I don't know what is wrong with it today – keeps jamming up!"*** sings in non-melodic mode while he works – appears to enjoy his time at the project	not appear to provide anything other than momentary distraction ***It appears to be an impossible task – some of these words are just not coming up!*** *Sound of frustration in his voice at trying to enter words into a table, and they disappear* ***"What do I do?"*** Leon often appeared to lack initiative	• ***Why have we lost the curser"*** Tammy was in Browse mode, and forgot that it is not used in browse mode	
PROGRAM ENTRY:		**Enters the project from start up OK. Second attempt, *program jams.* Goes to full screen – click x at top right OK**	**No trouble with entering project from start-up Second and third session entries to program OK**	**Tammy opens the project OK. Drag and drops the tree to a more central position Opens page OK**	On entering the project in the 3rd session, the project had been converted to read-only. Program hangs – ctrl-alt-del needed
TEXT					
	Entry	No problems 8 words takes 45 secs leaves highlight on and tries to type – *program jams* 9 mins 31 secs to load 31 words gets side-tracked easily e.g. types in "iceberg" 1m 7sec	No trouble with text entry interface, though took 37 secs to enter a three word title. During the first session, only interested in text entry 16 words entered in 1.5 mins Enters 36 words in 2:17 Enters text into a table using cut/paste – OK, then adds to text to this in the table. *Types 10 words that appear and disappear*	Types heading, appears to be comfortable with the skill Enters 35 words in 5:28 Enters 30 words in 4:24	
	Sizing	Easily handled, highlight and use buttons *Clicks to enlarge sub-heading size explodes – on trying to retrieve – reduces, but with different typeface.*	Heading size increase OK	Uses highlight and resize with ease.	Directs Tammy in the resizing process
	Fonts	3, only through preferences			
B,I,U	Attributes	All attributes easily implemented, *colour a little laborious, clicking takes too long to change colour*	Bolds heading OK		
Colour		Changes the text colour without difficulty	Colour change of text with out difficulty, though suspicion that final colour only settled for after laborious custom process. Background colour change OK, though found that background change will sometimes need text colour change as well.	• Use of highlight and colour OK • *NB: The colour edit box, has 3 unidentified windows that allow colour adjustment. Tammy chose the centre window at random and clicked the plus button alongside. 15x with only a minor change.* • *Tries to change the yellow heading colour the changes come too slowly, so gives up and chooses black*	***They both laugh in a frustrated way and accept the colour that results***
Edit		Delete by highlight and del button OK Centres text using c/align OK Experiments with highlight – double click will highlight whole line Leaves highlight on, when A. backspaces, line disappears	Centres heading using the centre align OK Maximises screen without prompting ***"You know that button, I've forgotten how to put that down the bottom. I did it last time, and it ended up with the heading"*** He is prompted to place the insertion point and	• Highlight and centre text OK • Has difficulty with backspace delete • Block highlights and centre justifies, using tool bar button	Block highlight and delete OK

Features Evaluation Data

Collected from the teacher, questionnaires, participant interviews and observation

Details		Antony	Leon	Tammy	Sally
		Tries to undo this – edit undo – no reaction - program locks	enter Moves the title to the left side using the left align.	• **"Ahh that looks good"**	
GRAPHICS					
	Import library	Inserts animated GIF OK			
	Import disc		Inserts the insertion point at desired spot. Chooses A: from Browse menu.	• Tammy inserts desired picture in page – hard up under text • Next insertion – uses insertion point first	Sally inserts floppy in A:
	Placement		Inserts pic OK Uses centre align to place pic Inserts graphics into a table – OK – table expands to fit	Wants to know how to move the pic down	Shows that she understands how t he program will work
SOUND	Insert				
	Import library	Inserts icon and inserts sound, and links it to the button Familiar with entering sound files from lib. OK	• Initially forgot how to enter a sound – with prompting, clicks the t/b icon and inserts a bean – double clicks the bean to bring up the insert menu chooses the appropriate sound and it plays b4 exit • Links text to sound by dragging OK • Shows familiarity with the routine as he inserts another sound for the correct answer	• Finds sound icon and clicks on. But has forgotten how to place it on the w/b – needs prompting	•
	Import disc			• Following this, has forgotten how to insert a sound into the icon double clicks after prompting to reveal the menu	• Sally coaches Tammy through the sound insertion.
	Edit	Took 11 sec to find sound button on T/b Inserting sound no problem		• Shifts the sound icon with drag-n-drop	• Inserts confidently. 2 sound buttons on the workbench
PAGE	Insert	Insert from *floating buttons unstable if mouse technique not exact – unnecessary duplication and link of page.* Second insert mastered. Antony set decided to install all the pages first, before editing each one. Insert new page OK next time. Save routine OK June 26 opens the project –inserts a new page, but *it has been converted to read-only therefore cannot be saved – no explanation & it won't go away*	Opens page by double clicking OK Save routine for page OK but needed prompting to remember Inserts page from menu OK Took 3x double clicks to open page. *The new page inserted from the menu, appears over the existing one and requires shifting* *Third session – first attempt to open the intro page fails tree disappears page icon remains. Second try, the tree returns. 2x more tries – no luck = ctl-alt-del* At DC3 reopen. OK		
	Edit	Delete pages OK. Needed guidance to disconnect a page and reattach in a different position.	*During third session attempts to open intro page, does not open – jams* *Attempts to open quiz page to begin edit –*		• Tightens up the page by placing insertion point in centre of page and pressing delete – thus pulling

