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Online health services: study of user
perceptions of the perceived usefulness of
an evolving web-based health community
using Q-methodology and activity theory

Ngo Lui M. Mok
University of Wollongong

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Online Health Services: Study of user perceptions of the perceived usefulness of an evolving Web- based Health Community using Q-methodology and Activity Theory

A thesis submitted in fulfilment of the requirements
for the award of the degree

MASTER OF INFORMATION SYSTEMS (RESEARCH)

FROM

UNIVERSITY OF WOLLONGONG



By

Ngo Lui Michelle Mok, BCom (BIS), MIS, MBA

School of Management and Marketing

Faculty of Commerce

2008

THESIS CERTIFICATE

CERTIFICATION

I, Ngo Lui Michelle Mok, declare that this thesis, submitted in fulfilment of the requirements for the award of Master of Information Systems (Research), in the School of Management and Marketing, Faculty of Commerce, University of Wollongong, is wholly my own work unless otherwise referenced or acknowledged. This document has not been submitted for qualifications at any other academic institution.

Ngo Lui Michelle Mok

28th August, 2008

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LIST OF ABBREVIATIONS

DT	Development Team
ICU	Intensive Care Unit
ICCMU	Intensive Care Coordination & Monitoring Unit
NSW	New South Wales
WBIS	Web-based Information Systems
WWW	World Wide Web

ABSTRACT

The main question asked in this study is what are the perceived information needs of clinical professionals working in Intensive Care Units (ICUs) that can usefully be accommodated with a Web-based Information Service? The study seeks to examine the perceptions of the service provision over a period of time during which the Web-based Information Systems (WBIS) was introduced.

This study aims to compare the views of two key groups of individuals that is the Professional end-users in ICUs as well as the WBIS Development Team in regards to the perceived usefulness of a Health Information Service over a 9 month period.

This thesis then is seeking to identify the efficient solutions using the Q-methodology and Activity Theory to improve the WBIS and communication within and among ICUs and to provide easy access for users.

The approach taken here is to obtain guidance from users on the additional growth paths the WBIS can take, which may include new features and functions in order to encourage, attract and provide better service to clinical and public users who require access to ICU related information.

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I would like to further develop my knowledge within the Information Service Provision. The main focus of this thesis is on the Intensive Care Coordination Health Information Services from a user's perspective. The research conducted here has sought to actively engage the participants in the research process. I would like to acknowledge all their efforts in contributing to this work. My motivation for undertaking this application has enabled me to further develop my research skills and to engage in a research project that may provide tangible benefits to the Health Care Communities.

OVERVIEW OF THE THESIS CHAPTERS

In Chapter 1, the research's framework is introduced to form and support the basis for the study. The main question asked by this study is: What are the perceived information needs of clinical professionals working in Intensive Care Units (ICUs) in New South Wales, Australia, which can usefully be accommodated with Web-based Information Systems (WBIS)? In Chapter 1 the background to the study and significance are explored and refined.

In Chapter 2, the main literature review covers the literature on WBIS. Due to rapid increase in the availability of Web-based services there is an increasing expectation for health care services to be provided in this manner; WBIS in health care have already had a significant impact in promoting a more uniform approach to using information and communications technologies in the health care sector.

In Chapter 3, the main literature review covers the literature on health care WBIS; it introduces the health care Web-based services that are using WBIS to provide health care information and services through the internet.

In Chapter 4, a longer discussion about using Activity Theory in this study occurs, in terms of its usefulness for the investigation, and its applicability to the study of WBIS and Web-based health care services. The examination of Activity Theory includes a brief review of its history and an exploration of some of the key theorists so as to provide a context and a clarification of its purpose.

In Chapter 5, the discussion of the reasons behind the selection of methodologies continues with an emphasis on how the adoption of these methodologies, based on the techniques that they include such as the concourse, and Q Sort, and how they allow this research to achieve its desired outcome.

Chapter 6 discusses the structure of existing WBIS and the problems identified for the existing Web services based on 4 topic areas: Services, Function, Design and Output.

In Chapter 7, the methodology and the data provided by the study is examined in greater detail and the initial analysis of the data of user perceptions of the perceived usefulness of an evolving health care Web-based services community using Q-methodology is done. The results for users are examined and suggestions for improvement of the service are offered.

In Chapter 8, the analysis uses cross factor comparisons and summaries from all the factors from the four areas studied namely, Services, Function, Design and Output, to highlight suggested improvements to the site; of note is the attention paid to information needs of end-users, clinical staff, medical staff and patients. The suggestions include improving the accessibility and sharing of information between ICUs; thus, a value-adding component to WBIS to ensure the WBIS is relevant to the working experience of the ICUs.

In Chapter 9, an evaluation and implication of the previous chapters occur and a discussion of insights drawn from the results for future Web-based health care development.

CHAPTER 1: INTRODUCTION OF THIS RESEARCH

1.1 Introduction

In this chapter, the research's framework is introduced to form and support the basis for this study. The main question addressed by this study is: What are the perceived information needs of clinical professionals working in Intensive Care Units (ICUs) in New South Wales, Australia, which can usefully be improved with Web-based Information Systems (WBIS)?

This study seeks to examine the perceptions of the service provided by a purpose-built website over nine months of its introduction. This chapter also presents the research questions and discusses how the research can contribute to improving health care through WBIS, with the aim of bringing health care closer to the standard of information services provided in other industries. Substantial benefits are also possible in health care, through a purposely-specific designed Web-based information system with the capability to deliver a variety of clinical, educational, professional development and administrative applications. The background to the study and significance are explored and refined as well.

Increasingly, health care services in Australia are being improved by technology such as computers and medical equipment is not a new concept, most of medical clinicians have been using a range of computer networks and telecommunications applications to deliver improved health care outcomes, and reduce costs for over twenty years. However, much of the benefit of health care WBIS in Australia has been achieved using administrative systems rather than systems related to the work practices of clinicians (ABS, 1988).

The Australia Government Action Plan (National Health Information Management Advisory Council Australia, 2001) for the health sector, Health Care Web-based Services, was released in November 1999 to provide a central focus whereby governments, consumer groups, health care providers and other interested parties can all work together to achieve a national collaborative approach to projects and build a better health care system for Australia.

There has recently been a significant move towards promoting a nationally uniform approach to Health Care Online Information Services and to using information technology efficiently and effectively. It has already served to bind Commonwealth, State and Territory Governments' thinking and activities and has drawn the health care information management agenda under a single framework (National Health Information Management Advisory Council Australia, 2001).

Health Online: A Health Information Action Plan for Australia is the national plan of action for information management in the health sector, developed under the guidance of the National Health Care Information Management Advisory Council. The plan, which was developed in consultation with the Commonwealth, State and Territory governments, was first published in 1999 and up-to-dated in 2001. It was endorsed by the Australian Health Ministers. The Online Health Care promoted new ways of delivering health services that benefit consumers, by harnessing the enormous potential of new technologies (National Health Information Management Advisory Council Australia, 2001).

1.2 Background of this Research

This research seeks to improve health care provision through an examination of health care Web-based Information Systems (WBIS), with the aim to bring them closer to information services provided in other industries. These benefits are possible in the health care sector through a WBIS with the capability to deliver on a variety of purposes, particularly embracing the information needs of the end-users, such as clinical and medical staff as well as patients. Increasingly health care professionals, whether in cities or in regional Australia, have Web-based access to medical records, clinical advice, specialist referrals, diagnostic test results and other Web-based health services.

While there has been significant change over the past six years in the provision of information in most commercial industries, there has also been a rapid increase in the availability of WBIS, and along with it an increasing expectation for health care services to be provided in this manner.

However, future advancement could still be limited due to the availability, consistency and acceptance of it. The availability of broadband at an affordable price, for example, has encouraged more widespread use to a broader section of the public, thus providing the potential for better health care service outcomes. This is important here, as the objective stated above cannot be achieved without the widespread provision of custom-designed reliable services, supported by sufficient connections (Classen D, Metzger J, 2003).

This research is also looking for new and innovative ways to help make WBIS become more open and accessible. Currently, most health care clinicians in Australia can access information they need in their own time and at their own pace. Additionally, the information available through these health care service sites is up-to-date on a regular basis, ensuring that the most up-to-date and accurate information is available to the clinicians.

This research has examined the views of two key groups of individuals, the professional end users in ICU and the WBIS Development Team, as they place high and unique demands on the provision of information services. The research has examined their perceptions of the usefulness of WBIS during the nine-month period of its introduction to intensive care environments in New South Wales, Australia.

The aim of this research was to enhance the development of Intensive Care WBIS through an approach that is user-based, facilitating the understanding between the clinical professionals who use the WBIS. The perceived information needs of clinical professionals working in Intensive Care Units (ICUs) are used to help support the informed development of Web-based Information Systems (WBIS). This thesis, in seeking to identify and propose the efficient solutions, uses a combination of methodologies: Q-methodology and Activity Theory, so as to provide a firm basis for the research with the aim to improve the WBIS and communication within and among ICUs. This improvement in communication should result in the provision of better access for its users and staff.

