

Development of Interactive Multimedia Health Informatics CD-Rom for Aboriginal Health Workers - Case Study: Tuberculosis (TB)

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Abstract

Aboriginal and Torres Strait Islander health workers are key providers of primary health services to Aboriginal communities, especially in remote and rural areas. Their roles often involve them being overloaded with competing demands. Despite all of this there has been limited attention given to the maintenance and ongoing enhancement of their skills and knowledge following the completion of formal training.

A culturally appropriate interactive multimedia self-paced health program as a mechanism to improve the accessibility and the use of scientific data and information for health purposes was proposed as a basic method for better supporting Aboriginal and Torres Strait Islander primary health care workers in their practice locations. This study involved four phases: program needs assessment, identification of the key factors that should be considered in developing the CD-Rom, model development, and formative evaluation for the model.

This paper is a case description for the third phase of the study: the development of a culturally appropriate interactive multimedia health informatics CD-Rom for Aboriginal and Torres Strait Islander health workers.

Background to the Project

Aboriginal and Torres Strait Islander Australians face substantial problems in accessing appropriate primary health care services due to large distances and the cost of logistics involved in transporting people to hospitals or clinics (Gruen, Weeramanthri & Bailie 2002). Cultural barriers are also regarded as major factors in reduced access by Aboriginal and Torres Strait Islander Australians of mainstream health services (QldHS 2007). Aboriginal and Torres Strait Islander health workers (ATSIHWs) play a very important role overall in health services and are considered key providers of primary health services to their communities, particularly in remote and rural areas. They are often overloaded with competing demands. The pressure to know a little about everything is a common theme (Grant 1992) (Pacza, Steele & Tennant 2001).

As reported by (Soar & Yuginovich 2006) there has been limited attention given to the maintenance and ongoing enhancement of ATSIHWs' skills and knowledge following the completion of formal training. Provision of education and skills transfer as well as professional support to ATSIHWs would help them to enhance their skills so as to make an even more effective contribution (Gruen, Weeramanthri & Bailie 2002).

(Lazakidou, Ilioudi & Daskalaki 2006) stressed the importance of more clearly recognizing and appreciating the role of information technology in health care education. (Collyer 2006) suggested that information technologies could offer potential for improving continuing

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education of ATSIHWs and consequentially for improving the quality of care provided within their communities. Using the capability of multimedia presentation technology ensures the effectiveness of content delivery to health workers (Chetley et al. 2006). (Geissinger 2001) supports using a CD as a delivery mechanism for continuing professional education for health practitioners in rural areas and suggests also that health workers living in remote areas need to be provided with a CD player as an add-on component if it is not supplied as part of their original computer equipment.

The benefits of a culturally appropriate interactive multimedia informative health program for improving the accessibility and the use of scientific data and information for health purposes is explored in this research. Expectations are that this would give ATSIHWs opportunities to more independently control their learning within an attractive and interesting environment, and improve their capacity for quality of healthcare delivery and overall health outcomes (Phillips 1997).

A needs assessment, as a first step in program development, was carried out using qualitative semi structured interviews with key stakeholders. The assessment indicated the opportunities for additional means to help deliver a sustainable, efficient and culturally acceptable program for ATSIHWs. The needs and opportunities for improving services for ATSIHWs are supported by previous published studies and the findings of the qualitative semi structured interviews that were part of this research.

The second phase is the identification of the key factors which need to be considered and that would impact the model development. The identification began with a systematic review of literature. This was followed by qualitative semi structured interviews with diverse key stakeholders and explored their expectations and recommendations. The main findings revealed that the most important key factors could be categorized under three main issues: cultural factors; information technologies literacy and availability; and interactive multimedia factors. Cultural factors included cultural inclusivity, oral cultural, pre-existing knowledge, and Aboriginal learning styles. Interactive multimedia factors were the requirements for the process, fitting and design of the program.

This paper explores the third phase in this study which is a detailed description of the development of the interactive multimedia informatics CD-Rom guided by the results and recommendations from the first and second phases of the study and supported by previous published studies.

Why choose Tuberculosis (TB) as a Focus for the Model?

In 1991, the World Health Assembly (WHA) resolution recognized TB as a major global public health problem (Uplekar et al. 2006), and one of the most important causes of death in adults which is strongly associated with social and economic inequalities (WHO 1998).

On the national level, (Bastian & Krause 2008) highlight that TB is a global health emergency in which Australia has responsibilities and the capacity to make a difference both within and beyond our shores. Australia has a low incidence of Tuberculosis (TB), which has remained constant for over a decade. However, the incidence is not the same across the population; immigrants and Aboriginal and Torres Strait Islander Australians are most affected and have rates many times those of non-Aboriginal and Torres Strait Islander (NTAC 2002) (Simpson, Clark & Knight 2006) (Bastian & Krause 2008).

