

# ***EDUCATIONAL MULTIMEDIA FOR THE SOUTH PACIFIC***

*Research Report for  
ICT Capacity Building at USP Project  
entitled*

*“Maximising the Benefits of ICT/Multimedia in the South Pacific:  
Cultural Pedagogy and Usability Factors”*

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Prepared for ICT Capacity Building at USP, August, 2004

Robbins, Christopher

Educational multimedia for the South Pacific /  
Christopher Robbins . – Suva, Fiji : ICT Capacity  
Building at USP Project, The University of the South  
Pacific, 2004.

69 p. ; 30 cm.

“Research Report for the ICT Capacity Building at  
USP Project entitled “ Maximising the Benefits of  
ICT/Multimedia in the South Pacific: Cultural  
Pedaagogy and Usability Factors.”

ISBN 982-01-0586-2

1. Computer-assisted instruction—Oceania 2.  
Interactive multimedia—Oceania 3. Distance  
education—Computer-assisted instruction—Oceania 4.  
Educational technology—Oceania 5. Learning I. ICT  
Capacity Building at USP Project. II. Title

LB1028.5.R62 2004

371.334

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## ACKNOWLEDGEMENTS

The project, entitled “Maximising the Benefits of ICT/Multimedia in the South Pacific: Cultural Pedagogy and Usability Factors”, is funded by the Japan International Cooperation Agency (JICA). In accordance with the grant contract, copyright for this paper is shared between JICA, the USP and the author.

I would like to thank Vignesh Shashidhar and Thomas Rodgers for Flash development, Maria Ronna Luna Pastorizo for content development, instructional design, usability testing, and general administrative support; and Mohammed Alim, Joyce Ravina Kumari, Filimoni Saumaki, Shalen Gounden, Nilu Ram, and Ashlyn Singh for their vital support as research assistants. Thanks also to Maki Kato and Natasha Khan for their guidance and support in the administration of this project, and to Roselyn Kumar for editing and proofing of the Pacific History portion of the project. Also to Barbara Hau'ofa, whose helpful insights as editor of this paper went beyond grammar and spelling. Further thanks to the University of the South Pacific (USP) Distance and Flexible Learning (DFL) staff and students who took the time to speak with me, and the USP School of Humanities (SOH) staff's support in auditing the ideas that arose during this project. Also to Shane Salesa, Alisi Matanakibau, Vilisi Nadaku, Sarika, Patterson Lusi, Taberannang Korauaba, Chinilla T. Pedro, Henry J. Peter, Asi Fangalua Halaleva Pasilio, Asogali Panapa, Joanna Olsson, Faletau Tonise, Melie Monnerat and Alex Teariki Olah for providing voice-overs and posing for photos as the virtual peers; to Paul Geraghty, Melie Monnerat, Shailesh Lal, Aaron Pitaaqae, Modesta Thugea, Milligan Pina, Collin Potokana, Charles Sivu, McMillan Mede, Daniel Rove, Angelo Waitara, Patterson Lusi, Temanori Tiree, Sifa Ioane, Breda Tipi Faitua, Emily Moala, Siniva Lauti, Coffey Kiluwe, Joanna Olsson, Nga Teinangaro, David Tamata and Alex Teariki Ola for translations; and Vishal Kumar and Maraia Lesuma of the USP Media Centre for their work in the audio studio. Thanks to Tevi Teaero for permission to reproduce a poem from his book of art and poetry *On Eitei's Wings* in the Group Learning section of this paper. Finally, I would like to thank Konai Helu Thaman, whose writing largely provided the inspiration for this project in the first place.

Of course, I would also like to thank Japan International Cooperation Agency (JICA), whose funding made this project possible.

## ABOUT THE AUTHOR

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## 1.0 EXECUTIVE SUMMARY

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The project explores aspects of learning approaches in the South Pacific with a view to their application to the development of educational multimedia in the region. The major themes covered include language, group learning, contextual learning, authority figures, the importance of relationships in learning, the role of imitation, computer and internet access, usability, and interface preference in the South Pacific. Based on the data collected, we developed a set of recommendations for educational multimedia in the region. We applied these recommendations to the development of an educational multimedia program by creating an interactive CD-ROM on Pacific History, and publicised these findings through a website and series of seminars.

This document summarises the project, the findings and recommendations based on these findings. It is designed for educators and educational technology developers, particularly those with a focus on teachers and learners in the South Pacific. The project approaches culturally inclusive educational multimedia from the design and development side, and so does not cover political, infrastructural or financial aspects of educational multimedia in the South Pacific.

In the course of the project, the research team conducted 153 interviews and 28 usability tests, administered 546 questionnaires, reviewed over 100 academic publications on learning and on technology in the South Pacific, and visited Distance and Flexible Learning (DFL) Centres of the University of the South Pacific (USP) in Nauru, Samoa, Solomon Islands, Kiribati, Marshall Islands and Fiji Islands.

The findings follow the general categories: language preference, group learning, contextual learning, computer and internet access, content-display preference, and usability. Language preference findings indicate that although most students (72%) prefer English as the main language of instruction, almost all staff and students turn to vernacular when confused. There was no clear preference for group versus individual learning, but there were clear trends on the beneficial and difficult aspects of learning in groups. Staff and students appreciated that learning in groups allows students to reframe course content to their local contexts and languages, and enables students to get answers to questions they are reluctant to ask their lecturers. However, they complained that authorities can develop within peer groups, inhibiting some students from asking questions, and that group projects can lead to unfair distribution of work. Additionally, many students who said they were unwilling to ask questions of lecturers in groups — both in person and via videoconference — preferred to ask their peers or to use one-on-one methods such as email or individual conversation.

Staff and students stated that local context is essential and lacking in their course work, and that they require educational media that utilise local metaphors or provide methods to ease their own localisation efforts. Findings show that visual displays of information such as graphics and charts are the most popular, while long text is the least popular method of receiving information. Regardless of the format employed, students indicated that they wanted to see the big picture, while being able to jump readily to specifics.

Computers and the internet are not easily available to many students: the average at USP DFL centres is one computer for every 68 students. Many of the more isolated students have effectively no access because they do not have electricity and cannot often visit the DFL centres. However, the access situation is continually improving,

with a further donation of computers for the centres by the Japan International Cooperation Agency (JICA) and current planning for a further upgrade of USNet, the satellite network that provides internet access to DFL centres.

Usability findings indicate that it is important to allow immediate action on instructions, that beginners cannot be expected to differentiate between the operating system and application functions, and have trouble distinguishing between right and left mouse clicks.

Several conclusions can be drawn. First, there is a need for educational multimedia to utilise vernacular languages, examples and metaphors, and to provide avenues for further customisation by staff and students. Secondly, we must not assume group-oriented learning activities are the best solution for all students. Nevertheless, individual multimedia activities can be designed to take advantage of the beneficial aspects of group learning by providing multiple perspectives, as well as a degree of “e-anonymity” (such as email or virtual peers) to encourage questions from reticent students more comfortable with indirect modes of questioning. Educational multimedia developers must also create complements to the long texts that dominate most students’ learning materials, providing information in a variety of more concise, visual formats, as well as audio voice-overs.

The technology access situation is daunting, but continuously improving, and while computer-based teaching currently reaches only a small portion of students in the region, it is important to develop our approaches to using the technology for teaching now, so that we are properly prepared once access is more widespread. Additionally, we can take several steps in the meantime to make the educational technology we develop more accessible in the region. Websites with large image, video and audio files are virtually unusable by most students in the region, so CD-rom counterparts are advisable. As computers are readily accessible to only a small portion of students in the South Pacific, CD-roms should be developed so that print and audio components can be easily isolated.

Recommendations based on these findings include:

- Provide Vernacular translations or glossaries within the educational multimedia. For ease of translation, save language files as separate text documents so that translators can make edits to the multimedia using simple word-processors, and need not know how to use multimedia development software.
- Offer opportunities for contextualisation of the educational media. Utilise decentralised methods that enable “on-the-fly” staff and student input, as well as dialogic methods that provide context in a more centralised, conversational manner, such as virtual peers from several countries who present examples and explain concepts using terms from their own backgrounds
- Divide materials by learning approach as well as thematically. For instance, the same material can be presented graphically, in outline form, through dialogic/conversation-like tests, and through exploratory hands-on interfaces. Also be sure to include audio voice-overs.
- Utilise modeling rather than separate instructions, enabling students to act on any instructions or practise any skills within the learning interface. For instance, overlay instructions on the active interface rather than providing separate instruction screens for help sections or lab simulations.
- Preserve the whole while offering specific anchors, creating successive approximations rather than a process of segmenting difficult concepts. For

instance, long text should be accompanied by quick summaries that link to different parts of the main text. More graphical interfaces should present concepts through “layers of simplicity,” in which details are available to the students without muddying the overall purpose of the graphics or confusing the interface.

- Encourage active interrogation of the materials by designing a layer of “e-anonymity” into educational multimedia. For instance, technologies that focus attention on the student publicly, such as video conferencing, can prevent reticent students from asking questions, so be sure to offer less exposing alternatives such as virtual peers and email.
- Develop educational multimedia so that it can be utilised in a variety of media devices.

In a nutshell, educational multimedia designed according to these recommendations would present materials in a variety of languages, using examples from a variety of countries in the South Pacific, and would provide opportunities for staff and students to customise the materials with their own examples and input. Ideally, the educational multimedia would be distributed as an interactive CD-rom rather than solely as a website, would have printable components, and would double as an audio CD when inserted into a CD-player. The interface would be designed so that drilling into specific aspects of the media preserves the “bigger picture,” keeping the overall framework of the lesson in view when examining details.

The educational multimedia we designed to audit and illustrate our recommendations is a CD-rom on Pacific History developed using Macromedia Flash and XML. The information is presented in 12 languages used in the South Pacific, and is divided into three sections: a simple, text-based outline, an animated map, and a “test-yourself” section with a virtual-peer from each USP country who gives hints and feedback to help students learn through the test. Audio files, text files, and animations are saved in separate folders so that they can be customised by teaching staff, and are integrated into the multimedia at runtime so that staff can continually update the educational multimedia. A help section demonstrates how to use the program within the active interface, showing students exactly where on the screen to click, so students can act on the instructions immediately. The help section is also presented in 12 languages used in the South Pacific, in visual, textual and audio formats. The program is distributed open source, with source files for layouts, illustrations, animations, code and text included on the CD-rom, so as to enable deeper customisation, and to serve as a building block for other educational multimedia.

## **2.0 BACKGROUND AND PURPOSE OF RESEARCH**

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As a regional university serving 12 island nations distributed over 33 million square kilometres of ocean, USP (University of the South Pacific) teaches to a widely distributed region with a variety of cultures. Traditionally, major barriers to reaching distance students have been those of culture and of communication (Frank & Toland, 2002; Gold, Swann & Yee Chief, 2002; Landbeck & Mugler, 2000; Primo, 2001; Tuimaleali’ifano, 1999; Tuqa & Guild, 2003; Williams, 2001). USPNet was designed to enable a degree of ICT/Multimedia access to regions outside the main campus, and current ICT/Multimedia initiatives aim to expand related technologies (Agassi, 2002; Montgomery, 1997; Zwimpfer & UNESCO, 2002; SOPAC, 2002; JICA, 2004a, 2004b). Much existing literature examines cultural pedagogies particular to the South Pacific region, helping to bridge the cultural gaps between the largely imported formal education system and diverse South Pacific cultures (Lockwood, Roberts & Williams,

1998; Lockwood, Smith & Yates, 2000; Thaman, 1997; Va'a, 1997, 2000; Wah, 1997). However, little work has brought these two aspects together. The current project examines the learning and technology environment in the USP region, and applies these findings to the production of a model educational multimedia project and a set of recommendations for others to create multimedia that is appropriate to the regions in which it is being used.

### 3.0 RESEARCH QUESTIONS

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1. What are the major themes of Pacific learning approaches, pedagogy theory and practice?
2. What are common usability needs in the South Pacific?
3. How can we apply these findings in Pacific pedagogy and usability to the development of educational multimedia in the South Pacific?

### 4.0 RESEARCH METHODOLOGY

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#### 4.1 Definitions

**Multimedia** is “the delivery of information, usually to a personal computer, in a combination of different formats including text, graphics, animation, audio, and video”. (*Glossary of Terminology*, n.d.). In the scope of this project, I am referring to *interactive* multimedia, in which the user can take an active part in the experience, providing input that affects how the multimedia is displayed.

**Usability** “is a generic term that refers to design features that enable something to be user-friendly” (Congress Online Project, 2004). Key features of usability include the ease of learning and utilizing an interface, as well as the satisfaction experienced and errors encountered during its use (Nielsen, 1993 in Richardson, 2000).

**Pedagogy** is “a term that is used to describe an approach to schooling, learning, and teaching that includes what is taught, how teaching occurs, and how what is taught is learned” (Diekelmann Web, 2002). For the purpose of this project, pedagogy is not restricted to school-based teaching and learning, but encompasses learning in non-formal (organized but not institutionalized) and informal (unorganized, non-institutional) learning environments (Thaman, 2001).

**Culture** For the purposes of this study I use Konai Thaman's (1999) definition of culture as “a way of life of a group of people”, as distinguished from the “narrow sense focusing on . . . creative expressions such as language, song, dance and art” (Crocombe, 1980 in Teaero, 2003). In this sense, cultural pedagogy is an approach to teaching and learning particular to a specific group's way of life.

**Interface** In this paper, interface refers to the visual layer presented to a user by a piece of software or multimedia. “An interface between a computer and user refers to the elements of the computer and software that the user interacts with—the screens, icons, menus, and dialogues” (VNU Business Media, 2001). The term *active interface* refers to an interface the user can interact with, and *passive interface* for an interface that presents without allowing user control.

## **4.2 Project design**

### **4.2.1 Challenges**

A large part of this project involved applying general learning principles—often with traditional and informal roots—to educational multimedia design. There are several base challenges in designing such a project. First, the idea that indigenous learning approaches can be applied successfully to formal education without bastardising the original principles or neglecting institutional inequities is debatable. For example, see Malin (1998) and Nicholls, Crowley and Watt (1998) for a discourse regarding “Aboriginal learning styles” and formal education in Australia. Secondly, attempting to use technologies based in one set of cultures to elicit cultural inclusivity of another, very different set of cultures can be problematic. For instance, in *The Electronic Colonization of the Pacific*, Spennemann and co-authors (1996) explore how “Western” notions of identity that shape and are promoted by ICT/Multimedia can be seen to be at odds with related “Pacific” notions. Finally, as an “outsider” whose own cultural upbringing occurred in a place very different from the South Pacific, I needed to consider the additional challenges of cross-cultural communication in the design of this research and development project.

### **4.2.2 Approach**

The project utilises a combination of qualitative and quantitative research methods, separated into two major focuses (technology use and learning approach), and audited at the conceptual, developmental and practical usage levels. By separating the project into technology-focused and learning approach-focused divisions, I aimed to ensure that the core data collected would be valid and useful, even if connections between the two divisions turned out to be untenable.

#### *Learning approach focus*

The first division was a qualitative analysis that examined general learning approaches and preferences, focusing them into general educational recommendations. This portion was not related specifically to technology or to formal education, but summarised basic ideas to improve educational access whatever the mode. This layer was built primarily through interviews, focus groups and a regional academic literature review.

#### *Technology focus*

The second division was more specific, directly testing students’ educational technology interface preference. This aspect of the study included questionnaires focusing on layout, language and navigation preference; interviews; and a set of usability tests exploring how students interact with educational technology.

#### *Auditing Process*

Aware of my role as an outsider, I tried wherever possible to act as a collator, rather than a creator of ideas. I did this by limiting the scope of the links I made between data sets, auditing any results or outputs with the target audience through several channels, and by maximising the role of the target audience in producing the outputs. For instance, the learning approaches that form the base of this project came from the staff and students for whom this work is designed. The programmers, translators, content-developers, data collectors, analysts, and auditors are all staff or students for whom this work is designed. Additionally, applications of general findings to educational multimedia were tested at the conceptual level through focus groups and peer-review, at the development level by having people in the target audience create

prototypes of the ideas, and at the usage level by testing all media with the staff and students for whom this work is designed. In other words, I organised interventions as we formulated our ideas, again as we developed these ideas into educational multimedia examples, and finally by testing the educational multimedia we developed with some of the staff and students for whom it was designed.