1.3 Background of Research Area: Web-based Information Systems

Every year in New South Wales, thousands of patients are admitted into ICUs. These units are designed to deliver the highest medical and nursing care to the sickest of patients. These units are spread across the state, and are located in hospitals organised in health care areas. Some smaller rural and urban hospitals do not have ICUs and so the larger metropolitan hospitals which have specialised ICUs may take the more seriously injured patients from the smaller units on a regular basis.

Since the ICU is a high demand service with very limited equipment and clinical resources available to the public, it is important that efficient information access is established for both clinical and public use, in order to facilitate inclusive usage of the limited resources and to increase communication between the local area ICUs.

The Intensive Care Coordination and Monitoring Unit (ICCMU) is a division within the New South Wales (NSW) Health Department, established to provide centralised information resources to the ICUs across the state. The aim of the WBIS is to enhance communication and information provision so they can share valuable knowledge gained from the experiences of their practice. A clear focus is the provision of evidence-based material

1.4 Significance of the Research

The research contribution is significant, in that it provides a method for improving health care Web-based information delivery in intensive care environments. The problem of how information systems are understood by the users themselves is of increasing importance, as these services become a fundamental part of health care provision. It is equally important to acknowledge the context of use, and the user's perceptions of information needs within a specific context.

This increasing importance arises both out of opportunities that have come about as a result of recent developments in WBIS, and through the development of digital methods for information provision. The research methodologies selected for the resolution of the new conceptual and practical problems must acknowledge the user, their context and the demands of specific environments, such as intensive care services.

Q-methodology and Activity Theory have the capacity to do this. The Q-methodology research technique was applied as a field methodology – using its facility as a systematic way of examining and interpreting participants' subjective views and opinions. Activity Theory is used to further explore the relationships of tools, processes of use, subjects and objects.

The thesis concludes with an Activity Theory analysis via mappings of the results of the Q-methodology Research, in order to establish the relations that exist between the Activity Theory elements of community, subjects, tools, activity and objects with each factor.

1.5 Purpose and Objectives of the Research

Health care today is so complex that it surpasses the human mind's capacity to operate without information systems and technology (Andrews L, Stocking C, Krizek T, et al. 1997). Practitioners need tools that reduce uncertainty in decision-making, promote efficient patient care and help bring about the best possible outcomes. Compared with other key industries, like some financial institutions such as banks and wholesale business, health care has been slow to accept information systems and technology support.

The purpose of this research then, is to provide informed recommendations on the WBIS (as tools) for bodies like the Intensive Care Coordination and Monitoring Unit of New South Wales, Australia. The aim therefore is to facilitate the communication between and among the state's regional ICUs and to share information with clinicians, patients' families and the community.

In the near future, health care informatics is likely to follow a path similar to banking and finance, which long ago realised the importance of investing in information systems. Although health care organizations are becoming more willing to allocate funds for technology, they still remain fearful of spending dollars unwisely (Donchin Y, Gopher D, Olin M, et al, 1995).

The objective of this research is to evaluate from a user's perspective the evolving health care WBIS for ICUs to provide comparable resources for hospitals, health care services and practitioners in rural and regional areas.

The patients, patients' relatives, ICU clinicians and like health professionals should be at the centre of WBIS' decisions in health care services, including information dissemination and telecommunications, as well as decision-support systems. Although health care is a business and has to remain profitable, it is also part of a services industry that must balance access, quality and cost.

WBIS is a tool for achieving objectives, which can deliver patient care, education and information provision more effectively and efficiently, as well as increasing the connection and communication between communities. Patients will ultimately judge whether the ICUs have fulfilled their vision and mission. Thus, the community-centred focus will drive WBIS forward in a way that best serves as ICUs objectives.

1.6 Methodology of this Research

As the objective of this research is to inform the planning and designing for more effective WBIS, it takes into consideration the context of clinicians and elicits their distinct and indistinct demands and needs. After comparing the strengths and weaknesses of several theories and methodologies, the Q-methodology and Activity Theory were selected as they were regarded to be the most suitable ones for use in this research.

1.6.1 Q-methodology

Q-methodology is used as it provides one of the most developed methodologies for the collection and analysis of individual understandings of an experience on a topic. It is able to reveal subjectivity, people's views, attitudes, opinions, understandings and experiences. It does this by using a process which includes group interviews called a “concourse”. Sampling statements are taken by participants in order to sort or weigh the outcomes from the concourse statements. The final stage is a factor analysis of the sorting process in order to establish the various factors or ways of thinking about the research objective. Its results can provide actionable outcomes, which can be used to enhance the level of use and further progress from the user’s perspective, and to provide insight so as to support requirements that need to be addressed.

The participants in the concourse stage of this study were able to contribute their thoughts on the nature of WBIS. The total of 17 participants in the concourse included clinicians from the ICU from a local hospital, staff and students from the University of Wollongong and 3 professionals from the WBIS Development Team.

The concourse group has been encouraged to produce as many statements as they could that fully expressed the range of their thoughts about improvement of web communication in the four broad areas of Services, Function, Design and Output. The thoughts expressed in the statements were not limited to their personal experiences, but would certainly be influenced by them. The sort size was reduced to a manageable but still meaningful set of statements by confining the set of statements to each of the 4 areas.

In the sorting of the statements in this research the participants were asked: “To what extent do you agree or disagree with the following statements?” The sorters were provided with a Q Grid where they were able to rank the statements in accordance with the extent of their agreement with the statements.

An advantage of “Q” Methodology for this study is the scale. Q-methodology does not require a large population in order to produce meaningful results. As a rule, a “Q” sample of 30 to 50 individuals is enough to produce an accurate picture of the range of views on a topic (McKeown & Thomas, 1990). Q-methodology also allows the users to both express their views and then to give a clear indication of the importance that they as individuals place on those views (Brown 1980).

1.6.2 Activity Theory

The final analysis uses Activity Theory to further explore the relationships of tools, processes of use, subjects and objects. The thesis concludes with an Activity Theory analysis via mappings of the results of the Q-methodology Research, in order to establish

the relations that exist between the Activity Theory elements of community, subjects, tools, activity, and object with each factor.

The community of users consists of the patients, the patients' relatives, clinicians of the ICUs and health care professionals. The analysis is the longest part of the task and the level of difficulty experienced will depend on the relative clarity of the factors that are produced from the Q study. There is software available: "Q method software" that will assist with the mechanics of the analysis.

Following the analysis, it is a good practice to re-interview some of the subjects for clarification. Activity Theory provides a means to examine the expressed and evaluated views in a framework that includes the community, the social context, the tools and most importantly the relationship between various aspects.

The methodologies selected allow access to the advice and guidance from users on the additional growth paths that health care services can take for the WBIS. The methodologies also have been selected for their ability to provide access to the views and judgments of the users on how they experienced the service and what are they think may improve its design and delivery. The suggested changes may include the new features or functions in the WBIS to encourage, attract and better serve clinical and public access to ICUs' related information.

1.7 Outcome of the Research

Health care increasingly focuses on using information systems and technologies to improve patient care. One of the recent challenges for ICU clinicians, is how and where to obtain appropriate information for the provision of health care service to individual patients who can benefit from this service. ICU clinicians must always consider a patient's safety issues and provide health care in a way that minimizes risks while improving patient outcomes (Beckmann U, West L, Groombridge G, et al, 1996).

It is also increasingly important then to find, select and apply valid and appropriate clinical information when making decisions about the health care of their patients, as the information is the key to making informed decisions. Improving WBIS development is particularly important when they are developed in conjunction with the approach known as evidence based health care (Sackett DL, Rosenberg WM, Gray JAM, 1996).

The intended outcome of the research is to enhance the development of WBIS while acknowledging the role of evidence-based health care. To accomplish this approach which is user-based, and to facilitate the understanding between the ICU clinicians, the health care professionals who use or are likely to use WBIS were involved as subjects of this study. This approach reduces uncertainty in decision-making, promotes efficient and effective patient care, and helps to bring about the best outcomes possible.

CHAPTER 2: WEB-BASED INFORMATION SYSTEMS AND THE APPROACHES ADOPTED IN THIS STUDY

2.1 Introduction

This chapter also introduces WBIS, which is used for diffusing, processing and managing information over the Web-based systems, which are discussed in depth. The chapter ends with a review of how WBIS can provide Web-based information to individuals, in the context of their work environment.

At the end of this chapter, a brief introduction to WBIS specifically designed for health care is provided, and an explanation of how user informed design in Activity Theory can be used, in order to understand and explain the nature of information in terms of exploring its relevance to current practices. This is one of the prime objectives of this thesis.

At the present time, Web-based Information Systems (WBIS) is popular to use for diffusing and processing information over the Web. Due to the large amounts of information that needs to be managed, it is therefore vital to be able to adapt the delivered information to users and to give them ready access to the information. WBIS is well placed to provide access to information that is Web-based for individual's use. Individual adoption of services will be a focus of this study in that it looks at a specific set of users (Chueh H, Banett G, 1997).