The main risk factors for Tuberculosis are poverty, overcrowding, malnutrition, diabetes mellitus, smoking, alcohol abuse, and advanced renal diseases. All those factors are common among many Indigenous people (Thomson N et al. 2008). (Oest et al. 2005) reported in his study about Tuberculosis services for indigenous and immigrant populations in New Zealand, that treatment is often discontinued prior to completion once the symptoms are resolved.

Tuberculosis needs a long time for uninterrupted treatment. Patients need assistance from health workers to successfully complete their treatment and be cured (Barlett 1995). The poor treatment and inadequate control of anti-tuberculosis drugs will result in the development of drug-resistant strains that may make Tuberculosis incurable (WHO 1998).

Important measures for preventing TB include public education and improving awareness-raising of TB through:

- 1) Education and training among health care workers in order to promote early detection, and to consider TB in at-risk patients,
- 2) Increasing patient awareness of available treatment,
- 3) Education and empowerment of high- risk groups and their families/cares which are provided by ATSIHWs. Patients who have this knowledge are less likely to delay diagnosis, a delay that could result in transmission of the disease to uninfected persons, (NTAC 2002) (Miller et al. 2003) (Bastian & Krause 2008).

Model development

(Pellekaan & Clague 2005) urge to the vital need for a sound primary health care and education program implemented by dedicated persons toward health and wellbeing for Aboriginal Australians. An Interactive Multimedia CD-Rom health program is required, providing basic information about Tuberculosis (TB) for ATSIHWs using culturally perceptive pedagogy fitting “the oral tradition”. This project was developed and guided by the principles of iterative software design and development.

Audience

The target audience for this course is ATSIHWs, especially those who are caring for persons with or at high risk of TB disease or infection. Previous studies revealed the initial phase of learning in any new program is based upon the learner's background knowledge, which is a sum of all abilities acquired as a result of exposure to earlier learning experiences. A clear audience profile regarding the age, educational level, corporate culture, needs and expectations, level of computer literacy, background knowledge, motivation and interest will provide the program producer with valuable information for script development, and media selection, as well as help create a concept of delivery that increases the program's chances of success (Harrison 1990) (Villamil-Casanova & Molina 1996) (Fedak 1999) (Cartwright & Cartwright 1999).

In the planned model the development of a general design was attempted, simple without affecting the main objective of the model which is provide the learner with important useful health information. During the assessment stage, and from a review of published literature and reports, the profile of ATSIHWs and their way of learning and cultural principles were explored and adapted in the program development. They are the following: 1- ATSIHWs are used to learning from stories, and the interactive multimedia health model's content should not rely on text, but depend on narration and visual demonstration. 2- Elements of traditional and cultural aspects should be incorporated into the model's content. 3- Model content should build on the pre-existing knowledge of ATSIHWs.

Goal

The purpose of the proposed application and the expected result must be clear and be considered throughout the planning and development phase of the program (Villamil-Casanova & Molina 1996). The impact of the program often becomes its overall objective or goals (Cartwright & Cartwright 1999). Developing an interactive multimedia health informatics program that is sustainable, efficient, and culturally relevant to ATSIHWs is the main goal of

this project. The expected results are: 1) the model is to be considered as a continuing professional development approach that enables ATSIHWs to constantly upgrade their skills, keep them updated with changes, and provide them with basic information about TB including type, diagnosis and early detection, management, and prevention procedures. 2) The model raises the awareness about TB as a major global public health problem and prepares ATSIHWs for potential TB outbreaks. 3) The model can be used to support ATSIHWs in their health education and promotion roles within their own communities.

Task Analysis

The task analysis is a hierarchical outline of the model content in which splitting a topic into the smallest measurable steps and dividing the final goal into enabling objectives by using the pyramid analysis technique to produces a learning map or flowchart which forms the main structure for the multimedia program (Cartwright & Cartwright 1999; Harrison 1999; Riptoningrum 2003). A thorough task analysis at the start of the project is crucial to clarify a clear set of educational objectives and the information to be taught, as well as to assist in designing the details, and to determine an effective learning sequence for the program (Boyle 1997; Cartwright & Cartwright 1999; Harrison 1990; Riptoningrum 2003). A good learning sequence should begin with skills that only require the learner to, combine skills they already have, and should follow standard educational practice (Alessi & Trollip 2001) (Tomita 2003). Figure (1) illustrates task analysis for the Tuberculosis CD-ROM model in which:

- 1- Model starts with an introduction and general information about the topic followed by more detailed and specific information.
- 2- It clarifies the educational objectives regarding detection, treatment and preventive measures of Tuberculosis and reveals the anticipated model design.