In a nutshell, a combination of quantitative, qualitative and procedural research methods was utilised, and the likelihood of validity was increased by focusing the scope and auditing conclusions at the conceptual, developmental and practical usage levels (figure 1a).

**Figure 1a: Research and development project design**

	<b>Quantitative</b>	<b>Qualitative</b>	<b>Procedural</b>
<b>Technology-focused</b>	Questionnaires	Usability tests	Development of educational multimedia
		Interviews	Testing of educational multimedia
<b>Learning approach-focused</b>		Interviews	Peer review, focus groups

A more detailed explanation, including sampling procedures and a description of specific quantitative and qualitative data collection techniques is given below.

### **4.2.3 Activity summary**

#### *Site visits*

During each site visit, I conducted interviews, questionnaires and usability tests.

**Nauru:** 30 September to 6 October 2003

**Samoa:** 6 to 10 October 2003

**Solomon Islands:** 16 to 23 October 2003

**Kiribati:** 3 to 8 November 2003

**Marshall Islands:** 8 to 15 November 2003

**Lautoka Centre:** 5 December 2003

#### *Interviews*

Of 153 interviews conducted, 130 were with USP staff and students; 23 with members of external organizations.

#### *Usability tests*

In total, 28 usability tests were conducted with students at USP DFL Centres. See appendix 7.5 for screenshots of the software utilised.

#### *Questionnaires*

At the DFL centres visited, 546 questionnaires were collected from students. Of these, 196 focused on language preference (appendix 7.1), 196 focused on preference for the display of information (appendix 7.2), and 154 focused on layout preference for web-page navigation (appendix 7.3).

### *Seminars and workshops*

During the project I participated in a series of seminars and workshops to publicise initial findings and audit recommendations:

- **Cultural Pedagogies, Instructional Design and Educational Multimedia Production**, 12 June 2003. (appendix 7.7: CulturalNmBrainstorm)
- **School of Humanities Brainstorm**, 18 August 2003. Akanisi Kedrayate, Unaisi Nabobo, Teweiariki Teaero, Stanley Houma, and Joseph Veramu (appendix 7.7: NmSporeBrainstorm)
- **School of Humanities Brown Bag Seminar**, 4 September 2003. (appendix 7.7: SohSeminar)
- **Fiji Institute of Educational Research**, 6 January 2004. Presented a paper entitled “Culturally Inclusive Educational Multimedia” (appendix 7.7: FierConference)
- **Distance and Flexible Learning Showcase**, 5 March 2004. (appendix 7.7: DflShowcase)
- **School of Humanities Brown Bag Seminar**, 25 March 2004 (appendix 7.7: SohSeminarTwo)

### *Educational multimedia development*

Following collection and analysis of data, academic literature review and peer audits, I produced a set of recommendations for the development of educational multimedia in the USP region. I worked with a group of student research assistants to apply these recommendations to the creation of an educational multimedia software program. We developed the software using Macromedia Flash, a multimedia development tool (Macromedia, 2004), and Extensible Markup Language (XML), a simple and flexible text format (W3C, 2004). The software we developed, entitled *Tracing Our Ancestors*, is an educational CD-rom about Pacific History, focusing on immigration patterns into the South Pacific. See appendix 7.5 for screenshots of the software.

### *Project website*

I developed a website publicising the project activities, recommendations, educational multimedia, source code, and notes from all interviews and focus groups. This site can be accessed at [http://staff.usp.ac.fj/~robbins\\_c/nm](http://staff.usp.ac.fj/~robbins_c/nm) or <http://nm.grographics.com>

## **4.3 Data collection**

The research team collected data primarily through interviews, questionnaires and usability tests with staff and students at the University of the South Pacific, with a particular focus on the Distance and Flexible Learning Centres serviced by USP. Although I was unable to visit all twelve countries served by the USP (Cook Islands, Fiji, Kiribati, Marshall Islands, Nauru, Niue, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu, Vanuatu), I attempted to gain a reasonably broad sample by visiting one Distance and Flexible Learning (DFL) centre from each major geographic region in the South Pacific (Micronesia, Melanesia, Polynesia) as well as one less developed and one more developed DFL centre. As such, I visited Nauru, Samoa, Solomon Islands, Kiribati, the Republic of the Marshall Islands and Fiji (Lautoka Centre and Suva Campus). I conducted interviews via telephone and email with staff and students from the remaining six countries served by the University of the South Pacific: Cooks Islands, Niue, Tokelau, Tonga, Tuvalu and Vanuatu. It is important to

note that even though I conducted questionnaires, usability tests, and interviews at the DFL centres, the sample did not include more isolated students who were unable to visit the DFL centres during the study. The constraints of distance and dispersal within the university region are formidable, so this limitation reflects a persistent institutional division between students with access to DFL facilities and those without. In this way, the sample reflects those students who *can* access the DFL facilities, rather than just those who happened to be at the DFL centres during my visits, and so is symptomatic of far more pervasive conditions in the South Pacific.

#### **4.3.1 Interviews**

I completed over 150 interviews during the course of the project. Of these, 130 were with staff and students at the University of the South Pacific, and 23 were with members of external organisations. External organisations included ICT/Multimedia organisations such as TSKL Kiribati, Datec, Internet Fiji, Aptech and Connect; development organisations such as UNDP, the Forum Secretariat, and Peace Corps; government departments such as the Fiji Ministry of Education and Nauru Ministry of Education; and educational institutions such as Central Queensland University, Nauru College, and the College of the Marshall Islands. The interviews focused on preferred approaches to learning and technology. The major themes we covered included communication between staff and students, language preferences and issues, local metaphors in teaching, active learning, group/peer learning, computer access/usage, and centre access/usage. In addition to the individual interviews, I also ran several focus groups with academic staff. I conducted all interviews and focus groups myself, so that I could ensure that leading questions were avoided. Notes and quotations from the interviews are available online at the project website: <http://www.grographics.com/wiki/index.php/NmInTheSouthPacific>

#### **4.3.2 Questionnaires**

The interviews were augmented with (and often jump-started by) three questionnaires. The first questionnaire focused on language preferences at USP (appendix 7.1), the second examined preferences among different ways of displaying the same information (appendix 7.2), and the third looked at website navigation preferences (appendix 7.3). I administered all the DFL centre questionnaires myself, and Joyce Ravina Kumari, a research assistant, administered the Fiji campus questionnaires.

#### **4.3.3 Usability tests**

I ran usability tests with many of the students I interviewed, sitting them in front of an educational CD-ROM and instructing them to “try it out” while I took notes. The goal of these tests was to see how students work with educational multimedia, looking for trends in approach to the interface, common problems encountered, and methods used to solve these problems. See appendix 7.4 for screenshots of the educational multimedia software tested.

#### **4.3.4 Existing data and literature review**

I also completed a literature review, studying academic publications focusing on Pacific pedagogy, education and technology, and received quantitative data from USP Information Technology Services (ITS) on computer access at the DFL centres.

## **4.4 Data analysis**

### **4.4.1 Quantitative analysis**

As the sample included only those students with access to the five DFL centres I visited, I needed to restrict the variables analysed to preserve validity of quantitative results. Furthermore, due to potential confounding variables (age, academic course-focus, degree of computer-fluency), I analysed all results across the board, providing a single result for each questionnaire rather than looking for differences between subsets of the sample. As such, I focused analysis on just one dependant variable per questionnaire.

For instance, in the language questionnaire (appendix 7.1), I analysed language preference alone, without looking for correlations between independent variables such as country of birth, age, gender, degree of computer experience, etc. In the navigation preference questionnaire (appendix 7.3), the only dependant variable analysed was the students' navigation preferences: the inline navigation (option L) or menu-style navigation (option O). For the content display questionnaire (appendix 7.2), the dependent variable was layout preference (option 1, 2, 3, 4 or 5). I put these restrictions in place because of the very valid concerns about self-selecting samples raised by the research approval committee during planning stages of the project.

We determined statistical significance for all quantitative analysis through chi-square tests. Nilu Ram, a research assistant, initially conducted these tests using Minitab software. I audited these results myself using online chi-square test formulas available at [http://www.georgetown.edu/faculty/ballc/webtools/web\\_chi.html](http://www.georgetown.edu/faculty/ballc/webtools/web_chi.html) and <http://www.graphpad.com/quickcalcs/chisquared1.cfm>. Additionally, a statistician/accountant advised on processes and analyses.

### **4.4.2 Qualitative analysis**

Quantitative analysis was augmented with more robust qualitative analysis of the interviews, usability tests, and “why” questions in the questionnaires mentioned earlier. Following data collection, I entered all information from the interviews and usability tests, separated by country visited, into a searchable website I had customised for this purpose, and coded the data into several categories: access (appendix 7.7: NmAccess), active learning (appendix 7.7: NmActiveLearning), group learning (appendix 7.7: NmGroupLearning), language (appendix 7.7: NmLanguage), authority figures (appendix 7.7: NmQuestioningAuthority), and usability (appendix 7.7: NmUsability). Shalen Gounden, a research assistant, organised each category into its own page, so that we could analyse categories across the entire sample, as well as divided by country. Storing the qualitative information in a customised website made searching and sorting an efficient process, and displaying it in an open forum made peer audits easier to accomplish. It also provided an additional avenue for reporting back to participants.

The “why” questions from each questionnaire were analysed using similar methods—organising, coding and analysing data using Excel spreadsheets instead of the customised website. I used a spreadsheet for the “why” questions because the generally shorter responses were more easily handled with a spreadsheet than a website.

## 4.5 Application development

### 4.5.1 The development team

Following data collection, site visits, and the production of a draft summary of findings and recommendations, the development team began to define, design and program a sample educational multimedia project to illustrate and test the recommendations. The development team consisted of myself, two Flash and XML developers (Vignesh Shashidhar and Thomas Rodgers), and a content developer and tester (Maria Ronna Luna Pastorizo). We also utilised 12 different translators, and 12 students for recording the voice-overs of these translations.

### 4.5.2 Scope

The purpose of the educational multimedia development was to illustrate, audit, and refine initial recommendations. As such, the scope of the project was defined primarily by the learning approaches we wished to accommodate with educational technology. This is different from the scope of typical educational multimedia projects, which are generally defined by course content or teaching objectives.

At the outset of development, our scope included the following:

- **multiple languages**, with language files saved separately from the multimedia for easier translation and updating;
- **multiple perspectives**, with a quick outline, a visual display, and a test section that all cover the same content;
- **inline help section**, with audio, visual, and textual instructions, presented within the active interface, so that users can act on the help section's instructions immediately;
- **layers of simplicity**, presenting a basic first layer of information, with more information available deeper with the interface. This was meant to allow inquisitive or computer-savvy students to find more information without making the interface so complex as to confuse less computer-savvy students;
- **multiple platforms**; the software needed to work on both Macintosh and PC systems;
- **open source**; the software needed to be delivered in a format easily copied, edited, and learned from by other developers, students and teachers;
- **digital scrapbook**, allowing students to take notes and copy images and text to their own digital scrapbook, which they could save, print, and share with other students;
- **printable components**, allowing the multimedia to be printed, preferably with a version specifically designed for printing, rather than a reproduction of what is seen on the screen; and
- **audio/multimedia CD**; the CD-rom on which the educational program is distributed must be usable as an audio CD in a common music CD-player, as well as an interactive multimedia program in Macintosh and PC computers.

### 4.5.3 The development tools

We chose Macromedia Flash as the development application because it is a relatively inexpensive, cross-platform multimedia tool, and XML because it is one of the most extensible and widely-used markup languages currently in use. We used Adobe Photoshop and Adobe Illustrator to create still images and interface elements.

#### **4.5.4 File architecture**

We utilised a three-tier “mothership” file structure, saving image, audio, and text files individually, and linking them to the core Flash/multimedia through an XML database. See section 5.2.5 and figure 3 for more information on this process.

#### **4.5.5 Content development**

Maria Ronna Luna Pastorizo was in charge of content development. Liaising with staff in the History and Geography departments at USP, she assembled the content that was integrated into the educational multimedia program. It was proofread and audited by staff before being translated into 12 languages.

#### **4.5.6 Testing of the educational software**

We utilised an iterative development methodology, in which ideas and applications were tested, modified, and developed in a continuous cycle. We used *paper prototyping*, *usability testing*, and *heuristic analysis* for the testing/feedback portion of this cycle.

##### *Paper prototyping*

Paper prototyping, a process in which potential users view printouts of screens of the planned software, and talk through their actions and opinions of each screen, was utilised in the design stage of concepts, allowing us to refine our approach before development.

##### *Usability testing*

In the later development stage, once a functional prototype was available, we ran usability tests. These tests were either recorded with screen-capture software (BB FlashBack – <http://www.bbconsult.co.uk/BBFlashBack.aspx>) or through note-taking by Maria Ronna Luna Pastorizo, a research assistant for the project. Tests were conducted with 21 staff and students from eight different countries in the region—Cook Islands, Fiji, Nauru, Solomon Islands, Kiribati, Samoa, Tonga, Marshall Islands—and were augmented with exit interviews (appendix 7.6.1), peer review (appendix 7.6.2), and comprehension evaluations (appendix 7.6.3) to give the development team further insight into the usability and effectiveness of the software.

##### *Heuristic analysis*

The educational software was also tested through heuristic evaluation, in which an interface is examined according to accepted professional usability standards (OCLC, 2003), and was audited by lecturers at USP as to its educational usefulness.

## **5.0 FINDINGS AND CONCLUSIONS**

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### **5.1 Introduction**

Ten major themes were identified during the course of the project: language, group learning, active learning, aversion to questioning authority, contextual and universal approaches to learning, local metaphors, preference for content display, and preference for navigation, usability preferences, and access issues. For each theme, I discuss relevant literature, the results of this study, and the application of each of these themes to educational multimedia development in the region. For instance, in the following section, 5.2 Language, subsections 5.2.1 and 5.2.2 explore the findings in relation to existing literature, while 5.2.4 and 5.2.5 give specific, practical recommendations related to the language findings, with examples of how these

recommendations can be applied to educational multimedia design and development. This project approaches culturally inclusive educational multimedia from the design and development side, and so does not provide political, infrastructural or financial recommendations.

## 5.2 Language

### 5.2.1 Language preference

In summary, although students at the DFL centres expressed a preference for English as their major language of instruction, both staff and students expressed the desire for instruction and discussion in the vernacular as well. USP serves twelve different countries, each with at least one vernacular, and two (Vanuatu and Solomon Islands) with over 50 local languages (ethnologue.com, 2003)! In principle, English is the official language of USP (Gold, Swann & Yee Chief, 2002), and all classes are taught in English. In practice, this is usually the case, although in many centres where all students speak the same vernacular the class will often move into the local language.

Ninety-six per cent of students studying on-campus (Laucala Campus, Suva) indicated English as the language used in their classes at USP. Off-campus this figure dropped to 79% (figure 1). When we asked which language the students would *prefer* to use in class, 70% of on-campus students and 76% of DFL students preferred English over their mother tongue (figure 2).

**Figure 1:** Students' response to "What language are you taught in at USP?"  
(appendix 7.1)

	On-campus		Off-campus		Combined	
	Number	Per cent	Number	Per cent	Number	Per cent
<b>English</b>	137	96	62	79	199	90
<b>Vernacular</b>	0	0	2	3	2	1
<b>Both</b>	5	4	14	18	19	9
	$\chi^2(2, N = 142) = 249.55,$ $p < .0001$		$\chi^2(2, N = 78) = 77.53,$ $p < .0001$		$\chi^2(2, N = 220) = 320.149,$ $p < .0001$	

**Figure 2:** Students' response to "What language do you prefer to be taught in?"  
(appendix 7.1)

	On-campus		Off-campus		Combined	
	Number	Per cent	Number	Per cent	Number	Per cent
<b>English</b>	99	70	59	76	158	72
<b>Vernacular</b>	31	22	7	9	38	17
<b>Both</b>	12	8	12	15	24	11
	$\chi^2(2, N = 142) = 85.69$ $p < .0001$		$\chi^2(2, N = 78) = 63.30$ $p < .0001$		$\chi^2(2, N = 220) = 145.023$ $p < .0001$	

However, the picture changed considerably under qualitative analysis. Nearly every staff-member interviewed said that, at times, they needed to explain in the students' local language for students to understand the course content (appendix 7.7: NmLanguage).