WBIS has become a key facet in the management of modern organizations, to support their business processes and to attend to market demands (Enser, P. G. B, 1993). The WBIS is

increasingly being used as a powerful platform to develop information systems and also to establish interfaces with legacy systems. The advantage of the WBIS is that it provides an efficient and cost-effective way to integrate information, support internal work and allow distributed access throughout the public network (Horton, 2000). Thus, use of WBIS and process control procedures seems to be an effective way to keep competitive advantages and offer enhanced services. This study will seek to adapt the provision of information for specialised health care services.

This study is seeking to identify the efficient solutions using Q-methodology. It aims to improve the Web-based Information Systems (WBIS) and communication within and among Intensive Care Units (ICUs), and to provide easy access for users. Other factors that need to be considered include security issues; increasing the flow of user information within the WBIS to clinicians and patients' relatives. These information services need to adopt a managerial approach to coordinate the information systems in order to be able to accommodate any long-term issues that may arise in the functions of health care information provisions.

The study examines the understandings and expressions of the needs of the Web-based health care community using Q-methodology to give a voice to users, thus, allowing them to contribute to the improvement of the WBIS. To accomplish this aim, visits were undertaken at urban, regional and remote locations to achieve a collection of views and ideas in the form of statements for the four broad areas (Services, Functions, Design and Outputs). Once the statements were collected through the concourse visits, they were refined to remove duplicates and to gain greater clarity.

Through the use of the Q Sort technique, the statements, sorting instructions and a grid sheet were distributed. This sorting process allowed for individual participants, which included clinicians, university students and academics from Information Systems, and the WBIS Development Team. They were asked to more closely examine the views and make their own judgements, in terms of agreement or disagreement with the statements that hold importance in light of the possibilities raised by the statements from the concourse. This process allowed us to put all the collected thoughts on the table and for the participants to make judgments between the thoughts, to determine for themselves via the sorting process, what type of information service they believe should be provided.

2.2 Web-based Information Systems

According to Langefors (1973), an information system is a technological medium for collecting, storing, treating and distributing information. Web-based Information Systems (WBIS) has introduced the concept of interactive, graphically enhanced information systems. More recently, due to the communication that occurs amongst WBIS, there has been the development of Web-based “Communities”.

Web-based communities that are sometimes called virtual or digital communities are examples of these new kinds of information systems that are often designed, made and managed for the most part by the people who also use them. The history of the WBIS and World Wide Web (WWW) is full of examples of self-organizing Web-based communities like Yahoo! (<http://www.yahoo.com>) and Google (<http://www.google.com>). They offer hosted community services, as well as the availability of a number of open source community Web-based search engines. The open nature of the Web-based Information Systems (WBIS) and World Wide Web (WWW) technologies has been the major enabler of this development by Tim Berners-Lee.

The WWW is now considered a reliable medium for widely diffusing information and, unsurprisingly, more and more information systems, called Web-based Information Systems (WBIS). This WBIS addresses various application domains including e-business, education, geography, etc (Newman, I. A., Parks, L. M., and Smith, P. A, 1997). As with any other information systems, WBIS are designed to manage very large sets of data and to offer specialized services.

Moreover, in the context of being Web-based, they are supposed to offer navigation facilities through the hyperlinks generally embedded into a multimedia presentation of information. Although this characteristic makes these systems attractive, the measurement of the quality of WBIS must not only take into account the graphical appearance or the quantity of available information but also its relevance and ultimately its usefulness (Mekhjian H, Bentley T, Ahmad A, Marsh G, 2004).

The appropriateness of the information that a WBIS delivers to the user turns out to be an acute problem (Pappo, H. A, 2001), as the user needs to be considered because:

- all users do not need the same information
- users do not need all the available information all the time
- users will have differing expectations or understandings of the service

The first point can be tackled by distinguishing users' profiles, and is often referred to as adaptability. Recent systems, developed by commercial companies (Interligo & Broadvision 2001), see a new generation of Web-based applications able to track down the behaviour of their users and to dynamically react, by adapting the presentation of information.

More generally, a WBIS is said to be adaptable when the user gets the impression that the system has been specifically designed for her/him. Then adaptability, and its dynamic version called adaptively (Stephanidis & al, 1998) is defined by Stephanotis as the ability a

WBIS has to provide its users with some relevant information with regards to their rights, needs, individual characteristics and material configurations (WAP, browser, etc.), in terms of both content and presentation.

The second point concerns the delivery of information by WBIS and the fact that users may only occasionally need some parts of the health care or medical information (Interligo & Broadvision 2001). Indeed, even when information is appropriate, users can be confronted with a cognitive overload due to a too massive and/or difficult quantity of information. In order to spare users the trouble of getting “lost in the hyperspace”, Theng in 1998 proposed providing them with a gradual organization of information which allows them to progressively access it.

The third point refers to how users understand and what they expect from the system. The alignment between their expectations and the service provided from the system will determine its ultimate usefulness. Meloche showed that there can be diverse understandings of common terms such as information, information seeking and information technology, and that the understandings held by the user’ impact on their expectations, their use of services and their satisfaction with the service (Meloche, 1999). A number of factors will drive organizations to change information systems to these WBIS, such as the pressure to reduce the cost of information management, or the desire to provide (almost) instant access to information anywhere anytime. WBIS may also facilitate a reduction of inaccurate information provision and information processing errors.

Web-based communities benefit their users by offering a freedom from location and more

efficient use of time for their members. The idea to gather everyone who is interested in some specific topic, regardless of where they are, to a single Web-based community to discuss and to share information about it, will strongly help to build the Web-based health care communities which can be used when it best fits in with their schedule (Ellis, 2000).

In the core of all Web-based communities is the provision of asynchronous communication tools, such as news groups, discussion boards and file sharing services offering freedom of same time and space. In the popular culture world of the Web, these communities have been established among enthusiasts for a particular event, or topic (Ellis, 2000). However, researcher communities are also becoming prevalent, and more recently, work-based communities.

The benefits of WBIS are such that they are replacing existing information systems. While Web-based communities can be global, they are more likely to succeed if some of the members have met at least some of the other members and if off-line activities also occur (Epstein and Olsen 2001). Thus, the communities are often “local” even while they can be accessed globally. The case that is being examined here consists of the clinical community from ICUs across NSW. However, many international visitors regularly attend WBIS (Wearing, 1998).

2.3 Struggles of Information Systems

It is interesting that even the concept of Web-based communities in general is blossoming; yet the attempts to introduce WBIS for local communities – such as villages or city districts – have not been very successful (Tsagarousianou 1999, Ridell 2005).

The reasons that some local Web-based communities fail has been presumed to be related to the top-down nature of WBIS that do not facilitate grass-root activism, as well as to the obstacles and lack of easy access to the WBIS for citizens (Ridell 2005), amongst the obstacles that exist for local Web-based communities, limited access to the WBIS is probably the most obvious barrier for most people.

In addition and in association with the lack of physical access is a lack of basic skills, which limits people's opportunities to effectively use information systems. According to the Australian Bureau of Statistics in 2003, close to 50% of the Australian population do not have the computer skills required to participate in Web-based communities.

The differences among the elder age groups and younger age groups are the most remarkable; still more than every fourth person in the 16-24 year old do not have basic skills needed to use the Web-based communities (ABS, 2003). When we go further and consider regions and cultures where there is a lack of value placed on literacy, and functional literacy levels are low, the number of people who will have the access and ability to use WBIS is even lower (Ridell 2005).

We may also speculate that because Web-based communities are primarily supporting “weak ties” amongst their members, they may not facilitate the needs of communities with “strong links”. The cultures of Web-based communities are also global and not just local, whereas villages and city districts are by their nature local. People who share a physical space, basically, tend to have strong links with everyone else in the community rather than weak links (Greenberg, S. and Tauscher, L, 1997).

The strong links guarantee higher security and caring, which result in well-being. Many people would like to have technology that supports these strong links. However, we should not forget that different cultural patterns, customs and beliefs related to the use of different technologies are not the only obstacles to creating local information systems (Wearing, 1998). The general culture, or the sub-culture and/or simply the way of living do not necessarily support strong links among the people living close to each other.

2.4 User Informed Design

Activity Theory provides an approach that can facilitate user-informed design. Activity Theory analysis sees learning as a complex set of processes that result from tool-mediated interactions in specific contexts for particular objectives (Engestrom 1996). The theory can help one to understand, for example, how a computer or a mobile phone as cultural tools can facilitate learning, and how users are changed and transformed by the tool use over time (Hardman 2005).

Peter Merholz observes that user-informed design is contrary to common wisdom, as user-informed design is not a simple process, but a philosophy. The primary benefit of user - informed design is that, when performed well, it ensures that the product is generally useful, usable and significantly meaningful to the end-user. A variety of low reliability methods have been developed to achieve user informed design, which allows for short development cycles (Merholz, 1996).