Features Evaluation Data

Collected from the teacher, questionnaires, participant interviews and observation

Details	Antony	Leon	Tammy	Sally
		jams. Tries several methods to rescue the page – ends up with a BIG sigh: "Why does it do that sometimes?"		up the lower elements of the page to sit in the initial view
Colour	With guidance, inserts a background colour – some frustration with the clicking change of the colour. Found the layout of squares difficult to understand. Changes page – chooses yellow then edits it			
Background	After the colour is inserted discovers the background image facility and inserts "water" Then inserts another in a second page		Needed to remove a background graphic. Did not know how to do it. with prompting, went to page/page info/no image – image removed Tammy is hesitant about how to release the image – whether to double click or click OPEN	Sally coaches Tammy to put in a background tiled image – "Water" Sally guides Tammy to click open
Table		Inserts a three col 1-line table (with prompting). Table very unstable and difficult to move or scroll – jumpy		
Links	Links will only appear at the bottom of the last insertion in a page, so for this program, it may be easier to complete the pages first and then link them. To separate them, A puts the insertion point in between the heading and the links and repeats the enter command. Wants to shift the links to the page – does not know what to do, finally uses highlight and c/align	D&D linking of pages OK Shifts links to the bottom of the page by repeated enters.		
Browse	A. had to be reminded about how to test a link	• Tests link without difficulty – change to browse without diff.	• Shifts to browse mode OK. Forgets that the edit functions drop off in Browse – (insertion point)	
INTERACTION				
Workbench	Takes 8 secs to load Resizes – drags a link from button to an. GIF OK Edit size – OK The routine is easily negotiated Wants to reposition the w/b – uses outdent function	Recognises the icon OK and opens the workbench. The heading jumps to the bottom of the page, it appears that he did not place the insertion point first. Did have some difficulty getting rid of the cross insertion point after he clicked on a text display he later didn't want.	• They have forgotten the button that inserts the workbench. After my prompting, Tammy inserts it. While opening, Tammy reads the interim message. **Java bean, what's a Java bean?** I have not used the term in an effort to simplify the learning curve • Tammy is able to re-position the elements on the workbench – drag-n-drop after the dialogue box is closed • Changes to browse mode	• ***"Are these in millimetres?"*** Referring to the size dimensions of the w/b edit window • The resizing of the w/b follows a trial and error process from here. During this process, Sally discovers that the icons on the workbench do not have to directly relate to the w/b size – they are in fact virtual, so not confined except visually. **They do not appear to understand the value of the units represented outside this trial and error process** • Tries to shift the icons on the w/b b4 the dialogue box is closed – has