For example, a staff-member at the Nauru centre indicated that while she generally conducts her courses in English, she often uses Nauruan when the students are confused.

[Students often say,] ‘Miss can you please talk in Nauruan?’  
They are too shy to speak English. They’ll start fidgeting if I ask them to speak in English. They know it but they’re shy. If they have a Fijian or Filipino teacher they can speak English, but with a Nauruan teacher they prefer Nauruan.

– a tutor at the Nauru Centre (appendix 7.7: NmNauru)

Staff members reiterated this need for local language at most of the centres visited:

They need someone who knows their local language very well.  
– a Solomon Islander teaching at the Kiribati Centre (appendix 7.7: NmKiribati)

After class, when there are no other English-speaking students around, they ask me to explain in Samoan.

– a lecturer at the Samoa Campus (appendix 7.7: NmSamoa)

All students understand English, it’s just when it comes to tutoring, or when a point needs to be understood subtly, the students and the tutors prefer to exchange in the local language.

– a program assistant at the Tuvalu DFL Centre (NmTuvalu, 2003)

They are not comfortable asking questions in English.

– a tutor at the Solomon Islands Centre (appendix 7.7: NmSolomons)

You have the whole thing [in English] and then you say it in local language and suddenly they understand: ‘Oh, is that it?’

– an Institute of Education staff member at the Laucala Bay Campus, Suva (NmSporeBrainstorm, 2004)

Students expressed similar preferences in interviews. When confused, they needed their local language to help them understand, and they generally used local language for discussions outside of class.

Most people would prefer their own language over English.

– an outer-island Kiribati student (appendix 7.7: NmKiribati)

I prefer in English, but it is better to have both Samoan and English.

– a student in Savaii, Samoa (NmSamoa)

Likewise, a Geography student at the Marshall Island’s RMI-USP centre complained that as her teachers did not speak Marshallese, she often had to turn to fellow students for explanations (appendix 7.7: NmMarshalls) and a Kiribati Computer Science student stated that although she would prefer English as the main teaching language, she needs the Kiribati language when confused (appendix 7.7: NmKiribati).

An interview with a Fijian student studying at an American University (NmStudents, 2003) raised some further issues concerning the transition from vernacular-augmented to purely English instruction. Although English had been the primary language of instruction during his studies in Fiji, he had been able to use Fijian to discuss concepts with students, and so he often thought about course work in Fijian. Studying at an American University, he found he had to learn to “grasp the concept in English, to think in English”. Eventually, he made the transition to English to such a degree that he had difficulties explaining the concepts to his friends back in Fiji because he had “to translate back to Fijian”. His learning had become so divorced from his own language that he had difficulties conceptualising his studies in his mother tongue.

The difficulty English poses to students in the USP region features prominently in academic literature as well (Pagram, Fetherston & Rabbitt, 2000; Taafaki, 2001; Taufe'ulungaki, 2003).

... every group reported ‘understanding the lecturer’ as their main learning difficulty ... difficulty in understanding his/her accent; speaking too fast; using difficult words; not using local examples; not explaining clearly, not approachable. (Thaman, 1999)

Clearly there are issues other than language comprehension at play here (many of which are addressed in later sections), but providing additional explanations in both the vernacular and simple English is one way to ease difficulties in communication.

There are also indications that choice of language for instruction affects the depth of conceptual learning of the course material. Kalolo (2002) laments the emphasis on rote learning and copying notes in the Tokelau education system. He focuses on the role of the English language in this surface approach to learning, pointing out that “critical thinking and problem-solving are often language dependent, and students do not have the language or the skills for either”. Taufe'ulungaki (2000) cites a Tongan case study in which students were given exams in both English and Tongan. “In all the subjects tested, the results clearly demonstrated that understanding of content and skills was far superior in the Tongan language” (Taufe'ulungaki, 2000).

### **5.2.2 Language and culture**

While we speak of the practical importance of local language for educational multimedia, it is important that we also give some consideration to cultural aspects. A survey of academic literature in the region supports the inclusion of vernacular language in curricula. As the Dean of the Faculty of Education at the National University of Samoa puts it,

‘O la ta gagana o lo ta faasinomaga’ roughly translates as ‘our language is our heritage, our origin, our reason for being and belonging’. I would go even further and state that our languages mean even more than our fanua [land] ...  
(Afamasaga, 2002)

The view that vernacular language in education is vital to the survival of culture is echoed by many leading Pacific educationalists (Sami, 2004; Taufe'ulungaki, 2003; Veramu, 2004). Thaman (2002) puts the ability to communicate in at least two languages—each student’s own vernacular and English—at the top of her list of

ideal outcomes for education systems in the Pacific. Likewise, the 1992 UNESCO seminar on “Education for Cultural Development” held in Rarotonga recommended that educational policy recognise the role of language:

The survival of the indigenous home tongue is crucial in its own right, and as the primary means of cultural understanding and participation, and for the survival of the culture itself. (UNESCO, 1992)

Similarly, Linda Tuhiwai Smith (1999) frames the importance of “our language as an uninterrupted link to our histories”. Michael A. Mel (2001) explores the subjective perceptual qualities of language in Papua New Guinea, stating that “language is not a neutral medium that reveals truths about the world, but is used by individuals to impose meaning and make a meaningfully constituted world.”

There is also a political dimension to culture and choice of language:

This dependence on the colonial language is an insidious legacy for a nation that has purportedly attained political self-determination. (Puamau, 2002)

In summary, staff and student input as well as a review of academic literature supports the inclusion of local languages in educational multimedia, both for aspects of practical comprehension and for benefits to cultural sustainability.

### **5.2.3 The role of English: counterpoints to Vernacular in tertiary education**

It is important to remember that English is the official language at USP, and is necessary for the kinds of jobs many USP graduates seek. Vernacular instruction at the tertiary level is seen by some as a crutch, atrophying English language skills that are vital in the workplace as well as in formal educational institutions. In the Marshall Islands, a teacher spoke of learning in the Vernacular at University as a disadvantage to students, and felt that providing simple English alternatives to academic language was also detrimental to the students’ education.

I do not want it to be simplified; they need to learn it. (appendix 7.7: NmMarshalls)

There are also many cases (particularly in technical fields) in which translation to the Vernacular would muddy rather than clarify teaching materials.

Often it takes 10 sentences (in Marshallese or Tongan, for example) to explain one technical term of English. (appendix 7.7: NmMarshalls)

It is also important to note that many of the cultural considerations of language enter debates concerned with basic education for total populations rather than tertiary education. This does not mean that Vernacular languages have no cultural value in tertiary education, but that its role in relation to English is very different than in a primary school setting.

As such, I do not advocate replacing English instruction with Vernacular (which would be impossible even if I did advocate this for tertiary education); rather I stress the importance of providing a place for vernacular instruction in formal education and

educational technology. Presented alongside tests, texts and lectures in English, educational multimedia can provide vernacular alternatives that help students understand their overwhelmingly English language materials. Localising materials in this way can help more isolated students, as it complements the role already played by vernacular tutors at DFL centres.

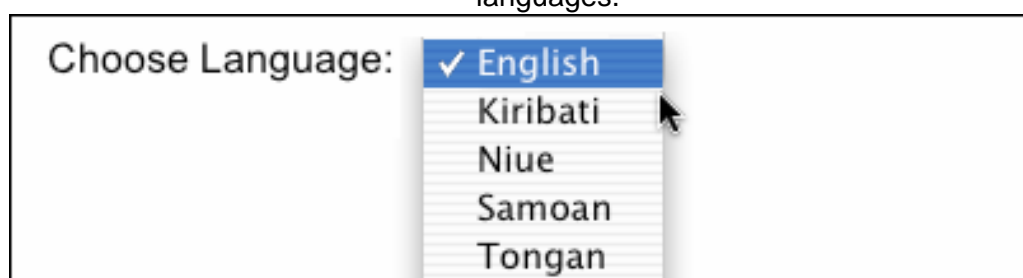
The goal is to provide with multimedia what other media may not, as well as to emulate those aspects of other media and formats that students most appreciate. This can mean explaining difficult concepts in Vernacular to students without access to multilingual tutors, or, as we will discuss later, complementing long English texts with narrated animations.

#### 5.2.4 Applications to educational multimedia: interface

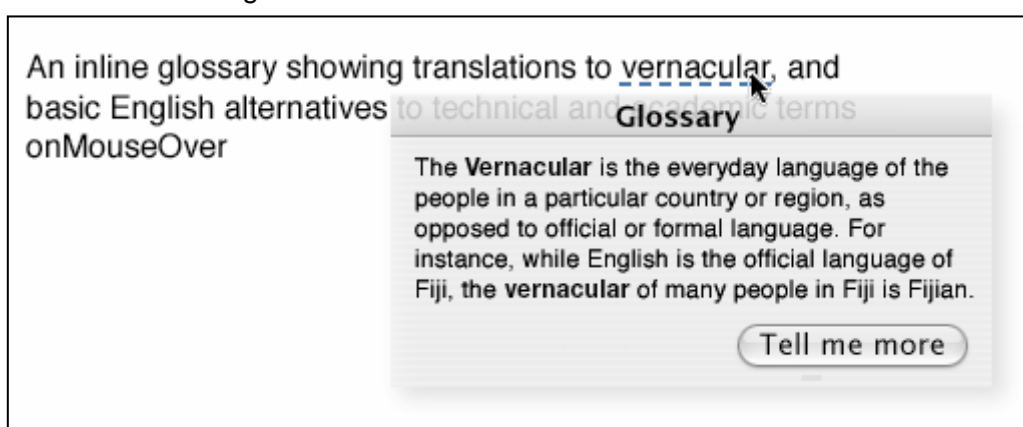
Taken together, we see that while USP DFL students generally prefer English as their main language of instruction, they prefer to use their local language when they become confused. They choose local language for discussions, and when classrooms consist entirely of vernacular-speakers, the class will often be run in this language. By providing alternative explanations in the vernacular and in basic English as a supplement to academic/technical English, educational technology can help isolated students tackle problems of comprehension.

Below are a few ideas for integrating multiple languages into educational multimedia.

**Figure 1:** A pull-down menu translates the text on a given page to local languages.



**Figure 2:** An inline glossary featuring translations to vernacular, as well as basic English alternatives to technical and academic terms

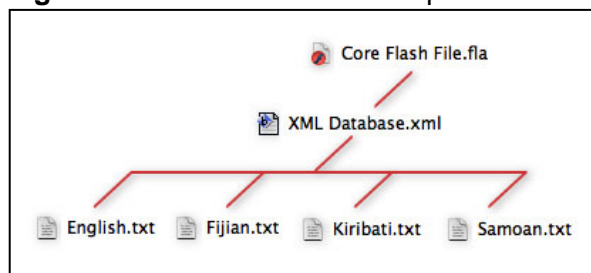


#### 5.2.4 Applications to educational multimedia: file structure

Translating course material into at least 12 different languages is no small task, and finding translators for some languages in the USP region who are also skilled at multimedia can be virtually impossible. As such, it is important that the multimedia programs be structured so as to ease this process, keeping the translated text in separate “flat” text files that can be edited in commonly available software such as NotePad, SimpleText and Word.

In the example illustrated in figure 3, the core multimedia programming is done in Macromedia Flash, a brand of multimedia development software. A list of available languages and alternative explanations is stored in a separate XML (Extensible Markup Language) file. The language files themselves are stored in individual text files.

**Figure 3:** a three-tier “mothership” file structure



When users select their language preferences, the appropriate text file is loaded into the educational multimedia program for viewing. In this way, translators need only understand how to use a basic word processor, without needing multimedia development software. This approach is similar to the “Mothership” structure tested in a previous DFL project at USP (Robbins, 2003), in which audio files and animations were each stored separately from the core multimedia development software. This can have the added benefit of providing simple text files that can be retrieved, edited and printed without running the educational multimedia program itself. This is useful for those with older computers incapable of running high-end multimedia, or who may not be comfortable using educational multimedia, preferring to use the operating systems’ built-in file navigation methods (opening documents in folders, etc.). The approach can also make the separate elements of a multimedia project (text, images, video, audio) available for re-use in other projects and other media, along the lines of learning objects in Object Oriented Instructional Design (Parrish, 2004).

#### 5.3 Group learning

There you say big I  
There you say big I  
There you say big I

Here there’s no big I  
Here there’s no big I  
Here there’s no big I

Only small i  
Only small i  
Only small i

And big WE  
And big WE  
And big WE

(Teaero, 2000)

It is commonly held that South Pacific learning cultures are traditionally collaborative (Mel, 2001; Taufe'ulungaki, 2003; Thaman, 2003; Va'a, 1997). The ability to share the learning process is a vital aspect of instructional design, particularly for indigenous learners in the Pacific (McLoughlin & Oliver, 2000).

However, staff and students presented drawbacks as well as benefits of communal learning at USP. In this section, we discuss how educational multimedia can be designed so as to emulate the aspects of group learning staff and students appreciate in the USP context, while minimising those aspects seen as difficult.

#### *Helpful aspects of group learning at USP*

In a nutshell, learning in groups encourages local contextualisation of learning materials, helps students find answers to questions they are unwilling to ask lecturers, and can encourage deep learning. Moreover, the group work skills learned in communal learning environments can be beneficial in their own right.

### **5.3.1 Local context and language**

Learning in groups can help students recontextualise their learning materials to their own circumstances. As a regional university serving students from over 12 different countries speaking dozens of languages, USP's coursework is often divorced from the home cultures of its member-nations (Thaman, 2000). Many lecturers and course books come from abroad, English is a second language (or third, or fourth!) for most students, and the educational system itself was imported from another part of the world. Learning with others from the same cultural group can help make students' education more understandable and applicable (Okamura & Higa, 2000; Pagram, Fetherston & Rabbitt, 2000). As a USP student noted in an earlier study,

'I find it (studying with others) really rewarding. Somehow lecturers, they seem to teach in a code, if I might say, code of their own, using complicated terminologies and whatever, like we walk in there, we sit in and absorb 50–60% or maybe 40%, but when we discuss with our own classmates, we sort of water down whatever has been given in lectures and we understand.'  
(Landbeck & Mugler, 1994)

### **5.3.2 Aversion to questioning authority**

Students who do not generally ask questions of lecturers are often more likely to seek help from their fellow students (Reeves & Reeves, 1997 in McLoughlin & Oliver, 2000). Whether due to cultural norms for acceptable behaviour towards elders (Nabobo, 2003; Teaero, 2003), practical difficulties conversing with Suva-based lecturers from remote DFL centres (Berno, 2001, Gold, Swann & Yee Chief, 2003), or the gulf between traditional and classroom-style discourse (Taufe'ulungaki, 2000), many students feel uncomfortable asking direct questions to their lecturers. Learning from their peers can help these students get their questions answered (Hutakau, 2002; Landbeck & Mugler, 1994). As a foundation student at the Samoa USP Centre pointed out,

There are some students who get their message from other students rather than from the teacher. (appendix 7.7: NmSamoa)

At the Cook Islands DFL Centre, students create their own peer-learning opportunities:

We've had problems come up, so we need help from each other, so we make plans to meet in the library, and also in the kitchen late at night, bring our own biscuits and food and work together in small groups 3–4–5 students. (appendix 7.7: NmCooks)

### **5.3.3 Deep learning**

For many distance-learners at USP, course materials are predominantly text-based and one-way, providing “a passive form of interaction and transfer of mostly factual knowledge, thus resulting in reduced critical thinking and reflection” (Deo & Nabobo, 2003). Collaborative activities enable students to “gain new and different ideas by working with others” (Mel, 2001). Discussion groups can make learning more actively critical and situated than rote, note-copying modes of learning.

As a student at the Nauru centre commented,

Groups are good because more brainstorming is done, more ideas are generated and in Maths we jump on the problem together. Then again, some people are too shy for the groups. (Appendix 7.7: NmNauru)

This sentiment was echoed in an earlier study of Distance Education at USP:

The courses that I did through Extension, I forgot most of the materials and I'm pretty sure that the materials that I did in my Summer School, I won't forget for a long time and I think similar to courses that are run full-time. People don't forget, they apply that. I think, well, the two reasons that I said, that there is a lecturer teaching you, and you sharing your knowledge with a lecturer and other students. (Landbeck & Mugler, 2000)

### **5.3.4 Community: group work in itself is a beneficial skill**

In her list of ideal exit outcomes for Tongan students, Konai Thaman recognises the ability “to work cooperatively with others for the purpose of achieving collective goals” as key for students in the USP region. (Thaman, 2002). Others echo this sentiment at USP:

The [group] workshops also encourage a pan-Pacific feeling of togetherness. While this may not be important for passing ED153 per se, it is nevertheless important in creating in students a feeling of ‘regionalism’. This is important for a regional university like the USP. (Deo & Nabobo, 2003).