Often times, what is most useful, usable and meaningful to the end-user may appear untenable from a business perspective; however, the product, while it may be popular, is a financial failure (Cooper, 1995). Additionally, user informed design can often get bogged down in the design process, in needing to verify every design choice with users, and thus unnecessarily encumbering progress.

Nate Shedroff sees user-informed design as an approach to creating experiences from the products, interfaces, events, or other media designed for people with their needs in mind.

Usability, while one of primary focuses, is not the only one but it is one of several. The others include usefulness, desirability, legibility and learn-ability etc (Shedroff, 2001); the benefits are that often these systems are easier to use in terms of functions and use, and more compatible with existing processes.

Alternatively, he considers several possible problems with this approach, but they are few compared with not using a user-informed design. One problem is that the users targeted for the experience are either too narrow or not reflective of the true users in terms of personality, needs, uses, behaviour and experience (Frj and Hertzum, 1996). Frequently, the choosing and defining of “users” is more political than it should be and less reflective of reality. Another possible problem that frequently happens is that, despite employing a user - informed model, developers ignore important issues and feedback, as they discount things that they do not really want to address (Fuchs, 1996).

User-informed design should not be confused with participatory design which is an approach that requires actual representative users to participate in the designing and project-specifying processes. This approach can have success over a wide-ranging scale. Sometimes, user involvement at this level becomes political and intrusive, or users only know to ask for things that they have already seen and there is no mechanism for truly innovative solutions. However, it is always worthwhile to test solutions with users in order to get feedback during the design process when changes and enhancements can still be made (Hackos and Redish, 1998).

User-informed design facilitates understandings and considers the cultural-historical conditions of the people, using existing technology to help designers and developers to come up with solutions because user-informed design is both a philosophy and a process (Hackos and Redish, 1998). It is a philosophy that places the person as opposed to the “thing” at the centre. It is a process that focuses on cognitive factors such as perception, memory, learning and problem solving, as they come into play during peoples' interactions with things (Norman, 1998).

User-informed design seeks to answer questions about users and their tasks and goals, and then use the findings to drive development and design such as:

- Who are the users of this 'thing'?
- What are the users' tasks and goals?
- What are the users' experience levels with this “thing”, and things like it?
- What functions do the users need from this object?
- What information might the users need, and in what form do they need it?
- How do users think this 'thing' should work?
- How can the design of this 'thing' facilitate users' cognitive processes?

User-informed design can improve the usability and usefulness of everything from “everyday things” to information systems and anything with which people interact. As such, user-informed design concerns itself with both usefulness and usability (Norman, 1998).

2.5 Approach to the User Informed Design

Activity Theory defines the larger context in which an activity occurs and details the dynamics that exist between the subjects, and breaks it into smaller components (Jonassen, 1996). The subject's qualifications, limitations, actions and other characteristics in the context of the activity are identified. One approach, "Cognitive Apprenticeship" uses learning-through-guided-experience by applying apprenticeship component methods with modelling, coaching, articulation, reflection and exploration (Conway, 1997).

Similar to Activity Theory, user-informed design provides the general information about users and user/Web interaction. However, that is not enough to make a particular Web-based information system usable; it is critical to discover how particular users interact with this particular site (Horton, 1998). This is a particular strength for the Activity Theory, to involve users from the beginning, by discovering their mental models and expectations that include them as an integral part of the design/development process and team (Ridell, 2005).

Thus, in chapter 6 is observing them at ICU's workplace, validating the assumptions about them, analysing their tasks, workflows, and goals to eliciting feedback via walk-throughs, card sorting, paper prototypes and think-aloud sessions are among the methods that would support an Activity Theory Study. The application of Q-methodology approaches to involve users, allows the researcher to capture their expectations to improve the current WBIS.

Finally, usability-testing is an iterative process; it is important to conduct usability-testing throughout the development cycle. Usability-testing can be conducted using elaborate labs

and equipment or using relatively simple and inexpensive means (Branaghan and Simeral, 1997). But, usability-testing is the only way one can know if this particular Web-based information system meets these users' needs.

2.6 Usability Guidelines

Usability refers to a quality attribute that assesses how easy user interfaces are to use, and to a number of techniques and methods for improving usability during the various stages of design and development (Branaghan and Simeral, 1997). Usability can also be separated into several components, such as:

- Learn ability: How easy is it to get to grips with an unfamiliar interface?
- Efficiency: How quickly can an experienced user perform a given task?
- Memorability: Once familiar with an interface, is it easily forgettable?
- Errors: How easy is it to make mistakes/recover from mistakes?
- Satisfaction: Is the design enjoyable to use?

These characteristics are all useful metrics, although the importance of each one depends on the expected uses of the interface in question (Branaghan and Simeral, 1997). In some circumstances, such as software designed for a telephone switchboard operator, the time it takes for a skilled user to complete a task is more important than the ability learned or satisfaction.

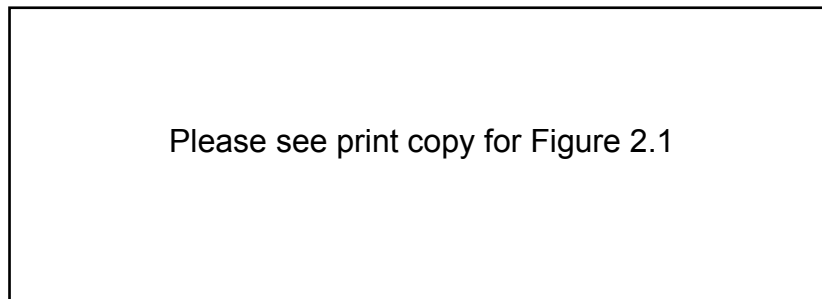


Figure 2.1: The structure of a Human Activity System (Engeström 1999)

Engeström's (1999) description of the cultural-historical psychology in Activity Theory is collective activity to development of technology and knowledge by cultural, psychological and physical instruments such as "tools" like WBIS and computers. "Tools" could be anything used during the transformation process. The form of tools could also be concrete or abstract (Engeström, 1999).

For an occasional Web-based user, a WBIS' designer may wish to focus principally on providing a site that is learnable, supports the user, and is enjoyable to use. Designing a usable site, therefore, requires a designer to learn about the needs of the site's intended users, and to test that their design meets the criteria mentioned above (Branaghan and Simeral, 1997).

Legal matters including right of access or use are also a concern. Presently, more attention is paid to accessibility than to usability in legislation. This attention may be the result of accessibility being perceived as a clearly defined set of guidelines, whilst, usability is seen as a large and rather nebulous set of ideas and techniques (Bias and Mayhew, 1994). However, while WBIS can easily pass accessibility certification, it can still have low usability. Usability is to accessibility as literacy is to libraries.

WBIS with low usability is often frustrating, causing mistakes to be made, time to be wasted and they impede the user from successfully reaching their intended goal. WBIS with low usability will not attract or retain a large audience, because if the WBIS are perceived as too difficult to use, visitors will simply prefer to take other, more familiar

options.

According to Prail, 1992, user-testing is traditionally an expensive and complicated business. Fortunately, modern methods have changed this, so that it is now possible to quickly test the usability of Web-based information systems at any stage in its development. This process, of designing with the user in mind at all times, is known as user-informed design. At the earliest stages, an interface may be tested using paper prototypes or simple lockups of the design.

It is advisable to test early and often to ensure that potential problems with a design are caught early enough to solve cheaply and easily (Bias and Mayhew, 1994). However, completed WBIS also benefits from usability testing, since many such problems are easily solved.

User-testing can be as simple as asking a group of users, chosen as representative of the expected user demographic, to perform several representative tasks using the WBIS (Dumas and Redish, 1994). This often reveals domain specific problems, such as vocabulary or language that is not commonly used by that group of users.

Sometimes user -testing can be difficult or expensive, so discount techniques such as heuristic evaluation, where evaluators compare the interface with a list of recommended rules of thumb, may be used (Nielsen, 1995). Other discount techniques include cognitive walkthrough in which an evaluator role-plays the part of a user trying to complete a task. These techniques may be applied to functional interfaces, to paper prototypes, or other

mock-ups of the interface.

A common method to help designers is the development of User Personas, written profiles of fictitious individuals who are designed to be representative of the site's intended users. These individual requirements are then used to inform the design process and to guide the design process (Nielsen, 1995).

Considering the usability of a WBIS not only helps users, but also tends to improve the popularity of the WBIS in general because end-users are likely to get a better impression from a usable WBIS. Quick and simple techniques such as heuristic evaluation can be used to find usability problems, and frequent testing of a developing design is ideal, since problems can be found and solved early on (Landauer, 1995).

CHAPTER 3: AUSTRALIAN HEALTH CARE WEB-BASED SERVICES

3.1 Introduction

The study analyses how the current development of health care services may enable clinicians to gain access to various services, including second opinions for decision-making, letting health consumers know about their state of health, access to real-time health care advice, and to gain a higher quality of individual care. There will also be suggestions of possible future improvements to these services.