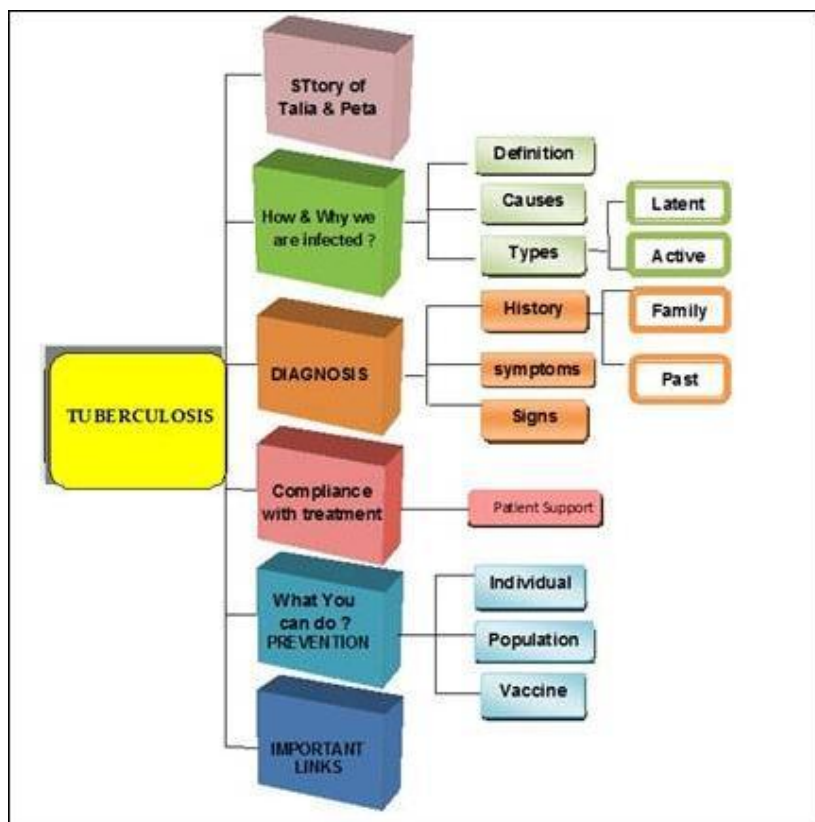


Fig (1); Learning Map

Model Objectives

With any health education program, clearly defined goals, and measurable objectives are essential to facilitate effective model design, and to help in the determination of the learning resources required. They are also considered the measurements of the evaluation for the program (Grant 1992; Kern 1998; Tomita 2003). Each objective should achieve the program aim, be stated precisely and specify the appropriate measurable outcomes (Boyle 1997; Harrison 1999). The success of the project can then be decided by measuring how well the outcomes have been achieved (Boyle 1997).

There are two types of objectives. Learner objectives provide a clear statement of the program outcomes, results the learner is expected to accomplish, and help the learner by pointing out important topics. Design objectives provide guidelines for media production decisions, help the developers prescribe appropriate activities, are more focused on required topics than on tangential issues, and determine the most effective delivery methods (Cartwright & Cartwright 1999; Gagne, Briggs & Wager 1992; Hannafin & Peck 1988; Harrison 1999; Kennedy, Petrovic & Keppell 1998)

Design Objectives

Design objectives are about how to turn a boring subject matter into an interesting screen-based unit (Harrison 1999). The program was designed to have the following features:

- 1- Navigation: simple and easy to use,
- 2- Screen: standard screen components with the presence of a main menu,
- 3- Interactivity: interaction through quiz
- 4- Cultural appropriateness by using storytelling, and
- 5- Learner control of the program

Learner's Objective

The learning objectives provided in the Tuberculosis informatics program developed in the present study include providing participants with basic knowledge of early detection, treatment and preventive measures of Tuberculosis relevant to Queensland health.

Essentially, this was accomplished by giving ATSIHWs an introduction to the different types of the disease and the life cycle of the microbe.

On successful completion of this program Aboriginal and Torres Strait Islander health workers will have moderate knowledge of early detection and preventive methods of Tuberculosis.

After completing Module One in this program they will be able to:

- Describe the classification system for TB.
- Identify ways in which TB is spread.
- Identify conditions that increase the risk of TB infection transmission
- Describe TB signs and symptoms.