In addition to being an ideal, group work is a reality; for many it is a more natural way of approaching tasks than working alone. As a student at the Nauru Centre points out:

You grow up working in groups ... [you] learn better in groups.  
Take it out of the classroom and it's great, it works. (appendix 7.7: NmNauru)

## **Aspects of group learning that present difficulties at USP**

### **5.3.5 Cultural differences: not everyone prefers to learn in a group**

While many staff and students from throughout the region feel that group work is an essential part of traditional Pacific life, USP's formal academic system is not a traditional village system. We cannot necessarily assume that because a student has been raised fishing or tending fields socially, this student will feel comfortable writing reports and conducting reading research as part of a group, or participating in group discussions (Landbeck & Mugler, 2000). A lecturer at USP, Laucala Campus, points out, "group dynamics are different at University than at the village, so parallels aren't necessarily that applicable" (appendix 7.7: NmGroupLearning).

Additionally, differences between cultures within the USP region, and between urban and rural students, mean that many students are simply not raised working in traditional groups systems. Of the centres I visited, this was most evident at the RMI-USP Joint Education Project in the Marshall Islands.

Sometimes they [students at RMI-USP] come to the Centre to do group study, but most of the time they do the individual study. I think it is cultural, it seems they have never done group discussions. (appendix 7.7: NmMarshalls)

They [students at RMI-USP] are not exposed to group work. We tend to do more of that in Fiji. (appendix 7.7: NmMarshalls)

Within Fiji, several staff members spoke of the differences in group work between indigenous Fijians and Indo-Fijians, stating that on the whole, they found their Indo-Fijian students to be "more individualistic" (appendix 7.7: NmGroupLearning) and "independent" (appendix 7.7: NmFrancesKoya). Speaking of students at the Solomon Islands DFL Centre, a staff member pointed out that "some like to do things on their own, some like to do it in groups" (appendix 7.7: NmSolomons) This wide range of sentiments was echoed in most of the centres I visited:

Nauru :

Some just need a quiet space, some want to be in groups. Some will leave a group, get permission to just read on their own. I know they are supposed to be with the group, but when I ask the group, they understand [that] he just wants to be alone. (appendix 7.7: NmNauru)

Kiribati:

[I] prefer group study to solo because others can answer questions in a group.

[I] like to study both in groups and alone.

Students are more comfortable asking questions alone or in small groups.

[I] sometimes study alone, and study in groups when I have problems.

[I] prefer to study in groups, can share ideas.

(appendix 7.7: NmKiribati)

Samoa:

More things I can get by working on my own. I can get answers in my own mind. I never ask in groups. I can do it myself.

(appendix 7.7: NmSamoa)

As is always the case, most generalisations will have exceptions, and with regard to preferences for studying alone or with groups, I found the number of “exceptions” so great that any generalisation on preference for group or individual study within USP’s formal education system would be ill-founded. The best we can do is to cater for students who prefer group work as well as those who prefer to work alone, and to aim to use technology to ease those aspects of group work that pose problems to some students. Aspects of group learning we have discussed so far revolve around translating ‘teacher-speak’ into terms with which the students are more familiar. Aspects of group learning that pose problems are centred on inequities within group learning scenarios, such as unfair distribution of workload and authorities within peer groups.

### **5.3.6 *Unfair distribution of workload***

A lecturer at USP pointed out that uneven workload in group exercises can become a source of frustration for students. “Picking up the slack for others, being held back by others in the group, and feeling ‘used’ by others who don’t work as hard” can often result in a student feeling “I’d rather hand it in alone” (appendix 7.7: NmGroupLearning). A lecturer at the USP School of Law in Vanuatu noted that “students tend to work much better in groups”, but lamented that “study groups can result in virtually identical work being submitted”. (Farran, 2003) The Nauru Centre Director noted the same trend, in which students working in groups sometimes complain that “I don’t want to tell her the answer, she’ll copy that” (appendix 7.7: NmNauru). The importance of preserving individual responsibility in group work is underscored by international research on collaborative educational technology as well (Johnson, Johnson & Smith, 1991; Slavin, 1995 in Moallem, 2003; Burniske, 2003).

### **5.3.7 *Authorities within peer groups***

As discussed previously, a great benefit of learning from peers in groups is that it allows students unwilling to ask questions of their lecturers to get answers to their questions from their fellow students. However, authority-figures can develop within these peer groups, making some students as reticent with other students as they are with their lecturers.

Older students, in-service [employed] students can often intimidate other students because they are seen as being more experienced, and serve as a proxy authority figure in front of which they do not want to be shamed. (appendix 7.7: NmGroupLearning)

If more than one person, only one will dominate, and the teacher must step in to allow, or even force, the other student to get hands-on practice. (appendix 7.7: NmSolomons)

Students don't like to boast so group-learning can make people even quieter. (appendix 7.7: NmNauru)

Before I discuss the application of these findings to educational multimedia development, I will summarise the key points.

Staff and students presented a number of benefits of group learning at USP:

- Group learning allows course materials to be adapted to the local context and language
- Learning from peers allows students to get answers to questions they won't ask their lecturers
- Group learning can enhance deep learning rather than surface memorisation
- Group work is itself a valuable skill to develop

Staff and students also expressed a number of drawbacks with group learning at USP:

- Due to the many cultural differences it is difficult to generalise students' preferences
- Working in groups can lead to unfair distribution of workload
- Authorities can develop within peer groups, marginalising the same students who are not willing to ask questions of their lecturers

### **5.3.8 Application to multimedia development**

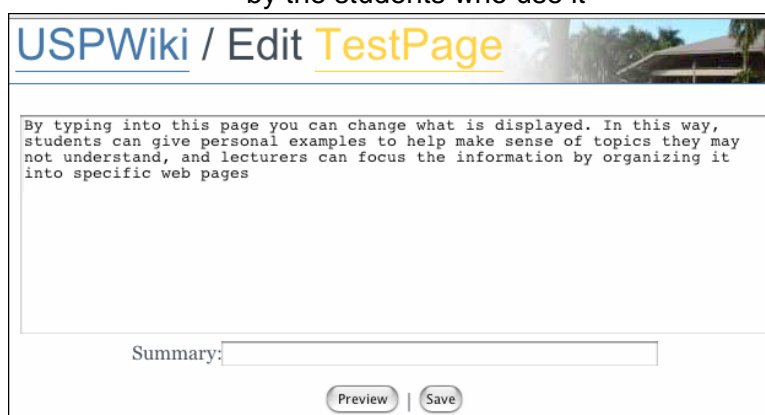
*Local context and aversion to questioning authority*

*Discussion Boards and Wikis*

The ability to adapt materials to the local context and language of students is an aspect of group learning on which educational multimedia must focus. This can be achieved on an educational website through discussion boards and "wikis", collaborative websites that can be edited by any viewer. The term "wiki" is derived from the Hawaiian *wikiwiki*, meaning "quick" (Cunningham, 2003). As such, a wiki is meant to be a quick and easy way for non-technical users to create websites together.

Like the electronic discussion board, the wiki enables staff and students to ask questions and give feedback when they are physically isolated from fellow students and lecturers. A key difference is that while in a discussion board users can add comments progressively to a web page, in a wiki, users can edit each other's content. This allows users to hone the same content into a collaborative website, facilitating a more structured result. It is an approach more in line with consensus than debate, closer to traditionally Pacific approaches to decision-making (Taufe'ulungaki, 2000, 2003; Teaero, 2003). At the same time, the unstructured and unscaffolded aspects of the wiki would need to be modified for use at USP. I have created an open "USPWiki" (figure 4) for testing and feedback, which you can see and edit at: <http://www.uspwiki.grographics.com>.

**Figure 4:** The “USPWiki”, a collaborative website, designed to be built and edited by the students who use it



A benefit of these electronic means of peer learning is that they provide a perceived cushion of “e-anonymity” in social situations. Many students unwilling to ask questions of their lecturers in person, video conference or audio conference feel at ease emailing questions or using electronic discussion boards (appendix 7.7: NmMarshalls; Hunter, 2003). As a Maths/Education student at the Kiribati centre put it, “for us it is better to email because it is not face to face” (appendix 7.7: NmKiribati).

However, as many students have little or no access to the internet at the various centres, it is important that we also develop solutions not reliant on the internet. Moreover, the wiki, discussion board, and email are primarily text-based communications, which can alienate some students. Multimedia has the potential for much more than text-based communication of ideas. As a DFL staff member at the Laucala Bay Campus pointed out,

“Computer alleviates the ‘loneliness of books’ because it is interactive, like a person, has images and sounds, helps communicate with people.” (appendix 7.7: NmFiji)

In summary, it is important to develop communal-learning technology that:

- offers alternatives to purely textual interfaces;
- is scaffolded;
- is not dependent on the internet; and
- preserves interpersonal aspects without “putting students on the spot”.

#### *Virtual peer*

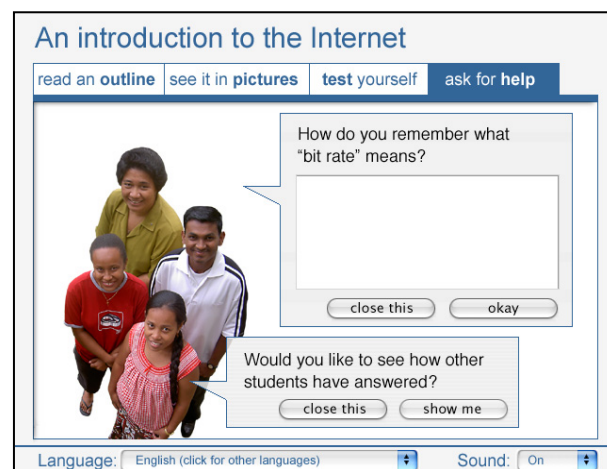
A “virtual-peer” achieves many of these goals. In figure 5, a group of peers representing different cultures in the South Pacific discusses aspects of the internet using metaphors from their home countries. Clicking the “show me” button can bring up an animation, illustration, or audio clip, so the interface is not predominated by text. And by providing these alternative explanations in vernacular language, the teaching can be further situated to the student’s learning environment.

**Figure 5:** A virtual peer gives his or her own descriptions of the concepts in local terms



To further situate the learning to the student's own circumstances, the student is asked to make his or her own descriptions of the concept at hand (figure 6). These answers are saved on the computer for future iterations of the program, allowing other students to view each other's perspectives. This enables a degree of collaboration without the need for an internet connection.

**Figure 6:** The student is asked to make his or her own metaphors to describe streaming media

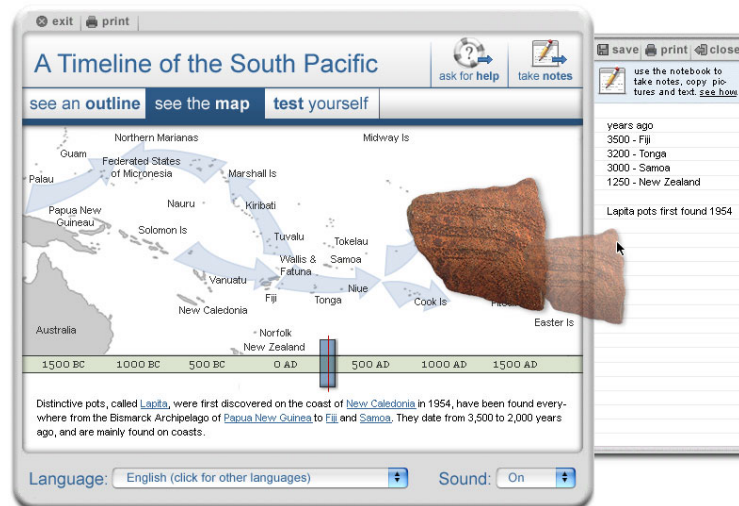


### *The digital scrapbook*

When staff and students spoke of the aspects of collaborative learning they appreciated, the opportunity to share ideas came up frequently. A common thread through these conversations was the chance to translate what they were learning to their own situations and language, or as Mel (2001) puts it, "local participation in making and realising the world". As such, in order for educational multimedia to reap the benefits of collaborative learning without the aspects that cause difficulties for some students, it must enable students to communicate with each other and actively to alter their learning materials to make them more applicable to their local context and learning/evaluation needs without putting the students on the spot. As I met with different students and staff, these dichotomies came up regularly, until during the Solomon Island Centre site visit Jerry Pakivai, the computer teacher, came upon an idea that seemed to cater to all these groups: the digital scrapbook (appendix 7.7:

NmSolomons). A digital scrapbook (figure 7) meets all of these criteria by allowing the students to copy portions of text, images and even video into their own electronic scrapbooks, add their own information or summaries, trade their creations with other students and save them for individual study. By mixing a degree of constructive learning with passive materials, the electronic scrapbook caters to different types of students. Making the scrapbook printable enables it to be used at the student's home or when the electricity (often inevitably) goes out.

**Figure 7:** A digital scrapbook integrated into an educational multimedia program



The “Mothership” approach to file structure discussed earlier (section 5.2.5), in which we externalise all files from the core multimedia software, extends the electronic scrapbook idea further by allowing the individual student’s assembly to go on outside of the educational multimedia program. If every image, video, text and audio file is saved separately, students can view and reassemble many media assets without ever opening the educational multimedia program itself. This direct access to the individual components of a multimedia project is useful for students with older computers incapable of running high-end multimedia, or who prefer to use the operating system’s built-in file navigation methods (opening documents in folders, etc.).

## 5.4 A contextual approach to learning

### 5.4.1 Learning as a whole, rooted in context

Many Pacific approaches to learning are rooted in the local context of the concept’s application and use (Pabram, Fetherston & Rabbitt, 2000; Taufe’ulungaki, 2003; Thaman, 1992, 2003; Va’a, 1997). Ideas are taught as they are applied in real life, rather than as abstract theories. This approach to contextual learning focuses on the idea or activity as a whole, rather than being broken into distinct conceptual building blocks (Harris, 1992; Thaman, 1992; Yorston, 2002). In order to preserve the whole, complex activities are tackled as “successive approximations of the efficient product” (Harris, 1992). In other words, rather than master each step consecutively, learners witness and then imitate the whole, attaining the desired goal through “trial and error” (Mel, 2001). For example, in learning a musical piece using successive

approximations to the whole, a band would play the entire piece through until they had mastered it, as opposed to repeating individual refrains. In this way the learners focus on the purpose of the task as a whole.

In the formal sector, where abstract “universals” are often required, the base is firmly rooted in the student’s personal context before progressing to the abstract.

We don’t just give the concept and let them apply it; we proceed from known to unknown based on student’s background, and then link to the abstract concept.

- A lecturer at USP Laucala bay Campus (appendix 7.7: NmSporeBrainstorm)

The goal then, is to encapsulate complex ideas within a simpler framework that is based on something the student already knows, and to maintain that framework as we increase the complexity of the concepts covered.

#### **5.4.2 Local metaphors**

Cultural context is an incredibly important aspect of learning anywhere in the world, but it becomes a particular focus when there is a gulf between the cultures expressed in the educational materials and institution and those of the students. Traditional educational hierarchies in most member-countries of USP require that learning be grounded in the needs and context of indigenous culture before the learner is considered to have attained a high degree of knowledge (Ene, 2003; Lima, 2003; Mokoroa, 2003; Nabobo, 2003; Teaero, 2003; Thaman, 2003).

On a purely practical level, students perform better when concepts are explained in terms of their personal experience (Okamura & Higa, 2000; Taufe’ulungaki, 2000). However, much of the educational material used in the Pacific utilises examples and metaphors from Europe, North America or Australia (Henderson, 1993, 1996 in McLoughlin & Oliver, 2000; Thaman, 2000). Thus, the task of using local examples in most cases falls to the teacher.