In addition, as the development of health care places high and unique demands on the provision of information services, this chapter also provides some brief background on the intensive care environments in the state of New South Wales (NSW), Australia. The NSW Intensive Care Coordination and Monitoring Unit (ICCMU) and the Service Development Team share valuable knowledge gained in the experience of their practices and in the provision of evidence based material across the state.

Information systems provide powerful platforms for communities to manage coordinate and develop their activities where people focus on some common interests or hobbies to share information (Berryman, 1990). With the growing demand for safer and improved health care, a Web-based health care service is a system that provides health care information and services through the Web-based Information Systems (WBIS) to actualise better and more efficient patient care.

Web-based health care services can enable medical clinicians to gain and communicate information about individual patients and to inform their relatives. Additionally, they enable clinicians to gain access to provide and access second opinions for decision-making, they help enable health care consumers to know more about their current state of health, as well as to gain access to real-time health advice and ultimately to gain a higher quality of individual care (Lajoie, Wiseman, and Faremo, 1999).

3.2 Australian Health Care WBIS Development

The Australian Government has undertaken a number of initiatives to improve the efficiency of the health care delivery by adopting information systems, and these are expected to be the major drives for the Australian hospital information systems as well as National Health Information from National Health Information Management Advisory Council, Australia. The following reviews a number of the initiatives that have been undertaken recently within Australia.

The Advisory Council has embarked on an ambitious project known as “*Health Online: A Health Information Plan for Australia*” (<http://www.health.gov.au/healthonline/action.htm>) to build a national health information network. The Health Ministers have recognised the need for a national collaborative approach to ensure that the benefits that Web-based technologies bring to the health care sector are realised for all Australians.

“*Health Online: A Health Information Plan for Australia*”, launched by the Federal Minister on 4 November 1999, and authorized by Health Ministers provides the “blueprint” for activities across the health sector. In August 2000, a health Web-based summit was held, to provide key stakeholders the opportunity to participate in reviewing current activities, and to set future priorities for the national health information agenda for incorporation into the next generation of the health care innovation project.

Australia is slowly moving towards an efficient and effective health care delivery structure, where health care organisations will be linked with each other. Information systems are

expected to play a vital role in this structure, and there is likely to be an increased uptake of hospital information systems, to allow for more seamless integration between the legacy and contemporary health care information systems, increasing availability of Web-based health care services and use of Web-based applications for clinicians and the general public.

Thus, the “General Practice Information and Technology Strategic Framework” (<http://www.dcita.gov.au>) outline provides a blueprint for progress, so that health care information management can modernize and support take-up issues, including training, coding and electronic health records development throughout the NSW public health care (<http://www.health.nsw.gov.au>) and shift into WBIS.

The Commonwealth Government supported the data protection legislation and security framework for the private sector, arranged a national workshop on health care data protection issues, and gained the commitment of Health Ministers to work towards nationally reliable health care data protection legislation.

The Commonwealth Government has allocated AUS\$8.60 million across all divisions of general practice to employ information systems support officers to assist GPs with their computer needs through training and support activities. It convened a national standards workshop to identify priorities among standards issues, and in particular, to identify those standards that Australia has recommended to an international standards committee for development, and standards issues which will need to be developed in Australia. Thus, a plan for health care information standards development in Australia is being prepared.

In March 2000, “HealthInsite” (<http://www.Healthinsite.gov>), developed a standard interface, which provides health information and electronic health care records. “HealthInsite” enables the sharing of data across a number of key applications. This was based on the work of the “Good Electronic Health Record” (<http://www.ehto.org/ehto/ehealthrecord.html>) for general public, patients and clinicians to enable them to access and use health care information to promote better health care.

A more efficient and effective health care WBIS can be built through a greater adoption of e-commerce, and an improved availability of aggregate data for research, policy and planning purposes. As a result, options have been examined to develop an Australian health care industry Web-Based Information Systems that provides links to promote Commonwealth and State departments and industry groups involved in the export of health care products and services. As this group de-identified the data, linking Medi-Care Benefits Schedule (<http://www.medicare.gov>), Pharmaceutical Benefits Scheme and hospital morbidity data to investigate the potential these data sets have for research and planning.

Health care WBIS that makes more advanced use of the WBIS to provide clinician’s health care information, do a professional job of highlighting the brand name of the health care institution sponsoring the systems; this was proposed along with other things.

By 2003, most organizations in Australia, including hospitals, pharmacies and medical clinics were connected to the WBIS and had publicly viewable Web-based sites directed at patients and clinicians, but many of them are more like “place holder” sites, used mainly for marketing and promotion. They may have allowed patients and clinicians to review a

Web-based information systems directory of providers, or assist in recruiting employees, but typically they under-used the power of the WBIS to connect with patients.

When the health care WBIS is used on an even higher level, it gives patients and clinicians access to health care assessment tools and may, for example; provide a facility with the ability to schedule appointments. Such service provision will take the health care WBIS to a higher level, where patients can view their medical records and become engaged in self-care management. This increased level of service provision should result in an increased satisfaction level of patients, increasing the number and quality of procedures performed, promoting fewer medication errors, etc.

Effective health care WBIS is providing feedback on how well interventions are working, to achieve the desired patient care outcomes in that it measures the effectiveness and the overall impact of care, and monitors the effects of interventions in both clinical practice and formal clinical trials as well as monitors the course of an individual patient's illness as part of a management plan. Continued use of WBIS can also allow for tracking changes within populations and adapting public health care measures to changes in the population being serviced.

The health care WBIS also prompts patients and clinicians to seek or provide high quality health care in Australian Government Productivity Commission, 2005. Such systems can assist in appraising patients' health care conditions, as they can include details for follow-up, monitoring intervals, and procedures to be done at follow-up visits. As a result, health care WBIS is becoming more popular among clinicians to help facilitate communications

and to provide access to health care information and services for increasingly demanding patients. Clinicians and patients are now being integrated with clinical information systems and management information systems to offer patient-focused information, communication tools and administrative functions (Bagian, Lee and Gosbee, 2001).

Increasingly, when clinicians go looking for health care information, the WBIS is one of several resources to which they turn. Given the lack of organization and authority of the information on the WBIS, it is necessary to understand more about specific key groups. The clinicians' groups who are looking for health care Web-based information need targeted health care to be available, and have different information requirements for their needs, whether they are drug products, health care treatments, etc (Bagian, Lee and Gosbee, 2001).

Most clinicians in Australia are using the general internal hospital Web-based service, to get the primary sources of health care information and are searching for health care news, broad-ranging products and disease information. However, some clinicians, especially those in specific departments like ICUs, are more likely to spend a longer period of time on one specific Web-based service to search for health care information (Bagian, Lee and Gosbee, 2001) such as: evidence-based practices to locate more product-specific information and treatment pattern information that can be provided through the specific Web-based information systems.

3.3 Intensive Care Units in NSW

During 1960s and early 1970s physicians recognised the life-saving potential of placing patients into specialised areas called Intensive Care Units (ICUs). The purpose of ICUs is to provide more intensive management for patients by major injury, illness or after major surgery. They provide deeper health care and medical services for seriously ill patients.

Every year in NSW, Australia, thousands of patients are admitted into ICUs. These units are designed to deliver the highest of medical and nursing care to the sickest of patients. These units are spread across the state and organised in health care areas. Some smaller rural and urban hospitals do not have ICUs. The larger metropolitan hospitals have specialised ICUs and take serious patients from the smaller units on a regular basis.

The Intensive Care Coordination and Monitoring Unit (ICCMU), is a division within the NSW Health Department, established to provide centralised information resources to ICUs across the state. The aim of the WBIS is to enhance communication and information provision so they can share the valuable knowledge gained in the experience of their practice; a clear focus is the provision of evidence-based practices.

Since the ICU is a high-demand service with very limited equipment and clinical resources available to the public, it is important that efficient information access is established for both clinicians' use and the general public, in order to facilitate usage of the limited resources and to increase communication between the local area ICUs.

Currently, the ICU's health care WBIS is comprised of three components: clinicians, the general public and the ICU connect email list, each being targeted to benefit a specific audience. More detail will be provided in the discussion in Chapter 5.

The WBIS is just beginning to be more sophisticated and responsive to enhance health care maintenance/prevention programmes rather than focusing entirely on disease treatment. It is assisting ICU's clinicians through the development of evidence-based practice, and can deliver both timely information and facilitate a consultation with suitable professionals on a flexible basis.

A primary aim of the WBIS is to increase the communications between regional and national ICUs to somewhere between 50% and 90% of all information transactions within the health care systems (ABS, 2003), depending on which sector is being considered. While few studies have attempted to directly quantify what percentage of all clinician-to-clinician communications are direct interactions, those that do exist paint a similar picture. About 50% of "information transactions" occur face-to-face between colleagues, with e-mail and voice-mail accounting for about another 35% of the total and less than 5% of these exchanges occurs through WBIS (ABS, 2003).