After completing Module Two in this program they will be able to:

- Describe the pathogenesis (life cycle) of Mycobacterium Tuberculosis
- Identify conditions that increase the risk of TB infection progressing to active TB disease
- Identify high priority groups that should be tested for latent TB infection (LTBI)

After completing Module Three in this program they will be able to:

- Identify the major components of TB diagnostic procedures.

After completing Module Four in this program they will be able to:

- Identify anti tuberculosis medications
- Describe treatment regimens for TB disease

- Describe patient monitoring.
- List common adverse drug reactions to anti-tuberculosis medications.

After completing Module Five in this program they will be able to:

- Identify three levels of infection control (IC) measures to prevent the transmission of TB (administrative, environmental, and personnel controls)
- Identify BCG vaccination.
- Identify the roles of health professionals in preventing Tuberculosis.
- Identify the roles of patient in preventing Tuberculosis.

Multimedia Application Design Considerations

At this stage we consider other factors relevant to model design. They are the configurations of computer that will run the model, multimedia building blocks that form the model, the interactive multimedia methodology and the authoring program that use for model development.

Definition of Computer Configurations

An important planning consideration is to define the type of machine that will run the application. The average machine configuration is 33-66Mhz, 8-16 RAM, double speed CD ROM, 480-640 color monitor; video card 1024x768 with 65,536 color and 8- 16 bit audio board (Rathbone 1995) (Villamil-Casanova & Molina 1996).

Multimedia Building Blocks

These encompass the multimedia materials which form the multimedia model. They are usually produced using a variety of software applications and then assembled together using authoring programs (Villamil-Casanova & Molina 1996). According to (Fletcher 1990) and (Knebel 2000) people retain only 20 percent of what they hear; 40 percent of what they see and hear; and 75 percent of what they see, hear, and do. The model could therefore be more effective if a variety of communication modes are used to present the same concept which fulfill the different learning styles of all audience members (Villamil-Casanova & Molina 1996) (Cartwright & Cartwright 1999).

In the model video footage was developed using movie maker software and drawn pictures colored using black magic coloring software. The narrated stories were recorded directly over the authoring program, and a search of the web produced the graphic medical pictures, icons, and Aboriginal music.

Choosing an Interactive Multimedia (IMM) Methodology and Authoring Program

The decision of choosing the final interactive multimedia methodology for the model was based on the type of learning and methods of model delivery (via the World Wide Web or Using CD Rom), and depended on the functions of interactive multimedia (Cartwright & Cartwright 1999) (Alessi & Trollip 2001). Models that combine methodologies will have a greater likelihood of being effective (Alessi & Trollip 2001). Tutorials and storytelling was used as the most simple and culturally appropriate interactive methodologies for presenting information and concepts.

An authoring program is a software program that brings all media elements created together into a final project and allows an author to create multimedia applications (Luther 1994) (Ivers & Barron 1998). There are many software programs that can be used to author a multimedia project such as Microsoft Power Point, Hyper-Studio, Author ware, and Icon Author. The selection of the authoring tool depends on the job needs and on the choice of interactive

multimedia methodology (Luther 1994) (Villamil-Casanova & Molina 1996) (Ivers & Barron 1998). Microsoft PowerPoint was chosen to be the authoring program software to provide informative materials on CDROM with meaningful links between the various modules of the model.

Model Content and Structure

Medicine, public health, understanding of traditions, and development of social awareness are all important; but it is impossible for health workers to learn everything in detail. There is a need to determine and cover what is essential to know. (Werner & Bower 1982) in his book "Helping Health Workers Learn", identified important points that should be taken into consideration when developing a health program for community health workers. They are:

- Program content should aim to teach what is most important and essential to know.
- Learning must relate to life so program content should be based on what is already familiar to health workers, and should start with their own knowledge and experience within communities and individuals.
- In developing the program content, it is important to look at the social and physical causes, symptoms and effects on people's health and lives.
- Health workers learn better and remember longer if they understood the reason why things happen and what needs to be done.
- The program should discuss health matters in clear, simple language that everyone can understand.

(Harrison 1990) suggested an existing training material could be used as program content in the development an interactive multimedia health program.

Programs have successful outcomes only in so far as they introduce the appropriate ideas and opportunities to a group in the appropriate social and cultural conditions (Pawson & Tilley 1997). ATSIHWs come from many different backgrounds, and have different skills and knowledge. Some are highly literate, while for others English is a second language. Some live in large cities, and others live and work in remote communities (Barlett 1995). It is hard to meet every ATSIHW's needs using the same program structure.