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Details	Antony	Leon	Tammy	Sally
			• *They tried to solve the w/b white background problem by reducing the size of the w/b. They narrow the width to only a pencil thin image. After recognising that this may not be the best, they try to edit by reopening the resize edit box. However, repeated attempts to click on to the w/b fail, the curser appears to not be able to connect.* • Opens w/b OK	to close first • Still do not understand that the links and the icons will disappear in browse mode. • After the w/b elements are re-positioned, they proceed to reduce the size of the w/b • ***"Oh, so is that going to have a big white patch in the middle of our page now?"*** *The workbench is set with a white background. This shows as a patch on any page background colour or graphic* • ***"It won't matter if the sound thing goes off will it?as long as the button is in the middle"*** Sally demonstrates that she understands the way that the w/b will behave after transition to Browse mode. The sound button becomes invisible and the button shows. • ***"If I type something in*** *(to the button in the w/b)* ***it might make it bigger"***... This comment appeared to indicate Sally's understanding that with typing in the button, an automatic resizing would apply to the button and by default to the w/b
Text input field	No trouble with inserting this field		•	• Chose text input box for one of the answers, not appropriate for multi-choice – deletes once understood that it is not appropriate
Text display field	Selects the correct button, has no prompting to open the edit window, types in the question Adjusts position of window OK	Inserts the field OK Enters the question into the text display – no trouble getting to the edit window	• Took 10 secs to find the text display button on the t/box	• Types in a 7 word question
Button insert	*Takes 14 secs to find button.* Inserts button OK Second time round no problem finding the button – But not confident, asks if this is the answer space. Asks if it is OK to get the IF button – but has difficulty finding it – chooses the or button, then when aware of mistake – deletes Chooses and inserts the right button During construction of question, edited text on button without prompting	Inserts buttons for multi-choice question – no difficulties	• Has forgotten which icon inserts a button – needs prompting • Inserts 3 buttons for multi-choice OK	• Sally uses the buttons as the answers, by typing the separate answers on the buttons OK
Button edit	Drags handle to resize – OK highlight and delete		• Took 20 secs to find the button icon – used the yellow labels as clues	

Features Evaluation Data

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Details	Antony	Leon	Tammy	Sally
			• Drags the handles to re-size the button OK	
Multiple Choice	Inserts a 3x multi-choice.	Inserts a multi-choice question. Begins by inserting a text input box, instead of a text display. Fixes this and enters the questions into each of 3x text display Discovers that text display cannot be linked to sound responses. Replaces them with buttons that can be linked to the sounds Deletes links without difficulty Buttons can only be linked to objects, eg graphics, or sounds – rather than text Discovered that the text display box can not be linked to a sound		• Understands the construction of Multi-choice questions – used buttons connected to sounds. Connects the buttons to sounds without difficulty.
True false				
Short answer	Has good grasp of the structure of this type of question. Links IF button sound button OK During testing, he discovers the answer window for the If bean is still visible – after prompting, he goes to edit mode/status edit and changes the introductory status.			
Tool Box:	Tries to shift t/b aborts if too quick. *Takes 32 secs to find the image insert. Icons may be too small.* Second recorded try at shifting the t/b, OK *Repositions the T/B again* – It seems to appear each time over the navigation buttons – an inconvenient action!!			
PROJECT:	Save OK On re-entry to project mode, *links have disappeared between pages, (links appear in page mode, but not in project. Just as the exit is clicked, the project link reappears. Going back however, the links not there.* The	Opens and saves project without difficulty Links page 1, 2 – routine OK	• Save OK •	• Sally uses Ctrl-Alt-Del OK
NAVIGATION:	Shift From Project To Page Ok Uses arrows to shift from page to page – OK Page navigation by side bar OK	Shift from page to project view OK		

Appendix S

Field Journals Sample

Field Journal

26 March

I thought that this would be an introduction to the subject and meeting . However the teacher changed both the nature of the meeting and the to timetabling for the weekly meeting. I came therefore unprepared, and had to make the best of it. Valery is the child chosen for the pilot. She is a bright apparently very computer literate student, who I suspect is a daughter of a computer retailer. She appeared to have no problem with the questionnaire, though the terms "software" and "hardware" were terms that needed explaining.

I explained the concept of multimedia and what we were going to do as a task, as the task sheet was not included with what had been brought to this first meeting. I left her to install the program at home and return the CD's. This in itself is a challenge, and I am hoping it is well judged.

The Chisel was loaded onto a computer lab machine. We looked at the Main Menu and went to the tutorial. The urge to experiment overcame control and she went through the menus and navigated freely. She found, was excited by and installed without fuss, the animated GIF's "Welcome" and the dog – her favourite subject. An edit menu kept coming up while she was trying to run the Tutorial. As the problems arose she wrote them down easily, using the problem log. The affective section at the end of the problem log was not so easily filled in.

Observations:

1. Valery could not understand "insertion point" (as the curser).
2. She showed frustration at having to go through each background graphics file, as the contents were not identified in the file name.
3. The program hung 3x in the 30 minutes of this introduction, which meant restarting it each time.
4. When trying to select a tutorial lesson, a pull-down menu kept appearing.
5. Valery had no difficulty in filling out the questionnaire

02 April

Valery tried to install DC3 on her home computer during the week , but did not have any success. She opened the product and accessed the project that she was working on, without apparent difficulty. The session did not have any external interruptions.