Most information exchanges occurring within ICUs are informal and will not be captured in formal computer systems. WBIS developers have little interest in supporting this type of communication, and yet communication failures within the health care system contribute enormously to adverse clinical events and outcomes. In a conservative review in Australia of 14,000 in-hospital deaths, communication errors were found to be the leading cause of

such deaths, twice as high as errors made because of inadequate clinical skill. Furthermore, about 50% of all adverse events detected in a study of primary care physicians were associated with communication difficulties (ABS, 2003).

Advances in WBIS development, information systems and information technology offer significant opportunity to improve the effectiveness and efficiency of health care services in regional, national and remote regions. Technologies must be chosen that are both cost-effective and address high priority health care needs. The provision of access to a shared evidence-based practice for clinicians would be expected to improve the continuity of care and clinical decision-making (Anderson and Webster, 2001).

The potential benefit of ICUs' use of WBIS for clinicians includes increased access to timely, reliable information. The aims also include improved understanding of the critical success factors, for the introduction of an enterprise-wide clinical information management tool, new knowledge skills and capacities for the consumer, community and clinicians (Wu and Pronovost, 2002).

The benefits are gained from the integration of new technology and systems in health care to improve understanding of the technical, ethical and professional questions that surrounding the introduction of WBIS to ICU. The ethical issues include privacy and confidentiality. The operation issues include security, redundancy, reliability and quality.

The potential benefit of ICUs' use of WBIS for patients and their relatives is to increase patient knowledge of their own condition(s) and the factors impacting on their health, and

create positive change in patients' attitudes and behaviours regarding their participation and control in health care (Bagian, 2001). In addition, WBIS also increases activity by patients in self-monitoring and management of their own condition to improve health care outcomes for patients with constant diseases. It can improve the relationships with patients and clinicians to gain the efficiency so that patients can be better able to access the information about them, including the state of their own health and the treatment they are receiving. Additionally, patients should be empowered to increase their willingness and ability to self-monitor and self-manage, so that they take a more active role in maintaining their own well-being (Bagian, 2001).

The underpinning of WBIS has been developed to allow and review ICUs' new and innovative medical information publishing, consultation and treatment. The other information found in WBIS includes equipment procurement, monitoring and diagnosis technologies with applications such as biosensors, embedded chips and implants, telemetry, encryption by the patients and their relatives. Clinicians also can review the principles of evidence-based practice, in the recognition that in action, it can support the implementation of evidence-based policies and have a critical impact on their own practice and also give evidence, which can reduce medical errors. Without these skills in evidenced based practice, clinicians will find it difficult to provide "Best Practice" (Beckmann, West and Groombridge, 1996).

3.4 Evidence-Based Practice

The current WBIS links multiple ICUs in an effort to assemble a community of learning with regard to safety problems. This approach is particularly important for rare events that lead to significant need, where a rare event at a single hospital may not stimulate improvement; broad knowledge of the problem will.

The objectives of health care WBIS improvements were to develop an evidence-based practice that caregivers in a diverse group of ICUs could use, to identify the best methods to understand and integrate clinical experience, such as decision aids or patient-centred consultations, and to disseminate lessons learned in an effort to broadly improve safety (Kohn, Corrigan and Donaldson, 1999).

Evidence-based practice has evolved into a larger phenomenon, as increasing numbers of practitioners in various disciplines recognise the importance of evidence-based practice to inform all types of health care decisions. These decisions should be made by those receiving care, informed by the tacit and explicit knowledge of those providing care, within the context of available resources.

Furthermore, greater patient choice and complexity of care means that many clinicians practise as a team. In recognition of the importance of a united commitment to the principles of evidence-based, “Best Practice”, WBIS proposed that evidence-based practice be used to describe all aspects of the guidelines in the ICU (Kohn, Corrigan and Donaldson, 1999).

The evidence-based practice approach provides very important resources for ICU clinicians; they are able to gain, assess, apply and integrate new knowledge and have the ability to adapt to changing circumstances throughout their professional life. On the other hand, evidence-based practice requires a health care infrastructure committed to “Best Practice”, and one that is able to provide full and rapid access to electronic databases at the point-of-care delivery (Pronovost, Nolan, Zeger, Miller and Rubin, 2004).

In an effort to improve patient safety, evidence-based practice in health care WBIS collects data about adverse events and near misses from all clinicians in the ICU. Evidence-based practice, when voluntary, non-punitive and easy to complete, is capable of providing valuable feedback to clinicians. Qualitative and quantitative data are reported back to the ICU’s site study teams and frontline staff through monthly reports, case discussions, and a quarterly newsletter (Martin, 1999).

In the face of strong evidence, it is shown that virtually every patient admitted to an ICU experiences a potentially life-threatening error and it is imperative to glean important information about how to reduce the likelihood of medical mistakes which suggested by Boston in 2000, Medical errors and patient safety in Massachusetts: What is the role of the commonwealth.

The NSW’s WBIS Development Team believes that its use of WBIS can enhance the quality of patient care, by offering ICU clinicians the Web-based access to comprehensive, accurate and up-to-dated evidence-based practice information. The access to evidence-

based practice provided by a WBIS is then always available when and where needed. It can also be used to empower patients by providing them with greater access to their own information. In time, as patients become used to WBIS and use it effectively, a culture will develop where patients will be better able to access information about them, including the state of their own health, as well as information about treatments or interventions and any side effects (Leape, 2001).

The ICU's WBIS proposes using the service to provide clinicians with an effective way of carrying out on-line patient consultations, in a highly secure space within a private environment, with an aim to increase a patient's safety through the contribution of the evidence-based practice. ICUs can potentially have (instant) access to patients' complete medical records (Leape, 2001). This is especially important when patients are travelling and when different caregivers are involved in the consultation process, for example, in relation to allergies and other adverse events.

This study will evaluate an existing health care Web-based service and seek to provide guidance and enhance the further development for ICUs in NSW. This aid may include new features and functions in the health care Web-based services in order to encourage, attract and better serve clinical and general public access to national ICU related information.

CHAPTER 4: REVIEW OF THE LITERATURE - ACTIVITY THEORY

4.1 Introduction

In this chapter, there is a longer discussion about the use of Activity Theory in this study, in terms of its usefulness for the investigation, and its applicability to the study of Web-based Information Systems (WBIS) in general and Web-based health services in particular. The Activity Theory is examined in greater detail, including a brief review of its history, as well as an exploration of some of the key theorists so as to provide a context and a clarification of its purpose in this study.

Activity Theory originally emerged, and was elaborated by Russian psychologists in the early twentieth century. It is a philosophical, psychological and cross-disciplinary framework for the study of human practices as their development progresses. Activity Theory also can be an interdisciplinary approach to human sciences, which originated in the former Soviet Union as part of the Cultural Historical School of Psychology founded by Vygotskij, Leontijex and Lurija (Rodriguez, 1998). Activity Theory treats cultural and historical contexts as important considerations, and Activity Theory is comprised of several conceptual areas including: tools, community, subject and object.

In Activity Theory, units of analysis are actions, tools and objects, and the interaction of the individual within a social setting. Activities are associated with motives, and the people who would like to accomplish an objective. Hyland (1998) explained that “activity” in the Activity Theory is used to describe a motivated set of actions intended to achieve a result. Actions, unlike an activity, have more clearly defined goals. Activities can be decomposed

into actions, and the goals of actions, work for the motive or the objective, of an activity. The relationship between operations and actions is similar to those between actions and activity. The context of an activity influences the motive of activity and the level of categorization (Hyland, 1998).

Therefore, activity must be looked at more closely within the context of mediated action, and related to their design needs to incorporate the qualitative components of the action being studied (Hasan, Gould and Hyland, 1998). For example, when studying a problem for a clinical environment, it would be beneficial to understand the context of the activity and what possible activities the individual will contemplate, and those that will be contemplated by the community.

4.2 The components of Activity Theory

A fundamental component of the Activity Theory is the “task”. The development of information systems often begins with “task” analysis (Bedny and Karwowski, 2003). The person occupied in the “task” is an important factor that affects the completion of the “task” because different people with different experience may complete the operation in different ways.

Hyland (1998) explained that the level of experience of any person with a given role determines the way that person carries out the task and the level of support that is required by the person (Hyland, 1998).

4.2.1 Activity

According to Leontiev (1981), “activity” is not a reaction and not an entirety of responses, but a system that has constitution, its own internal transitions and transformations as well as its own development. Leontiev also defined the “object” of activity as its true motive, which may be either real or imagined, and that “activity” does not exist without motive (Leontiev 1981). Therefore, “activity” is not just the act of doing something, as a substitute of the term is used to describe a motivated set of actions intended to achieve a result.

Leontiev (1981) advised that “activity” is associated with motives, the motivation for the “activity” to prove something as being true, and so on. Gould and Verenikina (1998) argued that the real “activity” is a social cultural creation imposed on the context by the participants, thus, they believed the “activity” develops from the personal experiences,

knowledge, culture and social environment. Additionally, how to use the “tools” depends on the kind of experiences or prior knowledge that that person has, and this leads to different activities.