Model Structure

In order to present the content clearly, the completed program consist of five independent modules with a total of 16 learning objectives distributed throughout the modules. The learning objective were outlined descriptively and in detail in the section called "Program Objectives". The first module contains a story describing a health situation which gives introductory basic general information about Tuberculosis. As the learner progresses through the program modules, they are informed about Tuberculosis pathogenesis, diagnosis, treatment, prevention and prognosis of the disease in a storytelling, tutorial, and narrative manner. Each module ends with a quiz. Throughout the program there are on line national and international links to update information and keep the health workers in touch with mainstream health. Users can enter the program through any module from the main menu depending on their needs and interests.

Model Content

Each module gives information about a special topic to achieve the previously specified objectives, such as: Module One: Introduction and basic general information about Tuberculosis. Module Two: Why TB happens? What are bacteria and how can it can affect our body? What is the life cycle of bacteria inside our body? Module Three: How to recognize Tuberculosis? Diagnosis of TB through observation, history, and physical examination

Module Four: Treatment and compliance with treatment. Module Five: Prevention is a reflection on the long term need for the community, and the role of health workers and patient in prevention. Aboriginals tend to be concerned only with the present and conceptualize the future as a continuation of the present (Hausfeld 1977). Prevention is expressed in the model in the form of public health measures and advice to be accepted by Aboriginals, such as reducing crowding and care of the environment.

How the Story Written?

The content and style of the story was obtained from document research about Aboriginal cultural and healing belief (Devanesen 2000). Anthropology case studies of remote Aboriginal communities in Australia were utilized to draw, realize and tell a detailed story (Saethre 2007). That followed by the transformation of the story scripts and creation of a scenario that can be used to suit the health topic. The story is then reviewed and revised and affirmed by health workers participating in the study.

Medical Terminology

Interview results identified the friendliest approach to define health problems for Aboriginal communities are to divide medical terminology into a smaller number of conditions that have a common cause. This approach has been supported by (Barlett 1995) who argued that to define health problems for Aboriginal communities in terms of diseases does not help the communities much, but focusing on health problems by looking at the causes first, as it is explained in the table (1):

	CAUSITIVE FACTORS	HEALTH PROBLEMS
LAND	Poor physical environment: 1-Environmental health issues include water supply, waste disposal, shelter (adequate and appropriate space for numbers of people), domestic and personal hygiene, and dust. 2- Housing and health hardware should be determined by how people want to live. Aboriginals enjoy living outside.	Infectious diseases
MIND	Social and spiritual environment : such as unemployment, racism , lack of access/knowledge of country, loss of language/stories, inappropriate social behaviors	Alcohol/ substance abuse/ violence/ STDs, and mental health problems.
BODY	Poor nutrition	High blood pressure, heart diseases, obesity, diabetes, increases in infectious illness, poor development.

Table (1), Source (Barlett 1995)

Clarification of Health Information

The most important criterion by which the learning content in the program and medical resources are selected is that they focus on up-to-date information and provide comprehensive information about communicable diseases identification, reporting, control and prevention. Medical learning resources which meet this criterion are derived from different national and international organizations. They include the World Health Organization (WHO 2004), U.S Agency for International Development (USAID 2011), Centers for Disease Control and Prevention (CDC) Division of Tuberculosis Elimination (DTBE) (CDC 2010), the " Control of communicable Diseases Manual" by (Heymann 2004), and Queensland health's communicable

Diseases Branch who is responsible for surveillance, prevention and control of communicable diseases in Queensland and is provide information on communicable diseases as a key resources for health professionals (QLDHealth 2010a),

The skills and knowledge that health workers specifically need to detect cases of pulmonary TB, inform patients about TB, and monitor the success of TB case detection and treatment at health facility level can be obtained from the WHO guide, and the related set of training modules for health facility staff can be obtained from " *How to Organize Training for Health Facility Staff on TB Control*" (WHO 2004).

TB treatment regimens vary from country to country. The specific information regarding diagnosis of Tuberculosis, treatment guidelines, TB infection control guidelines, management of TB patients, and vaccination program was provided by Queensland Health's website for health professionals about Tuberculosis (QLDHealth 2010b).

Model Design

The goal of the design phase was to develop a framework for the "Interactive Multimedia Self-Paced Informative Health Model" interactive multimedia CD-ROM (Fig 2) which is intended to provide information about Tuberculosis to ATSIHWs.

The design was guided by the data collected from the interviews as a solid base, and information from the literature review was added. There was limitation and simplicity in the design as a result of concern about the computer's capacity to run large multimedia programs.