Observations:

1. All Valery's work was lost during an attempt to add a new page – may not have saved.
2. Valery inserted a new background, but found that it moved as the text was being inserted.
3. She appeared to recall the initial set-up routines without difficulty.
4. Valery has been able to use the problem Log without apparent difficulty.

9 April

I arrived at the predetermined time for the session with Valery only to find that Valery's class and the computer teacher had gone on a school trip, so the Pilot study had to be terminated at that point, as the school holidays were to commence in the following week.

Main Study:
I will be working with the group of four students as a group and the teacher would then utilise these as class peer tutors for the others in the class.

May 8
The Teacher asked that no research activities per se be undertaken as the parents had not been adequately informed of the nature of the study, and proper consent had not been given. I was able to spend some valuable time with the class as a whole, establishing rapport by answering questions, and introducing briefly, the reason for my visits.

The remaining hour was spent in a small group with the students that were chosen by the teacher. The concept of "multimedia" was discussed, and the idea of building up a single page using text, graphics and library animations was introduced. Each student in turn made up a first page and saved it, (there is only one computer to use).

The Students:
Tammy:
Sally:
Leon:
Antony:

In general the students appeared to understand the interface layout used in the Digital Chisel edit page. Each step of the activity (enter text, save project, save and name page insert graphic) was explained and the students were then in tern given an opportunity to complete each step.

Text:
As each child worked on a heading for their first page, they were asked to bold, resize, position and colour the text. In each case they recognised the appropriate button to achieve the format required. As they were in a group, some passive learning obviously occurred, as the later students required less instruction. They inserted a line to define the heading. Sarah asked why the line had to be inserted as a whole and could it be resized.

Graphics:
The insert graphics icon was easily recognised by all students and placing a graphic from the library provided with DC3 did not appear difficult to any student.

Environment:
The perceptual background was at times intrusive with general classroom noise making concentration difficult. Having only one computer also strained concentration.

May 15
All the parents of the student volunteers responded favourably to the student's involvement in the study, and signed the consent forms accordingly.

The Teacher decided to take the remainder of the class to the library, giving opportunity for the time with the study students to be uninterrupted. I briefly revised the work we did last week, then administered the questionnaire. During the completion of the questionnaire, the comment was made that there is restricted access to the computer during class time as it is mounted next to group work areas. I will try to discuss this with the teacher.

Initial observations from Questionnaire:
From the experience section, all the students appear to have a computer at home, and use it on a reasonably regular basis. The type and function of their computer may impose a limit on the variety of uses the individual can put it to. All the students regularly played games and typed assignments. This would indicate that at least basic navigation and edit conventions would be familiar. All the students at some stage have also personalised their desktop or work screen. From this experience, it can be assumed that the four volunteers for this study have at least the entry-level of skill required to master DC3.

Although the student responses indicated they would all be comfortable with general computer use, (Q1), the boys showed a more positive attitude (Q2, Q3, and Q7) and expressed more self confidence at being placed in a computer environment than did the girls. Though not too much can be read into these indications at this stage, I will be aware that some gender influence may emerge as the study progresses.

I developed an instruction presentation in DC3 to install on the class computer that the students could refer to, for guidance, as they proceed. After installing the application, I found that the curser would disappear when it was placed in the active screen area. The sound was also not operating on the computer, so the demonstration sound file inserted in the demonstration could not be reproduced

During this session, it was necessary to go over the mechanics of constructing a multimedia presentation. Using a "KWFL" format outlined by Morehead, we discussed identifying what was already known, what had to be found out, where to find that information and lastly, what had been learned during the whole process. The class teacher has been covering the same research process in class so it served as a valuable revision exercise.

To finish this session, I demonstrated how to link pages while in the project screen. Each student in turn then attempted to link a new page to his or her original one. Each student appeared comfortable with dragging and dropping the icons in project mode and the link was easily made and tested in browse mode.

May 22
As the Library was not used a great deal, especially on a Friday afternoon, I met with the students there for the first half of the afternoon to avoid distraction. We looked at the DC3 task and the way to build it up over the time that remains to the end of term. I handed out to each student, a folder with lined refill paper that will be used for keeping a diary, and a quantity of problem record sheets. I emphasised the need I have to follow what they were doing while I am not with them. Once I was satisfied that they understood how to use their own journals, we moved back to the classroom.

While seated round the computer, we looked at using the DC3 workbench to install a button and link it to both a picture/graphic, and sound. Each student tried the exercise and tested their work in the browser. All the students were enthusiastic about the results of this exercise.