Hyland (1998) explained that “activity” is a context of information retrieval, and a user of an information retrieval system might be involved in an activity such as writing a monthly report, proving the validity of a particular point of view, applying for funding for a project or showing how the information retrieval system works Hasan, H., Gould, E., and Hyland, P. (1998).

4.2.2 Action

In Activity Theory, Bedny and Karwowski in 2003 considered “action” as a major, discrete unit of analysis that conforms to these criteria, and also regarded it as the fundamental elements through which one can recreate holistic “activity”. In addition, each “action” has a separate conscious goal that must be reached to attain the overall goal of the task, (the initiation of goal formulation constituted the starting point of any action), thus, “action” occurs when the result of the action is evaluated in relation to the established goal (Bedny and Karwowski, 2003).

Hyland (1998) stated that an activity is composed of a number of lesser parts, in terms of information retrieval system, and actions might be identifying suitable sources of data, accessing that source, retrieving specific data from that source and applying the data in its desired context.

According to Gould and Verenikina (1998), “action” that recognises “activity” is aroused by its motive but directed towards a goal and particular action. This could be executed while a person participates in different activities such as work, play or education. “Actions” are different sub-tasks that we need to do in order to achieve the major task, which involves “tools” and are connected to conscious goals (Gould & Verenikina, 1998).

Although “action” is related to an activity at a particular time, action can also exist very independently of it and is transferable to other activities (Gould and Verenikina 1998 p.13). For instance, a particular action could be executed while a person participates in different activities, such as work or play.

4.2.3 Operation

“Actions” are themselves complex and they are often composed of a number of “operations”. According to Hyland (1998), an “operation” in Activity Theory is something done routinely to complete an “action” in view of the current conditions.

Just as “activity” is related to goals, “operations” are regarded as related to conditions, and it is the resources for reaching the goals. Hyland also explained that this decomposition of “activities” into “actions” and “actions” into “operations” is described as the hierarchical nature of “activity” (Hyland, 1998).

According to Gould and Verenikina (1998), even Hyland’s argument can be divided. However, it depends on the changeable characteristics of each component and on their inter relationship. Associated with each level is a specific type of unit, thus, the concept of

“activity”, “action”, “operation” and the relationship between these three units can be described (Leont’ev, 1979) as the following model:

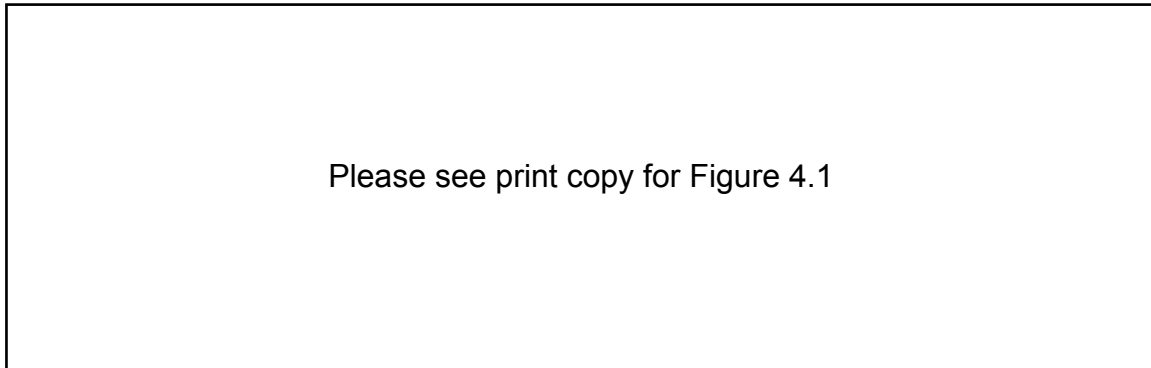


Figure 4.1: Leontiev’s model of Activity Levels (Verenikina 1998)

4.3 The Principles of Activity Theory

Activity Theory was developed by a group of revolutionary Russian psychologists in the 1920s and 1930s. The group consisted of Lev Vygotsky (1896 – 1934) and his colleagues A.N. Leont’ev and A.R. Luria (Hyland 1998). In considering the nature of Activity Theory, Gould and Verenikina (1998) suggested activity as: “It is the real activities which are a social cultural creation imposed on the context by the participants”. In addition, Hyland described activity as “A motivated set of actions intended to achieve a result” (Hyland 1998). As activity is defined as a “motivated set of actions” and is intended to achieve a “result”, it must be a goal or task that initially led to such actions.

However, the Activity Theory is not a real “theory” in the strict interpretation of the term. It consists of a set of five basic principles that constitute general conceptual systems, which can be used as a foundation for more specific theories. These basic principles of Activity Theory include “object orientedness”, the dual concepts of “internalization” and “externalization”, “tool mediation”, “hierarchical structure of activity”, and “continuous development” (Bannon, 1997).

4.3.1 Object Orientedness

The principle of “object orientedness” is one of the most important principles of Activity theory, where Activity Theory’s nature of objects arises as human agents interact. In addition, Activity Theory is based on the materialistic philosophy of collectivism, which assumes that human beings live in an objective reality, which determines and shapes the nature of subjective phenomena (Bannon, 1997).

According to Bannon (1997), the principle of object orientedness states that human beings live in a reality, which is objective in a broad sense. The things, which constitute this reality have not only the properties, which are considered objective according to natural sciences, but also socially or culturally defined properties and activities that can be poly-motivated.

The motive of an activity is always objective, whether the activity is real or an idea. In other words, there is no activity without an object. It is considered that activity is always purposeful even if the subject is not fully aware of that purpose (Hasan, 1998). For example, a manager's motivation for using executive information systems may include the desire to be better informed and to make better decisions, but may also include the desire to increase the status, to impress one's competitors, and a variety of other motives (Hasan, 1998).

4.3.2 Internalization and Externalization

Activity Theory differentiates between internal and external activities and emphasizes that internal activity cannot be understood if they are analysed separately from external activities, because they transform into each other (Nardi, 1997) and are mutually dependent.

Internalization is the transformation of external activities into internal ones, which provides a means for people to try potential interactions in reality without performing actual manipulation with real objects. Mental simulations, imaginings, considering alternative plans, etc. are examples of this (Bannon, 1997). The traditional notion of mental processes corresponds to internal activities.

Externalization is the transformation of internal activities into external activities, which are often necessary when an internalized action needs to be “repaired” or scaled. Therefore, internal actions or activities cannot be in isolation from external activities, because there are mutual transformations between these two kinds of activities.

In internalization and externalization, the general context of activities includes both external and internal components that determine when and why external activities become internal and vice versa. It is also important when collaboration between several people requires their activities to be performed externally in order to be coordinated (Nardi, 1997).

4.3.3 Tool Mediation

The central concept of Activity Theory is that all human activity involves the use of tools, and that distinguishes human activity from the activities of animals. According to Hasan (1998), there are three kinds of tools that mediate human activity:

- Primary Tools: Physical or Material Tools - artefacts, instruments, machines and computers, etc.
- Secondary Tools: Psychological Tools - language, sign, ideas and models, etc.
- Tertiary Tools: Psychological Tools - cultural systems, scientific fiction and virtual realities, etc.

Tools mediate or adjust activity. Hyland (1998) explained this idea by using this example, “In an organization with Web-based data access, the amount of data might be huge and thus the analysis of such data would be a very difficult and complex task, therefore altering the

scope and nature of the activity”. In an organization without Web-based access, the amount of data available would be far less and the researcher would have far less access to the information, and would have to adapt the smaller set of data to meet his needs and thus change the scope of the activity (Hyland, 1998).

In addition, tools mediation is another important factor because actions that involved tools were defined as “any physical device or mental technique that facilitates a task” (Hyland, 1998) such as a card catalogue. This is a physical tool, while Boolean logic is a mental tool, and if the user cannot use the tool to do whatever they want, the tool may be modified to achieve the desired result.

The other example, when a search engine cannot provide the selection of items by date of publication, it can be used to provide a similar result by sorting the search results in order of the date of publication and ignoring the dates that are not wanted (Hyland, 1998).

Activity Theory emphasizes that tools mediate human activity in a broad sense as they are created and transformed during the development of the activity itself and carry with them a particular cultural and historical meaning from their development.

According to Nardi (1997), use of tools is an accumulation and transmission of social knowledge, and influences the nature of external behaviour and also the mental functioning of individuals, which means that use of tools shapes the way people perform, and tools”carry historical and cultural knowledge (Nardi, 1997). Therefore, tools are never used in a vacuum, but have been shaped by the social and cultural context where the use is

taking place (Bannon, 1997).

4.3.4 Hierarchical Structure of Activity

According to Hasan (1998), Activity Theory focuses on activity, where the activity is usually performed by several actions and operations. Thus, the same activity can be performed by different sets of actions. The same action can be used in different activities as most subjects are often engaged in several concurrent activities (Hasan, 1998).

The hierarchical structure shown below is dynamic. Activities are comprised of actions, and actions are comprised of operations. With each of them, no matter whether they are an activity, action or operation, they are categorized in accordance with their purpose.