Figure (2) Model framework design

The design process began with documenting the design decisions through storyboards, followed by discussion regarding the navigation structure and the graphic design for the interactive multimedia model.

Storyboard

This is the learning map of the content, sequence and characteristics of a multimedia model in pictorial form which follows the development phase. It is used to reflect on the flow of the applications (Hofstetter 1997) (Cartwright & Cartwright 1999). Having good objectives based on and related to proper task analysis, and writing the program content based on those set objectives, is the first cornerstone of a good self-directed learning model (Piskurich 1993). The design phase uses the conclusions from the assessment and task analysis phase to build a road map for development (Alessi & Trollip 2001) (Lee & Owens 2004).

Creating a storyboard for a model is followed by creating script for it. A script is a complete specification of the text and narration in a multimedia application. It helps the designer to role-play the model from the viewpoint of a user and identify any missing elements (Hofstetter 1997). Figure (3) illustrates an example of a planned program storyboard.

Hypermedia storyboard		
Health Workers Education program-Tuberculosis		
<i>Title: INTERACTIVE MULTIMEDIA SELF-PACED HEALTH PROGRAM</i>		<i>Storyboard Number 1</i>
<i>Project details</i>		
		
The screen template is the same in all the model with indigenous pattern in the left border special for the title and module 1		
<i>Navigation</i>		
Button 	Link to: Are you sure you want to exit	Action: exit
Button 	Link to: next slide in the presentation	Action: go to slide 2
Button 	Link to: Audio file Introduction	Action: repeat the introduction
<i>Text</i>		
Colour: black	Size: 54	Font: Comic San Ms
<i>Audio</i>		<i>Video: NA</i>
Source: Recording MP3/1		Source
File: Introduction		File:
Description: general information about the model and its content and how to used it		Description:

Figure (3) Storyboard

Interactivity and Learner control

(Frater & Paulissen 1994) (Boyle 1997) argued that knowledge is neither pre-given, nor stamped in by the impact of external stimuli. It is constructed and validated through interaction, which is the most important aspect of a learning program, aside from the content itself. Multimedia has the potential to provide learners with educational experiences that traditional text-based methods cannot; they are often described as 'interactive' (Albion 2000).

Interactivity refers to activities performed by both the learner and the computer. These activities conduct an interchange (Orr, C.Golas & Yao 1993) (Mooney & Bligh 1997) (Cartwright & Cartwright 1999). They involve the learner in an active learning method which can serve to maintain attention, create new knowledge, and improve achievement (Barron & Orwing 1995).

Learner control refers to the degree to which learners are allowed to take an individual path through the material and to take charge of the instructions and the learning environment. It is the ability of the user to cause things to happen or to interrupt the flow of information in a program. The ability to do this is one advantage of multimedia over video or television (Orr, C.Golas & Yao 1993) (Abrams 1996) (Albion 2000).

Determination of the level and degree of interactivity is needed to accomplish the program goals. It is of particular importance to decide whether the program will provide questions, methods of answers and computer feedback (Villamil-Casanova & Molina 1996). For many medical multimedia programs the interactivity consists of button clicking or electronic page turning, and this is the lowest level of interactivity where the computer is performing tasks by the user (Mooney & Bligh 1997)

The truly interactive multimedia computer-based programs aim to establish an educational 'conversation' between a user and a computer and emulate interpersonal communication (Orr, C.Golas & Yao 1993). This can be achieved using features such as feedback on strengths and weaknesses and progress charts linked to learning activities and self-assessment (Mooney & Bligh 1997). In the planned model the interactivity is founded through a series of interactive questions at the end of each module followed by helpful feedback.

Navigation Structure

One of the challenges in the model design was to present the program material in such a way that the user will not get lost or confused. A clear notion of how the material will be organized and how the user will navigate from screen to screen is therefore essential (Hofstetter 1997). Multimedia technology enables the designer to design applications with several layers of information, each accessible by means of navigational tools and each containing several different multimedia building blocks.

The connections and links among various sections of the multimedia application are called navigational structures. There are five basic navigational structures which design the flow of a multimedia application: the linear, the menu, the hierarchical, the network and the hybrid structures. In practice, several of these schemes may be mixed in a single project (Villamil-Casanova & Molina 1996) (Phillips 1997).

The menu and the linear navigational structures were adapted in the design of this CD ROM multimedia program Fig (4), (5).