The two boys have decided to work independently on their projects, whereas the girls are going to collaborate. The concept of developing a tree schematic illustrating the branching of screens, for use in planning the structure of the project was introduced and each 'group' produced a preliminary written diagram for their chosen topic.

From this point on, the individuals will be worked with separately. I have decided to use a video camera focussed on the screen to provide extra data of how the individual features and construction routines of DC3 are used by the students. As the sound track will also be valuable the bulk of the construction work on the projects will be done on the library computer, using the video with an external microphone.

May 29
With the camera set up in the library, focussed on the computer, I had each 'group' in turn construct in project mode, the initial outline structure of their project, and then test it in browse mode. Antony began well and appeared both confident and well prepared. With minimal prompting, he established the first page.

Antony began by deciding to set up all the pages first. Used the Tools dialogue box. forgot that each time a click is made, a new page is entered. I showed him each step as he erased the unnecessary pages. Once the first page was created, save project dialogue box OK, and gave the new project a title - needed to be guided once in the db (dialogue box).
Text entry: typing heading OK, bold italic and sizing OK highlighting OK - no questions
Linked pages OK on reentry to intro page, found that links were too high on page (because links go where cursor is. Worked out his own solution for creating the gap - repeated enter.

Third page: At this point - page setup routine not yet established - tried first up to link instead of saving
Saved the third page into project - I prompted to name page
Asked if I had put a button in my projects
Created 4th page - no prompting needed till page naming - this routine OK
Asked to put in background colour. Went to db OK, I introduced the colour modifiers. he experimented and found a blue colour he liked. Discussed the same colour appearing in both background colour and background image

Girls missed – video camera not working

Leon continued with his work

Tape into uni for digitising. !!

June 5
Evaluation work carried out in library
Students had useful time – approximately 45 mins per group
Sound was not recorded, DC3 screen left local – smaller than I would have preferred

June 12.
Evaluation work carried out in library. Comments made by staff that DC3 was responsible for difficulties experienced on library computer (unstable), and class computer (extremely slow). As the whole class is involved in producing the multimedia projects, and saving them to disc, this may slow the class computer. I defragged the disk but was unable to see how would free up the speed. The students have not had any time to work on their projects this week as end of semester evaluation requirements have taken all available extra time. This has limited the depth of work that can be achieved in this session.

Antony had completed more of his project layout.

June 19
The session began approximately 1 hr early this week to give some instruction in the basics of setting out a quiz segment. We discussed that types of questions we can have i.e. true/false, multi-choice, short text entry answer . We looked at examples of these and then each student constructed at least one question item on the workbench. After this, each group in turn then proceeded to start work on their quiz segments in their respective projects.

Sally and Tammy:

Appendix T

Sample Interview with Expert

Interview with Expert 2 - DC3 Expert

The first try at installing the program, saw what appeared to be a large amount of hard disk space being eaten up by DC3. No technical confirmation for this assumption.

In WA we have a Microsoft education pricing policy that allows the complete Office – Pro suite to be installed in a classroom for around $60. This has quickly led to the Microsoft interface and metaphor becoming the default. In particular, Word, Internet Explorer and PowerPoint have become familiar applications and may not easily integrate with DC3. So, using Microsoft set-up makes the introduction of DC3 difficult. The price comparison seems to make DC3 prohibitive in a school economic environment that is usually very tight.

In Expert 2's learning model, parents should be suppliers of support and 'PD' and the teacher concentrate on the curriculum aspects. This accents the need for DC3 to be as intuitive as possible.

Expert 2 began to take multimedia creation seriously in the late 80's, using an Amega. These computers were very much more advanced in colour display and graphics handling, than even the Apples of their day. Ian developed his students to what he describes as expert level, only to find that when the monochrome PC technology superseded the Amega, His students were effectively reduced to "novice" status again, as they had to acclimatise to the new technology . His concern is that DC3 not close enough to the Microsoft model to easily fit into the existing settings and learning.

Expert 2 asked the question, why not design DC3 to work in conjunction with the established browser, rather than have it completely separate. He sees this as to some extent, reinventing the wheel.

One of the serious concerns, especially in the light of Ian's model, is PD and support. The possibility of local support provided by Microsoft challenges the introduction of another 'externally' sourced product.

Expert 2 saw the program as very Americanised: American coins graphics, maps and characters

Expert 2 found the program difficult to integrate with a network, (the more common scenario in a school setting). This is not to say that integrating is not possible, only not well documented. Again this is a support issue. Allied to this is configuring the browser settings while the default one is operating. Is it too difficult?