A tutor in the Solomon Islands DFL centre spoke of his students’ difficulties with Australian textbooks filled with Australian examples, and offered me the advice, “try to use a local example” (appendix 7.7: NmSolomons). The program assistant at the same centre echoed these sentiments:

It would be good to go through the courses to see where a regional example can be used, for each course, and truly go outside when we cannot find a regional example. (appendix 7.7: NmSolomons)

He went on to explain that even regional examples can sometimes be isolating:

Some of the course writers only use examples from the countries they know. If you look at sourcebooks, most use examples from Fiji and Samoa. (appendix 7.7: NmSolomons)

Staff at the Nauru centre also expressed the need for truly local examples:

The exam paper had to do with kava. It was like double-dutch to us. (appendix 7.7: NmNauru)

Most of the examples are very Fijian. We don't have veggie markets. We don't have military management. I have to pick something we can identify with. (appendix 7.7: NmNauru)

In Solomon Islands, the chemistry tutor used the local practice of chewing betelnut to teach about acids, bases and the chemical reactions of calcium oxide, lime and water (appendix 7.7: NmSolomons). In Kiribati, a computer science tutor used the main atoll's one road to illustrate the concept of bit-rate and bandwidth: "here we have one lane, but get them to imagine we have several" (appendix 7.7: NmKiribati).

Lecturers also used local metaphors for more general tasks, such as course management. A lecturer at the USP Laucala Campus helps students see the inter-relatedness of the individual components of the larger course as a whole by describing the individual sections of the course as the strands of the *sasa* broom, bound together to form a whole. She solidifies the idea that the components are all important to the whole with the aphorism "when you are a coconut, every part is useful" (appendix 7.7: NmSporeBrainstorm).

She also calls on the region's culture of story telling, illustrating different parts of the course with symbolic imagery:

On day one of the course the lecturer tells the story of the whole course, with pictures . . . and we are always going back to the map story/conceptual map ... relating it to a symbol.

- A lecturer at USP Laucala bay Campus (appendix 7.7: NmSporeBrainstorm)

So, we see that local metaphors and imagery are often used to unify concepts that may otherwise seem disparate.

### **5.4.3 Observation and imitation**

Observation and imitation are mainstays of learning (Lima, 2003; Pabram, Fetherston & Rabbitt, 2000; Taufe'ulungaki, 2003; Thaman, 1999; Yorston, 2002). Although appropriate and extremely useful in the village context for planting and fishing, imitation in formal education can manifest itself less desirably as rote memorisation and surface learning (Landbeck & Mugler, 1994). A Samoan student, quite accomplished at the traditional dances she had learned through observation and imitation, complained that in formal schooling, rote memorisation was often a much more difficult way to learn than "being given simple ways to remember things" (appendix 7.7: NmSamoa). Tying observation and imitation activities to application rather than memorisation can encourage deep learning (Landbeck & Mugler, 1994). In other words, showing how a concept can be applied to something the student already knows can situate the knowledge more deeply than having students memorise sets of tasks or terms. Designing these activities such that "without understanding the concept they [the students] cannot do the activity" can push the student further towards deep learning without sacrificing their familiar base of observation and imitation (appendix 7.7: NmSolomons).

This progression from rote imitation to more interpretive extrapolation can be found in the learning hierarchies of the traditional educational systems of many countries in the USP region. In Kiribati, learners progress from the base, rote level of knowledge (*atatai* 'acquainted with') to *taneiai* ('experienced') through repetition, but are only considered to be knowledgeable (*rabakau*) once they have the ability to *perceive* and perform (Teaero, 2003). In Fiji, one passes from the *kila ka* level of knowledge (having knowledge of things or events) to *vuku* (being knowledgeable) when one can organise items of knowledge oneself (Nabobo, 2003). And in Noolo society in Santa Cruz, in Solomon Islands, the notion of *wotipulee* (rote practice) is contrasted with the idea of *nakie-e-neoglae* (to analyse, distinguish, divide, separate things) and *noloto* (to examine, judge and evaluate) (Lima, 2003). In all of these cases, secondary or higher levels of knowledge are distinguished from lower levels by the ability to extrapolate from what is learned. After repeating exactly what they see, learners are taught to apply what they had imitated in new circumstances.

Important differences between this approach and popular notions of authentic or active learning are the degree of scaffolding given to the student, and the fact that in these South Pacific systems, learning remains teacher-centred, utilising guided modelling through "elicited imitation" (Jordon et al., 1981 in Taufe'ulungaki, 2000) rather than open-ended simulations requiring independent expansion on the part of the student (Thaman 1999; Va'a, 1997). Additionally, while the ability to extrapolate from what is learned differentiates initial levels of learning in many traditional knowledge hierarchies, it is the relevance of the learning to the learner's own culture, and the use of that knowledge with others from the learner's society, that defines the highest levels (Nabobo, 2003; Thaman, 2003; Mokoroa, 2003; Teaero, 2003).

Taken together, contextual approaches to learning in the South Pacific give us three major goals in the design of educational multimedia:

- 1) Show the big picture even when dealing with small sections of the whole.
- 2) Organise interactions around imitation that successively approximates the desired result.
- 3) Utilise local metaphors as building blocks to more abstract concepts.

#### **5.4.4 Application to educational multimedia: preserving the whole**

I found one simple way to preserve "the big in the small" while looking for something else entirely. During the study, we asked 155 students of the University of the South Pacific (72 off-campus/DFL, 83 on-campus) to choose between two web designs (appendix 7.3). The goal was to determine whether the students would feel more comfortable with contextual, inline navigation (links within the body of the text), or with a separate menu listing all of the links apart from the body of text. I expected students to prefer the simpler, inline approach, as this is closer to the layout of books, and so would be more familiar to them than the web-derived navigation menu. However, my hunch was proven unequivocally wrong: 93% of the students preferred the menu navigation (the "O" option in appendix 7.3,  $\chi^2 (2, N = 155) = 250.90$   $p < 0.0001$ ). When asked what they preferred about the menu navigation, popular responses included "keywords are categorised and listed on the sides", "easy to follow/understand", "main points are listed on the extracts", and "clear and to the point". Students appreciated that the separate menu neatly summarised the longer text, and allowed them to jump directly to points of interest without losing their place.

In the terms of the academic literature discussed earlier, the separate navigation menu anchors the individual aspects of the text within the context of the activity as a whole. In essence, the menu plays the same role as the previously mentioned lecturer's *sasa* broom, providing a quick visual key that shows how the separate

concepts in a course are interrelated. The broader implication of this finding is that, in designing educational multimedia systems in the region, we need to be sure that the goal or outline of the lesson as a *whole* is displayed regardless of how detailed a student's immediate activity may be. This finding is in line with several "Western" usability heuristics by providing progressive levels of detail, allowing the student to rely on recognition rather than recall, displaying system status (where the student is in a program and what the program is doing), and by giving students a set of permanent "emergency exits" should they encounter any difficulties in a particular section of the educational multimedia (OCLC, 2003; Nielsen, 2004).

The map/timeline discussed in section 5.4.6 also manages to preserve the whole while showing progressive levels of detail, anchoring the big picture to specific points and activities, which the students can grasp.

#### **5.4.5 Application to educational multimedia: local metaphors**

While the example above utilises interface design to preserve the whole, we can further anchor the information to its greater context by providing local examples within the course content. "Dialogic", interactive approaches have helped motivate indigenous learners in Australia by linking their learning to their own community interests and needs (Ryan, 1992; McCarthy et al, 1991 in McCloughlin & Oliver, 1999). As USP serves 12 different countries, providing truly local illustrations for every concept would be laboriously difficult to achieve. We can, however, give each country its turn, and anchor the regional examples to the student's own background by giving the student a chance to input. Examples discussed earlier such as the wiki (figure 4) and virtual peers (figures 5 and 6) provide such decentralised modes of contextualisation.

#### **5.4.6 Application to educational multimedia: successive approximations through imitation**

For the educational multimedia developer, designing observation and imitation activities to provide specific anchors can help students progress from rote to extrapolated learning, imitating the "successive approximations" through imitation that Pacific learners use in the "real world" (Harris, 1992). Frequently Asked Question (FAQ) lists can serve as seed-questions for students' further queries (appendix 7.7: NmFrancesKoya; Hunter, 2003; appendix 7.7: NmNauru). Virtual peers who contextualise key concepts to their own personal situations can ask students to do the same themselves. Quizzes within the multimedia learning materials can progress from testing memorisation to requiring improvisation on the part of the student. Note-taking tools like the digital scrapbook allow the student to modify the materials into their own point-of-view.

The key concept is that activities are example-based: the students are shown how to do something, and after imitating that method, learn through trial and error rather than verbal instruction (Pabram, Fetherston & Rabbitt, 2000). As such, multimedia activities should be designed as demonstrations to imitate, rather than instructions to follow. In figure 8, a student seeking help with the interface of an educational multimedia program is shown what to do rather than merely being provided with instructions.

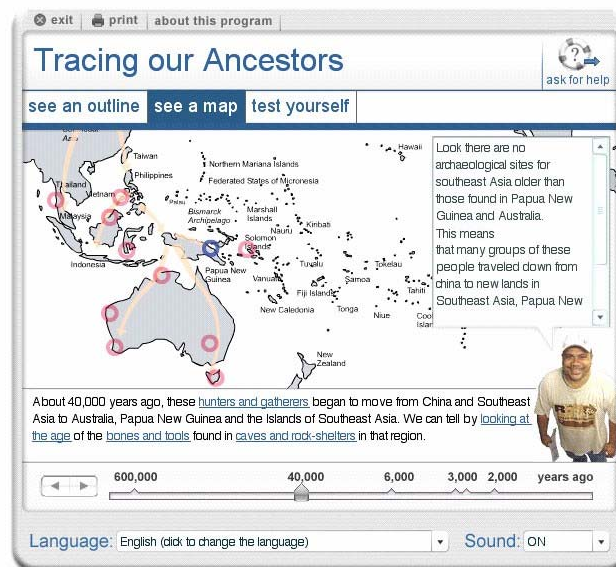
**Figure 8:** instructions are paired with an overlay showing how to act on the instructions within the interface itself



This same approach, by programming timers that automatically demonstrate the options for the user after a period of inactivity, can be used to help students with a tendency to “freeze” when confused.

Modelling has obvious applications in digital simulations of tools or science labs, and can be used in more conceptual applications as well. For example, when designing the multimedia materials for this project, we decided to use an interactive map/timeline to demonstrate immigration patterns into the South Pacific. We chose this method because it is less text and language dependent than charts or essays. Applying the idea of successive approximations, we present the student with a simple initial layer of information (arrows showing immigration patterns), augmented with deeper layers of information (descriptions of archaeological remnants at different sites or related stories from regional oral histories) the student can access into by clicking sections of the map/timeline with his or her mouse. See Figure 9.

**Figure 9:** using successive layers of approximation on a map/timeline to show immigration patterns into the South Pacific



A modification that would combine successive approximations with trial and error is to treat the map/timeline as a game board, allowing the students to move pieces

representing the explorers to different parts of the map at different historical periods, or to draw the arrows themselves after watching the animations. The idea is that, after seeing how people moved from island to island, the students could copy those movements. Ideally, students would notice the interplay between a few selected elements such as language development, archaeological remnants, oral histories, and immigration patterns, giving them a broader picture of the whole.

In summary, educational multimedia developers need to be sensitive to the contextual nature of learning in the region, ensuring that the big picture is clear even when dealing with small sections of the whole, organising interactions around imitation that successively approximates the desired result, and utilising local metaphors as building blocks to more abstract concepts. The tools we have proposed for this purpose include FAQ lists, interactive outlines/navigation menus, multimedia note-taking tools such as the digital scrapbook, and the portrayal of historical episodes in a visually cohesive timeline/map.

## 5.5 Access

### 5.5.1 Access to multimedia at USP DFL centres

Although we did not specifically focus on physical access to computers in this project, it did come up frequently during interviews, and obviously has a huge impact on the usefulness of educational multimedia. In a nutshell, internet access is unreliable and inaccessible for most distance learners at USP (Frank & Toland, 2002; Landbeck & Mugler, 2000; Primo, 2001; Tuimaleali'ifano, 1999). In 2002, a total of 249 computers with internet access was available for nearly 17,000 distance students, or an average of over 68 students per computer (without making allowance for the number of countries). See Figure 10.

**Figure 10:** Number of students, computers (PCs), and computers with internet access at USP DFL Centres in 2002

DFL centre/subcentre	Students	PC's for student use	Internet PC's	Students/PC	Students/internet PC
Tonga	1044	19	10	55	104
Tuvalu	117	2	1	59	117
Kiribati	1491	12	12	124	124
Niue	230	8	8	29	29
Marshall Is	97	14	11	7	9
Cook Is	245	10	9	25	27
Nauru	107	7	7	15	15
Solomon Is	1838	6	6	306	306
Lautoka (Fiji centre)	1662	51	51	33	33
Raiwaqa (Fiji centre)	7631	30	30	254	254
Labasa (Fiji subcentre)	990	50	50	20	20
Emalus (Vanuatu centre)	1117	66	40	17	28
Alafua (Samoa centre)	418	16	14	26	3

(Source: USP ITS department)

At first glance, it is evident that there is a wide disparity in computer and internet access at the different centres, from the Marshall Islands with one computer for every seven students, to Solomon Islands, where one computer serves over 300 students. However, computer access is improving, albeit incrementally. For instance, the Japan International Cooperation Agency (JICA) has donated 87 computers to USP DFL Centres since this survey was taken, and a further upgrade of USPNet is currently being planned (JICA, 2004a). Despite these efforts, internet access is still a difficult prospect for many DFL students in the region.

Looking beyond the data, there are additional hurdles students encounter in accessing computers, including limited bandwidth, unreliable electricity, and physical isolation of students from the centres. Due to limited bandwidth, many centres impose restrictions on the amount of time students may spend on the internet. At all but one computer lab at the main campus in Suva, students may access the internet only after 10 pm. In the Marshall Islands Centre, internet access was limited to 2 hours per day (appendix 7.7: NmMarshalls). In the Nauru and Solomon Islands centres, electricity cuts of up to five hours a day further limit the students' access. Once online, the prospects for educational multimedia are little better, as the connection speed is too slow to handle rich media content (appendix 7.7: NmAccess; NmNiue, 2003; appendix 7.7: NmSolomons).

In addition to connectivity issues at the centres, transport to the centres poses problems for many students. Most USP member countries consist of groups of islands scattered over expanses of ocean, so students outside the main island are effectively isolated. Tuvalu, for instance, is made up of 9 groups of islets, each separated from its neighbouring group by at least 6 hours by typical boat. None of the outer islands has internet access and boats are very erratic, with no set schedule, so it is a major logistical problem to send books, receive assignments, and communicate with students. As a program assistant at the Tuvalu centre put it, "the centre is only effectively accessible to approximately a seventh of the entire population" (NmTuvalu, 2003). And although Kiribati has an inexpensive and quick transportation system on the main atoll of Tarawa, outer-island students rarely venture into Tarawa, so their access is effectively zero (appendix 7.7: NmKiribati). In Samoa, the trip from Savaii, the largest outer island in Samoa, to the USP centre on Upolu takes several hours (appendix 7.7: NmSamoa). Many of the outer islands in Solomon Islands are days away by boat (appendix 7.7: NmSolomons). Even in Nauru, one of the smallest and most centralised of all the countries served by USP, fuel shortages prevent many students from regular attendance (appendix 7.7: NmNauru).

### **5.5.2 Application of access issues to multimedia development**

Clearly, many students do not have regular access to computers, and while the average multimedia developer cannot simply provide more computers and internet access, there are some meagre methods at our disposal to improve access to what we create. We can take our major cues from the students' own solutions when faced with isolation. A student in Savaii, Samoa, has used fax to communicate with her lecturer in Suva (appendix 7.7: NmSamoa). In Solomon Islands, outer-island students use radios from local churches, clinics, and schools to contact one staff member's personal radio at home (appendix 7.7: NmSolomons). The Lautoka Centre, Fiji, deals with the isolation of many of its students by providing video tapes of lectures so that students can watch several videos in one visit to the centre, or, preferably, take them home to watch at their leisure (appendix 7.7: NmLautoka). This approach has the additional benefit of including the family in the student's education

process. Of course, this approach does nothing for those students without electricity or video players, or those too far away from the centres ever to come in.

Providing alternative media can help the educational multimedia developer lessen the marginalisation of the isolated student. Radio is an incredibly accessible and flexible medium, one that must not be overlooked in the rush for newer technologies, and printed materials are vital even to those students with regular computer access. As this project focuses on the role of the educational multimedia developer, rather than of the radio producer or textbook writer, let us look at the ways we can make multimedia itself more accessible to distance students.