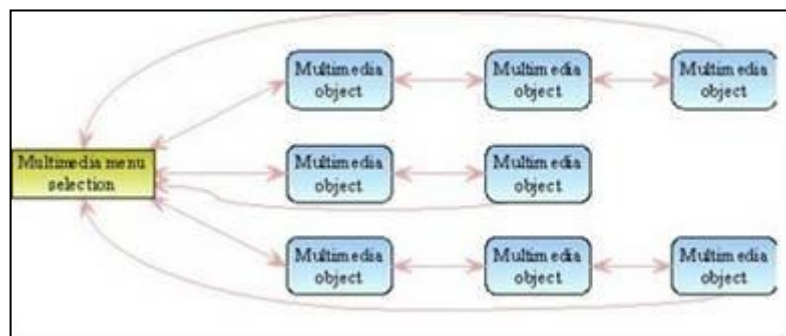


Figure (4) the menu navigation structure
Source (Hofstetter 1997)



Figure (5) the linear navigation structure
Source (Hofstetter 1997)

(Shank 2011) recommended that the learning environment for the program is designed to be more direct as this is the best approach for learners that are new to information technology. A

CD- ROM multimedia program need to have a main page, table of contents, or main menu where the user may view all of the contents of the CD- ROM and may be informed about how to navigate and find information (Tomita 2003).

The planned model was designed to have limited instructions, and be as straightforward to use as possible with full learner control of content. The model does not require completion of a certain topic before jumping into the next topic, making it easy for learners to freely and easily search for specific information. Users can exit the program at any time. This type of program has many limitations associated with behaviorism, however it holds user attention much longer than traditional methods of learning (Conrick 2006).

The navigation design is presented in a flowchart as a logical diagram that illustrates the steps involved in an interactive decision-making process and includes the general order in which the learner will encounter directions, choices, presentations, interactions, remediation and finalization (Hofstetter 1997) (Alessi & Trollip 2001).

The model frameworks in figure (6) and (7) are the underlying structures of the planned model. These are designed to provide information in the form of tutorial presentations (P) within each module (M) followed by a short Quiz (Q) and feedback (F). The tutorial presentations (P) in modules one, two and four are offered in the form of storytelling videos and in modules three and five are presented in the form of Power Point presentations.

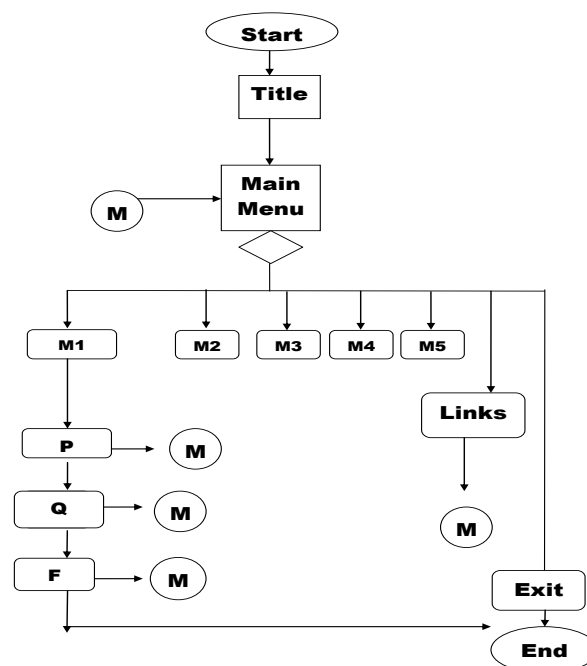


Figure (6) Flowchart of a Model framework

Model modules are connected by permanent links that are used to link related screens in the simplest form and to allow the user to return to the main menu or exit the program from any screen in the program. The design framework provides two methods for navigation. The Systematic User's Guidance (linear method) is present only in the presentations (P) of each module. The random access browser, a menu or web-like structure, provides the freedom to explore the information at any point in the program and to move between the different modules. This navigation of the design framework ensures the effectiveness of learner control. The presence of optional quizzes followed by feedback at the end of each module, which corrects the learner's answers and verbally acknowledges achievement, provides the interactive learning experience.

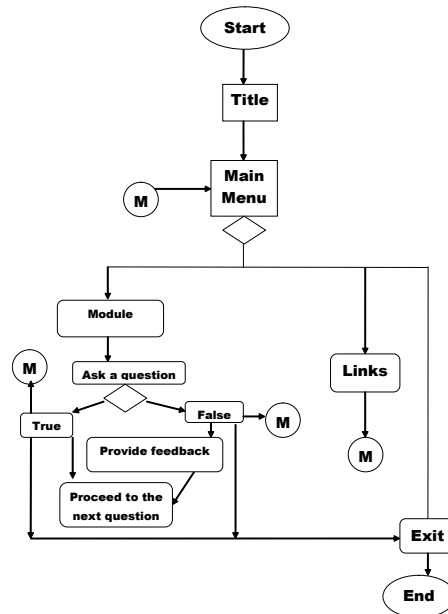


Figure (7) Flowchart of quiz

Each module, whatever forms it is in (presentation or story), is primarily narrative -based, and is supported by text, images, drawings, figures and links to medical references.

Design objectives and learner control of the program were achieved through the following functions:

- 1- Learners are able to make better sequencing decisions for their learning activities
- 2- Learners are able to temporarily end the program and return to it later
- 3- The screen buttons are visible and remind learners of things that can be done
- 4- The menu list is present throughout the program and the options available are clear
- 5- The main menu is easy to access in the entire program
- 6- The mouse is used as a simple mode of control of the program
- 7- The presence of a repeat button in each slide throughout the program provides a way for the learner to control hearing of the instructions and the narration.

Screen Graphic Design

(Harrison 1990), (Ivers & Barron 1998) and (Cartwright & Cartwright 1999) identified some important factors that should be considered in any program screen design, which help the learner interact and concentrate with the content of the program. Those factors are:

- 1- The screen should be simple, consistent and intuitive
- 2- Readable text on the screen and clear effective writing
- 3- Presence of standard screen types throughout the program
- 4- Presence of separate main menus summarizing the program content and allowing learners to jump directly to a point of interest
- 5- For consistency, the screen template used in the project should contain defined functional areas.

The exact design of the screen template depended on the type of information presented and the authoring program used, which depend on the primary purpose of the designed screen (Ivers & Barron 1998) (Cartwright & Cartwright 1999).

There was more than one template used in the project. These are: a template for information (Screen Template, fig 8), another for questions (Interaction Screen, fig 9), and a third for the menu screen (Navigation screen, fig 10).



Fig (8) Instructional Screen Template

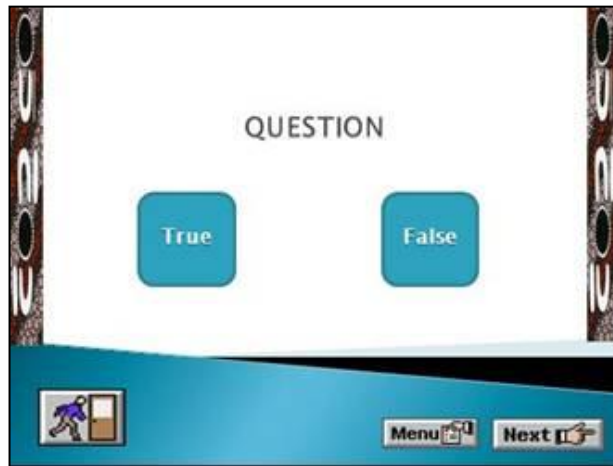


Fig (9) Question Template



Fig (10) Menu Screen Template

Program Implementation

The program design was directed by the adult learning, population health and medical education learning approaches. It was influenced by constructivist and socio-cultural learning theories.

Story transcripts were sent to artists to portray the pictures. The graphics were produced using Black Magic painting software. The material collected and the narration used were recorded direct on the authoring program software. The main designs of screen templates were specified. The media modules were assembled using Movie Maker software to produce the stories in the form of video clips. Following the completion of the storyboard, the program was developed using PowerPoint software.

Conclusion

A culturally appropriate interactive multimedia CD-Rom informatics model as a mechanism to improve the accessibility and the use of scientific data and information for health purposes was proposed as a basic method for better supporting Aboriginal and Torres Strait Islander primary health care workers in their practice locations. A CD-Rom was developed guided by the results and recommendations from a needs assessment through the use of qualitative interviews with key stakeholders and supported by previous literature.

The development procedures started with identification of the audience's profile, determination of the program's goal, preparation of the task analysis and specification of the program objectives. This was followed by determining computer configuration required, and the multimedia blocks to be used in the program. Tutorials and storytelling was used as the interactive methodologies for presenting information and concepts. PowerPoint software was chosen to be the authoring program software. Program content and structure was decided upon and a transcript to the storyboard was developed, which described in detail the interactivity, navigation, learner control, and screen design.

It is envisaged that through establishing this interactive multimedia CD-ROM informatics model, ATSIHWs will be encouraged to be self directed learners, improving their up to date knowledge and information. It is also hoped that it may also encourage ATSIHWs to pursue other health care courses. Furthermore, it is envisaged that this model will empower ATSIHWs and support them in their practice locations, especially those in remote and rural areas. The CD-ROM will be sent to key stakeholder with various backgrounds for formative review as the next stage in the study.

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