First, it is my contention that we cannot currently rely on the internet as the sole vehicle for transmission of educational multimedia at USP. Connections are too slow and irregular even at the main campus in Fiji. As such, I suggest that educational multimedia be distributed as interactive CD-roms as well as websites. If the interactive CDs are made to double as audio CDs, even students without computers can benefit to a degree. Of course, this still requires a CD player and electricity, but this is easier to come by than a computer in many households. Ensuring that educational multimedia can be easily printed is another way developers can make multimedia more accessible. In fact, students taking web-based courses at many DFL centres still request that their materials be printed for them (Hunter, 2003; appendix 7.7: NmVanuatu). The three-tier mothership approach to file architecture (section 5.2.5) can potentially make it easier to isolate elements of the educational multimedia for re-use in other media such as print and radio.

In summary, educational multimedia is a long way from becoming readily accessible in the South Pacific, and it is important that efforts to improve access and design of multimedia do not come at the expense of more traditional educational media. Access is improving, with computer donations, training, and a USPNet upgrade underway (Va'a, Naidu & Jasen, 2003; JICA, 2004b), and it is vital in these early stages of multimedia development in the South Pacific, that we consider how media can be designed most equitably.

## **5.6 Content display preference**

Just as approaches to learning are governed by cultural norms, so are preferences for visual media (Hedberg & Brown, 2002; Evers, Kukulska-Hulme & Jones, 1999; Evers & Day, 1997). The need for an analysis of content display preference is underscored by learner preferences for alternatives to written instruction (Deo & Nabobo, 2003; Taufe'ulungaki, 2000), "charts, pictures, or animated gestures" (Veramu, 1992), the use of symbols and visual metaphors in teaching (NmLocalMetaphors), and the need to show the big picture within the small (NmSporeBrainstorm). Multimedia can emulate and extend many of the beneficial features of other educational media and formats, such as illustrations and discussions. However, if the useful aspects are not suitably understood, such attempts can lose the unrecognised but vital features of the "seed" media and formats that made them so successful in the first place.

In an attempt to ground these more general theories and observations in an application specific enough to be useful for the basis of a multimedia layout, I designed a set of content display preference questionnaires (appendix 7.2). The questionnaires showed five different layouts of the same information pertaining to immigration patterns in the South Pacific. The first option was inspired by a

conversation with a group of USP School of Humanities lecturers referring to “concept maps” and “flowcharts” as methods for displaying “the big in the small” to USP students (NmSporeBrainstorm). It shows the dates of arrival in different countries along a visual timeline. The second option explains the same information in a paragraph of text. In the third option we display the information in a table, summarising the data without lengthy text. The fourth option is the most graphical, laying the data over a map of the region. And the final option preserves the geographical spacing of the fourth option without the additional graphic information. We distributed this questionnaire to over 200 students, and received 196 responses. Approximately half of the students (99) were off-campus DFL students, and the rest were on-campus students in Fiji. The largest percentage (31%) of students preferred the fourth option, the map. However, there was a difference in preference between on-campus and off-campus students, with on-campus students opting for the timeline and the table before the map,  $X^2(4, N = 196) = 12.00$   $p < 0.025$ . See figure 11.

**Figure 11:** Student responses to content display questionnaire (appendix 7.2)

All students (N = 196)			On-campus students (N = 97)			Off-campus students (N = 99)		
	%	No.		%	No.		%	No.
Option 4 (map)	31	61	Option 1 (timeline)	3	30	Option 4 (map)	4	41
Option 1 (timeline)	24	47		2			1	
Option 3 (table)	21	42	Option 3 (table)	4	23	Option 3 (table)	9	19
Option 5 (flowchart/map)	13	26	Option 4 (map)	2	20	Option 1 (timeline)	1	17
Option 2 (paragraph)	10	20	Option 5 (flowchart/map)	1	15	Option 5 (flowchart/map)	1	11
			Option 2 (paragraph)	9	9	Option 2 (paragraph)	1	11
$X^2(4, N = 196) = 21.91$ $p = 0.0002$			$X^2(4, N = 97) = 13.05$ $p = 0.0110$			$X^2(4, N = 99) = 30.95$ $p < 0.0001$		

What is clear in each sample is that the paragraph of text and the experimental flowchart-map are the least popular, while the simpler (timeline and table) and more graphical (map) are more popular. Considering that the great bulk of educational materials are predominantly text-based, it is clear that we need to offer more variety in the display of information. Of course, written language skills are essential at university, as well as in the jobs many students anticipate after graduation. As with vernacular language and English, I do not advocate the removal of all text-intensive instruction, but wish to discuss how educational multimedia, by using images, animations and graphical display methods, can provide alternative explanations of the concepts long texts cover with text and diagrams.

At the same time, it is important to consider that 68% of the students preferred options *other* than the map. When we look at the *reasons* for students' choices, we see that graphics per se are not what the majority of students prefer, but the ease of use and efficiency with which they present information. Looking at the reasons for their choices, students can be divided into three groups, those with preference for efficiency (68%), for graphics (22%), and for detail (7%), respectively,  $X^2(4, N = 196) = 307.47$   $p < 0.0001$ .

### **5.6.1 Efficiency**

Most students gave reasons related to efficiency for choosing their favourite display option:

- "It does not require too much time."
- "Less complicated easier to understand."
- "It has less stuff to read and understand."
- "Easy to study and memorise."
- "... there's no extra diagrams or long boring sentences or other unnecessary stuff."
- "It's straight to the point."
- "Data expressed simply and all races will find it easier to understand."
- "Easy way to list and get some information."

### **5.6.2 Graphics**

The second largest group of the students gave reasons related to visual aspects of the content display:

- "The illustrations are self explanatory."
- "Because of the arrows and an attractive map provided."
- "Clear to understand the direction of the movement of people and when they arrived."
- "Easy to follow the arrows to remember which is the first right down to the least."
- "A bit more catchier [*sic*] than the other captions."
- "Because of picture method."
- "I prefer arrows and illustration when I study."
- "Obviously people looking into the net will prefer pictures rather than words. A good distribution of movement. A picture has thousand words."

### **5.6.3 Detail**

The third largest group of the students cited descriptiveness as the reason for their choice:

- "detailed written form, informative for research purposes."
- "I prefer this to be the easiest 'coz it is more descriptive than the others."
- "it has more details and I like to read."
- "words specify more clearly than the other diagrams in the list."
- "it is more descriptive and it is easier to understand."

It is an interesting aside that about half the students who preferred the text option felt that it was more descriptive than the others, even though it actually contained slightly less information than some of the other options.

### **5.6.4 Application of content display preference to educational multimedia**

The results of this questionnaire support McLoughlin and Oliver's (1999) contention that "instead of adopting a set of prescriptive theories, instructional designers need to ensure flexibility and to take the learner's perspectives into account". More specifically, multimedia developers cannot rely on the old standby of text alone, and must utilise simple, visual layouts that are familiar to the students. Additionally, not all students are looking for engaging graphics or deep learning; many just want a quick way to gather the information they need. In a nutshell, one size does not fit all. While educational multimedia designers must avoid relying too heavily on text, we cannot rely exclusively on rich, graphical layouts. The most equitable solution is to provide a variety of content display methods, tailoring the visual approach to the type of

information it portrays, and providing multiple perspectives on information (Australian Flexible Learning Framework, 2003; Herrington & Oliver, 1995; McLoughlin & Oliver, 2000; Ngeow & Kong, 2002; Oliver et al., 1996). As the major preferences emerging from this portion of the study were, respectively, for graphics, efficiency and detail, educational multimedia designers would do well to cater to these three approaches.

In the idea presented in figure 12, there are three major navigation options offering different ways to work with the materials: “see an outline”, “see the map” and “test yourself”. Students can view the same information as a brief outline or an interactive map/timeline, can test themselves on the information, and can contact virtual peers, FAQs, or discussion boards through a help section.

### *Efficiency and graphics*

The outline and timeline/map portray information without relying on long, unbroken passages of text, with the outline catering to those seeking efficiency, and the map/timeline aimed at students preferring rich, graphical modes of learning.

### *“Test yourself”: dialogic trial and error, linking new concepts to what students know*

The test is conceived more as a dialogue between student and peer than as an assessment method. The questions are worded in such a way that the correct response can usually be derived from the question itself. In this way, the “test yourself” option is designed to strengthen conceptual links, helping the students anchor what they are learning to something they already know or can intuitively understand. When a student responds incorrectly, the peer offers a hint and encourages the student to try again. In this way, the “test” mimics interpersonal dialogue, and encourages learning through trial and error. The “test yourself” is really a vehicle to give examination-driven students something to hold onto.

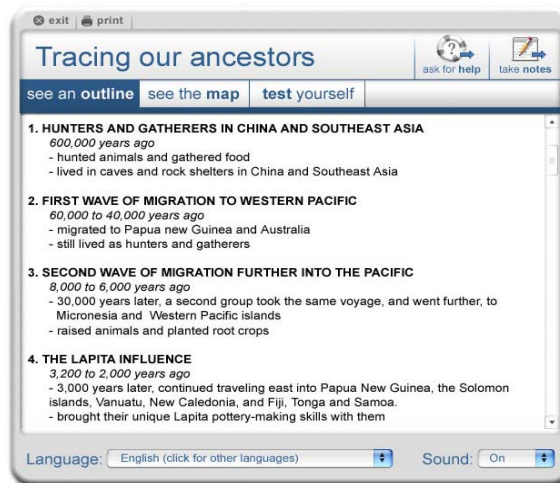
Voice-overs provide additional modes of learning. Printing any section gives not simply a reproduction of the view on screen, but a self-sufficient synopsis of the materials according to the approach the student has selected. For instance, printing within the “see an outline” section prints an outline of the materials as a whole, rather than just the screen presented. Printing within the “see the map” section gives a step-by-step, richly illustrated view of immigration patterns into the South Pacific as opposed to a screen snapshot. Printing “test yourself” provides a different test each time. In this way, students with different approaches to learning are given different options for learning both within the multimedia and with the printed components.

Although we have been using South Pacific History as the vehicle for most of our examples in this study, the approach is not confined to particular subjects. A Maths example can be explained in its application to the real world, its position and importance within the key concepts of the course, how it might be tested, and how other students like to think about the concept (NmMelissaGold, 2003).

The key goal is to separate the content by approach to learning rather than purely on divisions in the curriculum, and to tailor the visual layout to these different approaches to learning.

**Figure 12:** Multiple views of same information: an outline mode, graphical mode, and test mode.

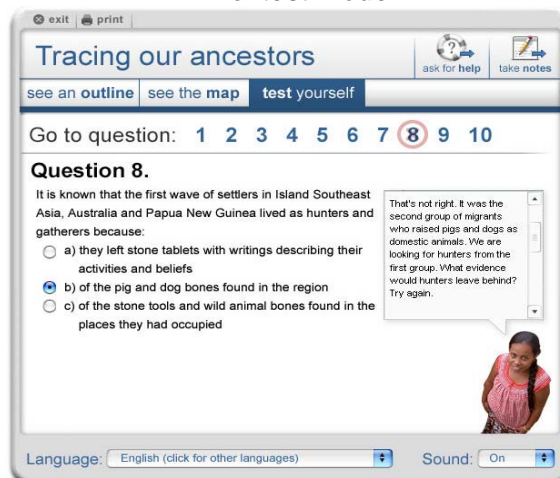
*12a: outline mode*



*12b: graphical mode*



*12c: test mode*



## 5.7 Usability

Typically, usability of multimedia interfaces is assessed through heuristic evaluation in which an interface is examined according to accepted professional standards (OCLC, 2003), and through usability tests in which users are observed and common problems they encounter are noted.

However, questions concerning cultural bias (Barber & Badre, 1998; Smith et al., 2002; Vöhringer-Kuhnt, 2002) and international applicability (Faiola, 2002; Galdo & Nielsen, 1996 in Evers, Kukulska-Hulme & Jones, 1999; Nielsen, 1990) arise when applying standards of usability to populations other than those on which the standards were initially based. As such, the usability portion of this project examines usability in the South Pacific context specifically, identifying common traits in USP students' use of educational multimedia, and developing a set of usability tips catering to the needs of these students. My goal is not to analyse correlations between usability heuristics and cultural variables (Vöhringer-Kuhnt, 2002), but simply to provide tips based on observation that will help multimedia developers make their products more usable in the USP region.

To that end, I ran usability tests with 28 students at the DFL centres visited. The goal of these tests was to see how students reacted to actual educational multimedia, looking for trends in approach to the interface. See appendix 7.4 for a screenshot of the educational multimedia software utilised. Students ranged from those who had never accessed multimedia before to students who study and use computers everyday. As there was clearly a wide range of skill-levels, the results below outline the most prominent issues among the students tested.

### 5.7.1 Usability findings

What follows is a concise list of the most prominent issues arising during the usability evaluations.

**Clear differentiation between active and inactive elements is vital.** Buttons received more clicks than hyperlinked text. Inactive illustrative elements garnered many mistaken clicks. Many students attempted to use the instruction page as an active interface, clicking on inactive examples. To avoid such confusion, illustrative elements should appear flat and “unclickable”, and active elements should share distinguishing characteristics such as colour or apparent three-dimensionality.

**It is also important to allow immediate action on instructions or other help documents.** Inline help overlays that point directly to the actual tools as they are being used would be much more effective than separate documents describing the processes (figure 8). I would also suggest inline help sections that auto-activate after a certain period of inactivity, to help lead those students who “freeze” when confused.

**Beginners cannot be expected to differentiate between the operating system and application.** Some beginning students were distracted from the interface of the multimedia by the Microsoft toolbar. Designing the multimedia to run in full screen mode can hide the distracting operating system from the student's view. However, “escape routes” are very important. Students often asked how to get back to the instructions and how to exit the program, so it is important to have obvious options for exiting and minimising the program, and for receiving help when confused.

**Many beginning students also had troubles distinguishing between right and left clicks,** and were often distracted by the options presented to them when they

clicked the right-hand mouse button. Disabling the right-click or remapping it to the left mouse button can help minimise many mouse-related problems.

**Eliminate unnecessary elements.** Several students, particularly in Solomon Islands, were so careful and deliberate in their use of the program that it sometimes caused problems. Elements generally considered extraneous, such as lengthy copyright disclaimers, can prove distracting to students, so it is important to limit the number of elements on the screen to the minimum possible.

All students were able to utilise pulldown menus without being shown how. For those who had never used them before, merely pointing them out on the screen was sufficient instruction.

For the audio portion of multimedia to be accessible, I recommend including a set of inexpensive headphones with the software. Although many computers at the centres had soundcards, few were connected to speakers, and those few computers with speakers were usually monopolised by music software playing MP3s, and so were useless for broadcasting the audio component of the educational multimedia.

Finally, although I would have liked to say that this goes without saying, perhaps the most important usability finding is that **educational multimedia developers must conduct usability tests on their materials**. Only one of the developers interviewed included usability testing as a regular part of his development process. As a developer at a prominent Suva web design company put it, “very little usability [is] done in this country” (NmUsability).

## **5.8 Limitations**

### **5.8.1 Sample limitations**

As all interviews, questionnaires and usability tests were conducted with staff and students at the DFL centres, our sample did not include those more isolated students who could not visit the centre during the study. This limits our sample to those students living in or near the capital city of every country, and would be likely to reflect a portion of the student body with more access to computers and the internet than those living in outer islands and atolls. This is a significant shortcoming of the project, one that is endemic to higher learning and technology in the region as a whole, whenever the extra cost necessary to reach more isolated students prevents those students from receiving the same benefits as more easily accessible students. In section 5.10, I discuss some future projects that explore educational technology in the region without neglecting more isolated students, providing more focused analysis after this general, exploratory effort.

### **5.8.2 Application to other academic disciplines**

The fact that this project used a Pacific History CD-rom as the testing-ground for ideas calls into question the applicability of the findings to other disciplines, such as Maths, Science or Arts. Just as students from different cultures approach learning in different ways, students studying different courses may approach their learning differently. As such, some ideas presented in this project will be more applicable than others to various subjects, such as Maths or Arts. Thus, the recommendations must be considered on a case-by-case basis, rather than a blanket application of all recommendations to all subject matter. In future studies, it will be essential to test

these recommendations on disciplines other than History by building educational multimedia about Maths, Science or Art.

### **5.8.3 The culture of the researcher**

It is important to consider the fact that I grew up in a culture quite different from that of most of the staff and students who are the focus of this project. As such, I may look at the results differently from someone who has grown up in the USP region, and my framing of the research questions may introduce a cultural bias. For instance, I initially framed my second research question as “how should we adapt Western usability heuristics for educational application in the South Pacific”, and later realised that a less biased-approach would be to ask “what are common usability needs in the South Pacific”, and changed it accordingly. This is a quite simplistic example; remaining limitations related to cultural bias are probably more difficult to identify. Although I was careful to audit my methods and conclusions with staff from the USP region, and to base my findings predominantly on the perspectives of people from the region, these conclusions should not be applied without undergoing reflection by people from the cultures involved in each application. It would also be immensely valuable for people from the cultures represented in this study to conduct research looking at the links between Pacific pedagogy and educational multimedia.

That said, this project provides useful ideas for the improvement of educational multimedia in the region, and I am confident that educational multimedia developers, teachers, and learning centres considering these recommendations will create more useful learning materials than those developing without considering the local issues covered in this study.

## **5.9 Challenges**

Most of the challenges in this project had to do with the development portion of the project. Initial issues with data collection (student reticence during interviews) were usually resolved by selecting more informal interview settings, under trees chewing betelnut or eating lunch rather than under fluorescent lights across a desk.

### **5.9.1 Development challenges**

As a research and development project, we encountered several challenges during the multimedia development phases of the project.

#### *Historical content*

Being neither a historian, nor an archaeologist, I had to rely on external sources for the content that made up our educational CD-rom. Our initial hope was to use both archaeological evidence and traditional oral histories to tell the story of how the original settlers of the South Pacific came to populate the region. However, archaeological evidence was much easier to come by and corroborate, and content development was only one part of a much larger project, so in the end we did not have time to integrate traditional oral histories into the program. Additionally, different archaeologists had differing opinions on the meanings of some findings, and we had some difficulty negotiating our sometimes-conflicting resources to select information that was meaningful and broadly accepted. For instance, we learned in the last month of production—after having translated our material into nearly a dozen languages—that new dates had been established for many of the archaeological sites we had documented in the timeline/map.

That said, we built the program to be flexible enough to accept new content easily without modifications to the multimedia itself. In other words, with simple text edits,

traditional oral histories or new archaeological dates can be added into the educational multimedia program. Building in such flexibility at the development level can allow multimedia developers to keep materials up to date with ever-changing information. By building in flexibility at the usage level, giving students and teachers their own input avenues, multimedia developers can also enable somewhat contextualised and constructivist learning environments. For instance, digital scrapbooks, assignments or workshops that use media development as part of the learning process, and interactive, exploratory interfaces can help give students the sense that 'creating' knowledge about the past is a never-ending and exciting process, rather than the false impression that knowledge has been frozen once etched into the CD-rom they are using.

#### *Dynamic assembly*

In order for the educational multimedia developed to handle multiple languages, we programmed a dynamic rather than static approach to interface assembly, with the ability to slot different languages into the same interface during runtime. This requirement made our code more extensible, but also made page layout more difficult than if we had utilised a flat, static document.

For instance, dynamic inclusion of images with Flash MX 2004 professional, the latest release available during development, was still somewhat "buggy" in an obscure but unfortunately vital area: the scrolling text area. In a text area that *does not scroll*, dynamic image placement within text worked perfectly. However, once the text and image extended beyond the size of the text-pane, causing a scroll-bar to appear, the image displayed intermittently, and sometimes prevented the scroll bar from functioning at all. We were unable to find a way around this obscure bug, and so were prevented from placing images within the flow of dynamic text. For a program whose goals included minimising the use of text, this was a very unfortunate setback. Later releases of Flash MX 2004 Professional will undoubtedly fix this bug, but as this fix was not achieved during our production cycle, we had to find other ways to keep our content dynamic and visual.

We were able to minimise the impact of this bug by separating images from text where possible. For instance, in the map/timeline portion of the program (figure 12b), the text panes that make up the peer's input to the right, and the information below, are isolated from the animated map image in the centre. This allowed us to utilise dynamic text and images on the same screen, without worrying about the scrolling text pane bug. However, we had to sacrifice many of our planned inline images.

#### *Digital scrapbook*

Due to a security restriction that prevents Flash executables/projectors from writing onto PCs, we were unable to put the digital scrapbook into action. Alternatives that permitted writing to PCs, such as Microsoft Visual Basic or Multidmedia (MDM) Flash Studio PRO v2 (<http://www.multidmedia.com/software/flashstudio/>), did not work on Macintosh computers. We also considered Macromedia Director, but comparatively few developers are skilled at Director in the USP region, and the cost of the software is several times that of Macromedia Flash. In fact, during the interviews for multimedia development assistants for the project, I did not meet a single developer skilled at Macromedia Director. As we wanted to use development tools that we could reasonably expect other multimedia developers in the region to be familiar with, and as the project was well advanced when we discovered this security restriction in Flash executables/projectors, we had to halt the digital scrapbook functionality development.

Considering that every DFL centre visited use Microsoft operating systems, and not

one computer lab uses Macintosh computers, it is not absolutely vital that educational software at USP be cross-platform compatible. As such, 'PC only' alternatives may be a better choice for future projects. However, the fact that the Media Centre develops almost exclusively on a Macintosh platform, and the fact that cross-platform compatibility is a goal for most multimedia developers, prevented us from developing exclusively for Microsoft operating systems.

#### *Assessing functionality of test*

The current implementation of the "test yourself" section provides an interactive quiz, giving students tips, feedback, and alternative perspectives on the learning material as they complete a series of multiple-choice questions. Ideally, the test would be divided into 10-question segments, as opposed to the seemingly endless and randomly repeating series of questions that are currently presented to the learner. Such segmentation of the testing would provide immediately attainable goals for the learners by giving the students opportunities to track and improve the assessment of each mini-test. We implemented the current version of the test due to development/time constraints.

#### *Printable components*

We had hoped to develop printable versions of each screen, specifically designed to stand alone as learning materials. Although Flash has a provision for creating separate layouts for print and screen viewing, this was dauntingly difficult to achieve with the dynamically generated files we created to support multiple languages. In the end, every section of the multimedia project we developed is printable. However, we did not develop separate printable components. In other words, the printed version of any screen is the same as what is displayed on the screen.

#### *Translations*

Many of the challenges posed in the development portion of this project were caused by the decision to enable multiple languages. The dynamic assembly process this decision necessitated raised complications in our plans for printable components and images, and added significantly to the time involved in producing content for the project. Additionally, as I do not speak many of the languages used in the region, assessing the translations was vicarious as well as precarious. For instance, students felt one of the translations was strictly perfect, but that it used many esoteric phrases not in the average student's vocabulary. Another translation was rejected by students as being awkward and "too literal". Another translation was deemed acceptable, other than the fact that it involved reading a language that is generally only spoken, and rarely written down! Translation involved a continuous cycle of edits and re-edits, and also meant that any general content changes needed to be done twelve times. The decision to include multiple languages dramatically increased the time and effort required, and added approximately two months and \$FJ 2000 to development.

That said, the availability of materials in the students' own languages came up time and again as one of the students' favourite features of the program in our usability assessments. Additionally, the dynamic assembly methods necessary to support the multiple languages left us with a much more extensible and easily updateable program than if we had developed a static version. Despite all of the issues raised by multiple language availability, I still feel it is worth the effort, and if faced with the same decision again, would opt to include as many languages once again.

## **5.10 Future research suggestions**

This study is a broad project covering many aspects of Pacific pedagogy and educational multimedia, and would benefit from future studies focusing further on specific issues raised during the project.

### ***5.10.1 More focused quantitative analysis of content display preference***

This project was designed primarily as a qualitative analysis, with quantitative aspects such as the questionnaires developed more as “jump-starts” to the interview process than as ends in their own right. The students in the sample were primarily limited to those with access to the USP DFL centres. As such, future studies focusing on specific quantitative aspects, and on more isolated students, could provide more support and understanding of the data. While the results for language and navigation preference were one-sided, the results for content display preference (appendix 7.2) were much more complex, and would benefit from a more focused, rigorous analysis.

### ***5.10.2 Case studies of remotely located students***

In order to reach the more isolated students in a meaningful way, I would suggest a series of intensive case studies with students in more remote locations. A project collaborating with students at a remote location to create educational multimedia catering to their specific needs could provide insight into the learning and technology needs of remote islanders in an immediately applicable context. Developing material the students already know from their own culture into a multimedia application would provide insight into the process of learning and multimedia development in remote islands. For instance, developing a multimedia application based on string figures with remote Kiribati students, or animated videos of local music, would not only give insight into the students’ approaches to educational multimedia, but would create indigenous multimedia, giving students alternatives to the multimedia currently available, which is based predominantly on “Western” cultures.

### ***5.10.3 Database of learning metaphors in local contexts***

Perhaps the strongest implication of the findings is that context and content—beyond media, mode and form—dictate the usefulness of educational materials. A database of local metaphors covering key educational concepts could provide situated material educators could use in a multitude of courses, countries, contexts and media. For instance, in the course of this project I collected several local metaphors explaining internet concepts like bandwidth and bit-rate. A useful future project would flesh out these examples as animations, illustrations, and sound-bites for use in public learning databases. Working with students and lecturers in management, maths, economics, sociology and other courses we could create material personalised to the diverse contexts of South Pacific nations. This would help ease the foreignness of many texts by providing local alternatives for use by teachers and students.

### ***5.10.4 Scaffolded simulations built on modeling and preservation of the whole***

Conceptually, I found this aspect of the study most exciting. Simulations are important to research and development in the region because:

1. many DFL centres do not have the labs necessary for hands-on experiments in science, and could benefit from digital simulations of these labs; and
2. the pedagogical implications of South Pacific context, modelling, and preservation of the whole point towards a different approach to simulations from that currently used in “Western” instructional technology. It would be exciting and worthwhile to develop in local languages simulations that are

scaffolded rather than open-ended, and that proceed to the desired goal through approximations, rather than through segmenting.

#### **5.10.5 *Alternative media***

Finally, I feel it is important to finish this paper by reiterating that while educational multimedia offers exciting potential links with regional pedagogy, and could play a vital role in preserving these approaches for new generations of students, educational multimedia is still accessible only to a vast minority of the region. Many of the lessons from this study can be applied with more immediate impact to accessible media like print and radio, as we still have much to learn about how we utilise older media in the diverse contexts the South Pacific presents. In addition to applying lessons-learned to other media, much of the content itself from multimedia can be repurposed for use in print and radio. For instance, as an outgrowth of this project, the Media Centre will be packaging audio CDs on Pacific History in various languages to be sent to regional radio stations.

#### **5.10.6 Effectiveness of educational multimedia**

The application of these ideas to other media is additionally important because, as educational multimedia is still in the fledgling stages of its development in the USP region, it is not yet clear if educational multimedia actually improves students' educational success. At this point, the technology reaches so few students, and has been integrated into so few courses, that we have little insight into the effectiveness of educational multimedia in comparison with other educational modes and media in the South Pacific. Only two DFL courses (a technical drawing course and an economics course) have been produced with educational multimedia components, and neither course has undergone comparative effectiveness studies. Although the usability tests and comprehension quizzes we ran during the development stages of our educational multimedia provide some insight into its effectiveness at teaching (students scored an average of 74.55% on the comprehension quizzes, appendix 7.6.3), they do not address the broader question of educational multimedia's usefulness to the education system. This question would best be answered by integrating educational technology into actual courses over several years, and comparing results with those before the inclusion of the educational multimedia. Of course, such a study says nothing about educational multimedia's effectiveness in informal, non-formal and other lifelong learning modes.

#### **5.10.7 *A final word***

If I were to sum up my perspective on where we must focus to improve the design (as opposed to delivery) of ICT/multimedia in the South Pacific, it would be *cultural context and content*: cultural context as the search for ways of using and developing multimedia that are specific to the Pacific; and cultural content as putting in the extra effort to utilise regional concepts, not just local metaphors to describe "universal" concepts (though those can be helpful as well), but teaching concepts whose origin is in the USP region.

## 6.0 SUMMARY

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Below is a concise summary of the major findings, associated conclusions, and examples of possible applications to the development of educational multimedia in the South Pacific. This is a quick summary; caveats and more specific suggestions are addressed within the body of this paper, labelled with individual reference numbers. For instance, for more detail on suggestions regarding integration of multiple languages into educational multimedia, refer to section 5.2.5, as mentioned in the summary below.

### 6.1 Language summary

FINDINGS	CONCLUSIONS	EXAMPLE
<b>5.2 Language</b>		
5.2.1 Most students prefer to be taught in English, but need local language when confused.	Use local language as well as English.	5.2.4 Clicking on specific words raises an inline glossary with a definition of the term and options to learn more deeply about the term. (fig. 2)
5.2.2 Language is vital to culture as well as learning.		5.2.4 A dropdown menu allows instant translation of the learning material. (fig. 1)
Translators of many languages will not know how to use multimedia development programs, or how to code.	For ease of translation, text should not be contained within the multimedia application, but saved separately in easily accessible text formats.	5.2.5 A three-tier “mothership” approach saves each language in its own text file, which is imported into Flash via an XML database at runtime. (fig. 3)

## 6.2 Group learning summary

FINDINGS	CONCLUSIONS	EXAMPLE
<b>5.3 Group Learning</b>		
5.3.1 Learning in groups provides local context to often-foreign materials.	Provide examples for key concepts within local contexts, and not just Fiji and Samoa.	5.3.8 A virtual peer gives his or her own descriptions of the concepts in local terms. (fig. 5) A “wiki” allows students and teachers to collaborate to build a consensus-based website about the coursework. (fig. 4) Electronic discussion boards allow students to contextualise the learning to their own situations.
5.3.2 Many students prefer to get their information and answers to questions from students rather than teachers.	Encourage peer collaboration.	
5.3.3 Students often engage in deep learning by sharing multiple perspectives.	Encourage sharing and multiple perspectives.	Students use a digital scrapbook to copy and alter the multimedia learning materials. They can save files on disk, print out their own creations, or email them to fellow students. (fig. 7)
5.3.5 Not all students prefer group learning over individual study and exercises.	Design group learning environments so that students are not “put on the spot”.	Provide a cushion of “e-anonymity”, while preserving interpersonal aspects, rather than having the technology focus attention on the individual.
5.3.7 Authority-figures often develop within peer groups, leading to the same kind of “shyness” exhibited with lecturers.		
5.3.6 Group work can lead to unfair distribution of workload.	Preserve individual responsibility in group work.	Provide individual roles in all group learning activities.

### 6.3 Contextual learning summary

FINDINGS	CONCLUSIONS	EXAMPLE
<b>5.4 Contextual Learning</b>		
5.4.2 Many students prefer local metaphors to broad universals.	Build from local metaphors, give each country a turn, and allow students to input their own contextual examples.	5.4.5 A virtual peer discusses how the concept at hand relates to his or her life, and then asks the student to give his or her own example. These student examples are saved and used by virtual peers in subsequent runs of the software. (fig. 6)
5.4.1 Many students like to understand the broader context of their learning, while being anchored by specific points.	Show the big picture when exploring small details.	5.4.4 The navigation menu is organised as a table of contents, showing where the student is within the lesson.
5.4.1 Many students learn in wholes, rather than in segments.	Teach with successive approximations of the whole, rather than fragmenting.	5.4.6 A timeline/map displays immigration patterns into the South Pacific. Students can interact with the map/timeline to see increasingly detailed information while preserving simplest level.
Modelling plays a role as important as, if not more so than, self-led exploration in the region	Model activities rather than instruction.	5.4.6 Help section runs as interactive demonstrations rather than passive instructions. (fig. 8)
	Use scaffolded activities that allow for trial and error, rather than free form simulations.	5.4.6 Timeout helpers autorun when a student has been inactive for a certain period of time.
		5.4.6 Virtual labs are not open-ended simulations, but guided demonstrations within the active interface.
		5.4.6 Treat the map/timeline as a game board, allowing students to move pieces representing the explorers to different parts of the map, imitating the animation and learning immigration patterns.

		5.6.4 Design interactive tests as dialogues between student and peers, with hints to encourage trial and error, and to help contextualise the questions to the student's own situation. (fig. 12)
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#### 6.4 Access summary

FINDINGS	CONCLUSIONS	EXAMPLE
<b>5.5 Access</b>		
5.5.1 Many students can only rarely come to DFL centres.	Create elements that are not dependent on computer access, so can be used at home.	5.5.2 Educational multimedia is distributed on CD-roms that double as audio CDs so that students without computers may still be able to use the materials at home.
5.5.1 Many of the centre computer labs are overcrowded.		5.5.2 Printable components of the educational multimedia are standalone.
		5.5.2 Encourage re-use of individual media elements (text, image, audio) in more accessible media (radio, print) by isolating elements for inclusion in the multimedia at runtime.
5.5.1 Some centres have intermittent electricity.	Create elements that do not require electricity.	5.5.2 Printable components of the educational multimedia are standalone.
5.5.1 Students have limited access to the internet and meagre bandwidth at the centre. Many have no access whatsoever. (fig. 10)	Do not rely solely on internet.	5.5.2 Educational Multimedia is distributed as a CD-rom as well as a website.

#### 6.5 Content display preference summary

<b>5.6 Content Display Preferences</b>		
Text is the students' least favourite mode of display.	Minimise the use of text.	5.6.4 Seek ways to complement text when appropriate, such as charts, pictures, and audio recordings.
Graphics are the students' most favoured mode of display.	Use graphics to portray information whenever possible.	5.6.4 An interactive timeline map can show the same information with just a few dates and photographs, which would take lengthy

		paragraphs of text to portray. (fig. 9)
Most students look for efficiency, detail, or graphics, respectively.	Provide treatments that cover all three preferences. Organise information according to learning preference, not just curriculum.	5.6.4 Students are presented with multiple views of the same information: Test view, Graphical view, and Outline view. (fig. 12)

## 6.6 Usability summary

FINDINGS	CONCLUSIONS	EXAMPLE
<b>5.7 Usability</b>		
Some students tried to click inactive, illustrative elements.	Differentiate between active and inactive elements.	Treat active elements in a consistent and distinctive manner.
Some students were more likely to click buttons than underlined text.		
Some students had difficulty distinguishing between operating system and software.		Run educational multimedia in full screen mode to minimise distraction from the operating system.
Some students tried to follow instructions in passive mode, attempting to click inactive, illustrative elements.	Allow immediate application of instructions; provide an opportunity to practice in the instructing environment.	Display instructions as overlays, demonstrations running within the active interface so that students can act on the advice immediately. (fig. 8)
Some students read entire copyright disclosure.	Minimise superfluous information. Present non-vital, wordy information in deeper, "hidden" levels of the interface.	Copyright information is presented in a separate window, viewed when the student clicks an "about the program" button.
Some students had difficulty distinguishing between left and right mouse clicks.		Disable or remap right mouse button to left.
Students unclear how to exit, view instructions, or return to home/startup page.	Provide clear escape routes.	Provide clear buttons for home, help and exiting.
Most computers at centres had sound cards but no speakers.	Distribute educational multimedia with headphones.	

## **7.0 APPENDICES**

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### **7.1 Language preference questionnaire**

I work at the USP in Fiji, making educational multimedia for students. As part of a study trying to help us make educational multimedia better for the students, we'd like to ask a few questions.

Where are you from?

What language are you taught in at USP?

What language do you prefer to be taught in?

Be sure to explain why.

## 7.2 Content display questionnaire

### A

Please let us know:  
Where are you from?

How long have you lived in Suva?

What languages do you speak?

Gender:

Age:

### Instructions

All of these choices show the same information presented in different ways.

**Please choose which one you would prefer to use to study. Be sure to explain "Why."**

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1.

#### A Timeline of the South Pacific

When people first came to the islands of the South Pacific

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2.

#### A Timeline of the South Pacific

When people first came to the islands of the South Pacific

Fiji was first populated about 3,500 years ago. About 3,200 years ago, some left Fiji and headed for Tonga and then about 3,000 years ago, to Samoa. The canoes took to the waters again and headed eastward reaching New Zealand about 1250 years ago.

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3.

#### A Timeline of the South Pacific

When people first came to the islands of the South Pacific

Country	Approximate date of arrival
Fiji	3500 years ago
Tonga	3200 years ago
Samoa	3000 years ago
New Zealand	1250 years ago

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4.

#### A Timeline of the South Pacific

When people first came to the islands of the South Pacific

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5.

#### A Timeline of the South Pacific

When people first came to the islands of the South Pacific

7.3 Navigation preference questionnaire

Inline: L

A timeline of the Pacific: the first Pacific people

How we know our history

[Lapita pottery remains](#) found in archaeological digs around the Pacific give us clues as to when and where the original settlers moved. [Folk tales](#) from different countries give us alternate views on the original settlers. Changes in [Plant life](#), such as the introduction of coconuts to new islands, also give us clues about the movements of the original settlers. Similarly, the introduction of new [Animals](#), such as pigs or rats, tell us more about how those first settlers traveled. Records of [Diseases](#) can also give us clues about our past.

The prehistory of human evolution dates several million years ago and that humans assembled in South East Asia some two million years ago. It has been scientifically established that the South East Asia was the dispersion point into the Pacific region. At the time of dispersion, the landmass of South East Asia was joined to the western half of the Pacific zone by what has been called the Sunda Shelf. At the time, the sea level was low and it

Menu: O

A timeline of the Pacific: the first Pacific people

How we know our history:

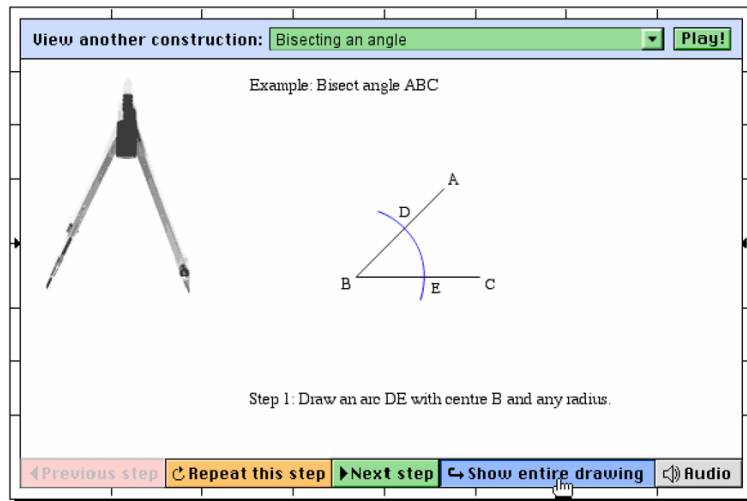
- [Lapita pottery remains](#)
- [Folk tales](#)
- [Plant life](#)
- [Animals](#)
- [Disease](#)

[Lapita pottery remains](#) found in archaeological digs around the Pacific give us clues as to when and where the original settlers moved. [Folk tales](#) from different countries give us alternate views on the original settlers. Changes in [Plant life](#), such as the introduction of coconuts to new islands, also give us clues about the movements of the original settlers. Similarly, the introduction of new [Animals](#), such as pigs or rats, tell us more about how those first settlers traveled. Records of [Diseases](#) can also give us clues about our past.

The prehistory of human evolution dates several million years ago and that humans assembled in South East Asia some two million years ago. It has been scientifically established that the South East Asia was the dispersion point into the Pacific region. At the time of dispersion, the landmass of South East Asia was joined to the western half of the Pacific zone by what has been called the Sunda Shelf. At the time, the sea level was low and it was possible for humans to cross into Papua New Guinea and

## 7.4 Usability tests

A screenshot of one of the applications used to assess usability preferences




## 7.5 Images of the software developed in this project



exit print about this program

## Tracing our Ancestors

see an outline see a map test yourself ask for help




About 40,000 years ago, these **hunters and gatherers** began to move from China and Southeast Asia to Australia, Papua New Guinea and the islands of Southeast Asia. We can tell by **looking at the age of the bones and tools** found in **caves and rock-shelters** in that region.

600,000 40,000 6,000 3,000 2,000 years ago

Language: English (click to change the language) Sound: ON

Back to help

The tools, animal bones and pottery found in many sites where our ancestors once lived are studied by archaeologists to see whether they could figure out HOW and WHEN these people lived. The scientific way of collecting and studying the remains left behind our ancestors is called



exit print about this program

## Tracing our Ancestors

see an outline see a map test yourself ask for help

- Hunters and Gatherers in China and Southeast Asia**  
600,000 years ago
  - hunted animals and gathered food
  - lived in caves and rock shelters in China and **Southeast Asia**
- First Wave of Migration to Western Pacific**  
60,000 to 40,000 years ago
  - migrated to Papua New Guinea and Australia
  - still lived as hunters and gatherers
- Second Wave of Migration Further into the Pacific**  
8,000 to 6,000 years ago
  - 30,000 years later, a second group took the same voyage, and went further, to Micronesia and Western Pacific Islands
  - raised animals and planted root crops
- The Lapita Influence**  
3,200 to 2,000 years ago
  - 3,000 years later, continued traveling east into Papua New Guinea, the Solomon Islands, Vanuatu, New Caledonia, and Fiji, Tonga and Samoa.
  - brought their unique Lapita pottery-making skills with them
  - still raised animals and planted root crops

Language: English (click to change the language) Sound: ON

exit print about this program

## Tracing our Ancestors

see an outline see a map test yourself ask for help

**Answer a, b or c:**

If you lived as a hunter and gatherer in China, Southeast Asia, and the Western Pacific 40,000 years ago, you would have

☐ a) Hunted animals, gathered fruit and edible plants in a certain area, moving to new areas when you had exhausted the food supply

☒ b) Kept some animals to be domesticated then killed and eaten in times of food shortage


☐ c) Hunted animals for domestication and gathered seeds for planting

new question submit answer

Language: English (click to change the language) Sound: ON

Back to help

Wrong answer. Think about this: The hunters and gatherers then did not know that they could tame, raise and domesticate the animals that they hunted. What they do know then was that they could hunt animals and gather fruits and seeds to eat. So there you go, pick an answer again!



## 7.6 Testing of example educational multimedia

### 7.6.1 Exit interview questions

What was your favourite part of this program?  
What was your least favourite part?  
What did you find difficult about this program?  
How would you improve this program?  
What other tools would you find useful?  
Would you find this sort of software helpful for your courses?

### 7.6.2 Peer review questions

Would this be useful in your teaching?  
Which aspects do you find most useful?  
Which do you find least useful?  
How would you improve this program?  
What other tools would you find useful?

### 7.6.3 Comprehension quiz

An example of a comprehension quiz used to gauge the effectiveness of the software.

1. The **first** group of settlers in Island Southeast Asia, Australia and Papua New Guinea
  - a) planted crops and domesticated animals.
  - b) hunted and gathered food to survive.
  - c) depended on marine resources and had a diet based mainly on fish.
2. The **second** group of settlers in the South Pacific
  - a) planted crops and domesticated animals.
  - b) hunted and gathered food to survive.
  - a) depended on marine resources and had a diet based mainly on fish.
3. The earliest inhabitants of the **Polynesian** islands were
  - a) people who were shipwrecked in the islands.
  - b) hunters and gatherers from Southeast Asia, Australia and Papua New Guinea.
  - c) Lapita descendants who prepared for their long voyages to uncharted islands in the Pacific.
4. Many of our ancestors who **first** migrated to Island Southeast Asia, Papua New Guinea and Australia chose to live in
  - a) caves and rock-shelters.
  - b) stilt houses and huts.
  - c) dwellings made of concrete and sand.
5. The group of people who discovered uninhabited islands in Polynesia did not have the distinct Lapita pottery style. Along with other evidence, this tells us that
  - a) The Lapita culture did not reach beyond Tonga and Samoa to the other Polynesian islands because they stopped their

nomadic seafaring ways and changed to living in stable coastal village settlements.

- b) the Lapita cultural influence gradually died and their descendants developed a separate post-Lapita culture.
- c) the Lapita culture was replaced by another tradition that had distinct Polynesian copper and bronze tools and ornaments exchanged for barter with the Southeast Asians.

## 7.7 Notes and quotations from interviews

Title	Web Address
CulturalNmBrainstorm	<a href="http://www.grographics.com/wiki/index.php/CulturalNmBrainstorm">http://www.grographics.com/wiki/index.php/CulturalNmBrainstorm</a>
DflShowcase	<a href="http://www.grographics.com/wiki/index.php/DflShowcase">http://www.grographics.com/wiki/index.php/DflShowcase</a>
FierConference	<a href="http://www.grographics.com/wiki/index.php/FierConference">http://www.grographics.com/wiki/index.php/FierConference</a>
NmAccess	<a href="http://www.grographics.com/wiki/index.php/NmAccess">http://www.grographics.com/wiki/index.php/NmAccess</a>
NmActiveLearning	<a href="http://www.grographics.com/wiki/index.php/NmActiveLearning">http://www.grographics.com/wiki/index.php/NmActiveLearning</a>
NmCooks	<a href="http://www.grographics.com/wiki/index.php/NmCooks">http://www.grographics.com/wiki/index.php/NmCooks</a>
NmFiji	<a href="http://www.grographics.com/wiki/index.php/NmFiji">http://www.grographics.com/wiki/index.php/NmFiji</a>
NmFrancesKoya	<a href="http://www.grographics.com/wiki/index.php/NmFrancesKoya">http://www.grographics.com/wiki/index.php/NmFrancesKoya</a>
NmGroupLearning	<a href="http://www.grographics.com/wiki/index.php/NmGroupLearning">http://www.grographics.com/wiki/index.php/NmGroupLearning</a>
NmIdeaAudit	<a href="http://www.grographics.com/wiki/index.php/NmIdeaAudit">http://www.grographics.com/wiki/index.php/NmIdeaAudit</a>
NmIndofijian	<a href="http://www.grographics.com/wiki/index.php/NmIndofijian">http://www.grographics.com/wiki/index.php/NmIndofijian</a>
NmKiribati	<a href="http://www.grographics.com/wiki/index.php/NmKiribati">http://www.grographics.com/wiki/index.php/NmKiribati</a>
NmLanguage	<a href="http://www.grographics.com/wiki/index.php/NmLanguage">http://www.grographics.com/wiki/index.php/NmLanguage</a>
NmLautoka	<a href="http://www.grographics.com/wiki/index.php/NmLautoka">http://www.grographics.com/wiki/index.php/NmLautoka</a>
NmMarshalls	<a href="http://www.grographics.com/wiki/index.php/NmMarshalls">http://www.grographics.com/wiki/index.php/NmMarshalls</a>
NmNauru	<a href="http://www.grographics.com/wiki/index.php/NmNauru">http://www.grographics.com/wiki/index.php/NmNauru</a>
NmQuestioningAuthority	<a href="http://www.grographics.com/wiki/index.php/NmQuestioningAuthority">http://www.grographics.com/wiki/index.php/NmQuestioningAuthority</a>
NmSamoa	<a href="http://www.grographics.com/wiki/index.php/NmSamoa">http://www.grographics.com/wiki/index.php/NmSamoa</a>
NmSolomons	<a href="http://www.grographics.com/wiki/index.php/NmSolomons">http://www.grographics.com/wiki/index.php/NmSolomons</a>
NmSporeBrainstorm	<a href="http://www.grographics.com/wiki/index.php/NmSporeBrainstorm">http://www.grographics.com/wiki/index.php/NmSporeBrainstorm</a>
NmTestingContentDisplay	<a href="http://www.grographics.com/wiki/index.php/NmTestingContentDisplay">http://www.grographics.com/wiki/index.php/NmTestingContentDisplay</a>
NmTuvalu	<a href="http://www.grographics.com/wiki/index.php/NmTuvalu">http://www.grographics.com/wiki/index.php/NmTuvalu</a>
NmUsability	<a href="http://www.grographics.com/wiki/index.php/NmUsability">http://www.grographics.com/wiki/index.php/NmUsability</a>
NmVanuatu	<a href="http://www.grographics.com/wiki/index.php/NmVanuatu">http://www.grographics.com/wiki/index.php/NmVanuatu</a>
SohSeminar	<a href="http://www.grographics.com/wiki/index.php/SohSeminar">http://www.grographics.com/wiki/index.php/SohSeminar</a>
SohSeminarTwo	<a href="http://www.grographics.com/wiki/index.php/SohSeminarTwo">http://www.grographics.com/wiki/index.php/SohSeminarTwo</a>

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