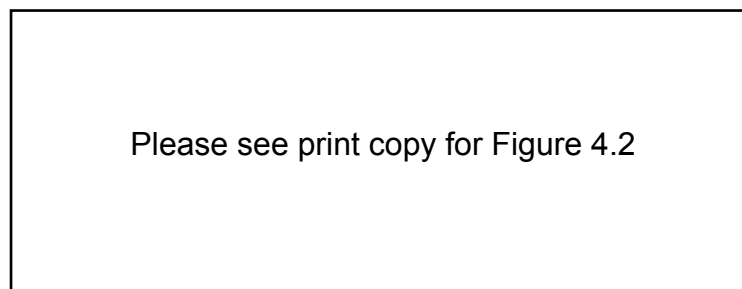


Figure 4.2: The Hierarchical Structure of Activity (Hasan, 1998)

Hasan (1998) illuminated that the hierarchical structure of an activity is that activities are always related to motives, and actions are always related to goals: “an activity can consist of many actions and operations in context, it is more than the sum of these” means that actions are conscious, and different actions may be undertaken to meet the same goal, and also that actions are implemented through automatic operations. It is shown that operations do not have their own goals, however, operations do provide an adjustment of actions to the

current situations (Hasan, 1998).

In addition, Kuutti also presented the three levels of hierarchies in activities: activity, action and operation (Kuutti, 1999). These hierarchies correspond to motivation, goals and conditions to the lowest level of this hierarchy in operation, where once the prerequisite or the condition for this operation is fulfilled, and it can be realized. The middle level is action, which consists of several operations. It is driven by the goal to do something new; and it must have a plan or a goal. However, when this action does not need to be deliberate or follow a plan, this action collapses into operation (Kumar, Dissel, and Bielli, 1998).

The highest level that Kuutti presented is activity, which in turn consists of many actions. The activity is driven by the motivation. Motivation is the need or desire that the subjects of the activity should answer together (Kuutti, 1999). An activity is considered collective, since it always focuses on complex interrelations between the individual subject and his or her community. It is notable that in this hierarchy, one operation may belong to different actions and similarly, the same action could be used as a contribution to various activities and considered as a collective activity, and it may consist of many subjects with different roles that interact with each other to achieve their individual goals (Kuutti, 1991).

Nardi (1996) also examined the hierarchical structure in the Activity Theory. She explicated that the unit of analysis is an activity directed at an object which motivates activity, giving it a particular direction, which means that activities are composed of goal-directed actions that must be undertaken to fulfil the object. Therefore, the Activity Theory holds that the constituents of activity are not fixed but can dynamically change as

conditions change (Nardi, 1997).

4.3.5 Continuous Development

Nardi (1997) considered that Activity Theory development is not only an object of study; it is also a general research formative experiment methodology that combines active participation with monitoring of the developmental changes of the study of participants (Nardi, 1997). Ethnographic methods adopted to track the history and developments of a practice have also become important in recent work.

4.3.6 Activity Theory can be the development of Information Systems

The above five basic principles of Activity Theory can be considered as the development of information systems, because they are associated with various aspects of the whole activity. A systematic application of any of these principles makes it eventually obligatory to engage all the other ones. Thus, it is necessary to consider the five principles as a whole.

In this study, Activity Theory was selected to take account for the context of users in order to support the design enhancement of the context of WBIS. Cultural means, tools and signs mediate the relationship between human agents and objects of an environment. According to Nardi (1997), the Activity Theory is a powerful and clarifying descriptive tool rather than a strongly predictive theory (Nardi, 1997).

This study uses Activity Theory to shape the dynamic and longitudinal WBIS as a guideline for the Development Team. Activity Theory offers a systemic and longitudinal response to a multi-layered approach to tackling social exclusion, therefore, it will work with the

concepts of Activity Theory to explore collaboration.

The ability to adequately profile users is one of the problems that cause ineffectiveness in the current stage of WBIS design. Based on Activity Theory, the user patterns of the services, function, design and output, especially in the context of the WBIS, are investigated and analysed.

4.4 Engeström's Generation on Activity Theory

Engeström (1988) developed the following triangle, which graphically displays the relationships between various elements. Engeström developed the diagram below, which presents the contacts between varieties of elements (Tools, Subject, Object, Rules, Community, Division of Labour and Outcomes) in Activity Theory.

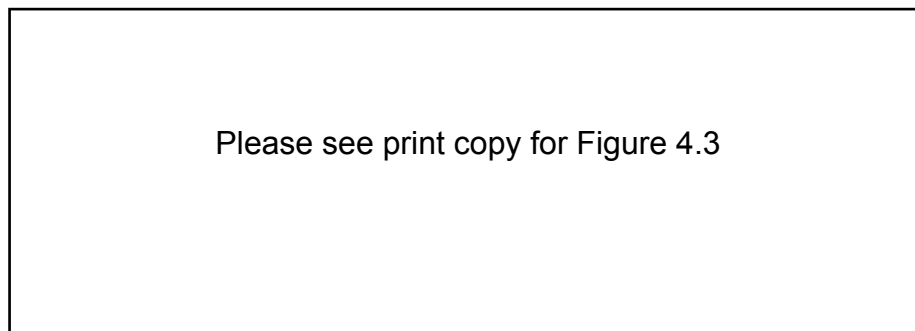


Figure 4.3: The structure of a Human Activity System (Engeström 1999)

This triangle represents the way in which Engeström brought together culture and human actions in order to examine the individual or social dualism. Engeström advocates integral and inseparable components of human functioning, yet he argues that the focus of the study of mediation should be on its relationship with the other components of an activity system (Engeström, 1999a).

In order to progress in the development of Activity Theory, Engeström expanded the original triangular representation of activity to enable an examination of systems of activity at the macro level of the collective and the community (Engeström, 1999b). This expansion of the basic Vygotskian triangle aims to represent the social or collective elements in an activity system, through the addition of the elements of community, rules and division of

labour, while emphasising the importance of analysing their interactions with each other (Vygotsky, 1979).

The object is depicted with the help of an oval indicating that object-oriented actions are always, explicitly or implicitly, characterized by ambiguity, surprise, interpretation, sense-making and potential for change (Engeström, 1999a). At the same time, Engeström drew on Ilyenkov (1977) to emphasise the importance of contradictions within activity systems as the driving force of change and thus development.

Engeström sees joint activity or practice as the unit of analysis for Activity Theory, not individual activity. He is interested in the process of social transformation and includes the structure of the social world in analysis, taking into account the conflicting nature of social practice. He sees instability, (internal tensions) and contradiction as the ‘motive force of change and development’ (Engeström, 1999), and the transitions and reorganisations within and between activity systems as part of evolution. It is not only the subject, but also the environment, that is modified through mediated activity.

Engeström also intends to develop conceptual tools to understand dialogues, multiple perspectives, and networks of interacting activity systems. He draws on ideas of dialogically and multi-voiced-ness in order to expand the framework of the second generation. The idea of networks of activity within which contradictions and struggles take place in the definition of the motives and object of the activity calls for an analysis of power and control within developing activity systems(Engeström, 1999).

Engestrom's triangle saw "rules" as society and community level laws (Engeström, 1999). The standards, norms and individuals (clinicians and public) are the level values and belief. "Community" is the immediate environment, in which WBIS is used. Subject is the end-users whose requirements can be satisfied with the use of tool. Object is the target of "activity" (by the use of the WBIS), which the subjects (clinicians and public) would like to influence or alter by using particular tools.

Outcomes are the results that actually happen when clinicians or the public use tools. In Activity Theory, tools are all the means, which the different subjects have at their disposal for influencing the object to satisfy an end-user's need (Hypponen, 2004). Obviously, in this study, tools are the context of WBIS.

4.5 Cultural Historical Psychology in Activity Theory

The principle of Activity Theory was further elaborated by Sergey Rubinshtein (1957), (who explicitly formulated the idea of human action as a unit of psychological analysis), and also by Lev Vygotsky (1978), (the founder of cultural-historical psychology, whose work in child development in a social and cultural context has since become well established). In the 1930s, Vygotsky's disciples and colleagues, Leontiev, Luria and others began studying higher mental functions from the perspective of the “activity” approach (Gould & Vernikina, 1998).

According to Gould and Verenikina (1998), the extraction of Activity Theory can be traced back to at least to the 19th century when Activity Theory was a psychological theory, which had its beginnings in the German philosophy of Kant and Hegel and was later developed by the Russian psychologists Vygotsky, Leontiev and others during the first half of this century. In the 1920s, a school of thought was founded in Moscow by Vygotsky, and study began on what was termed two broad approaches in the study of Activity Theory (Daniels, 2001): one through “individual psychological perspectives”, another in terms of “cultural-historical perspectives”, his study of the higher mental functions and consciousness.

According to Shchedrovitsky (1995), the “individual psychological perspectives” approach by Vygotsky considers activity as an attribute of individuals, under which the individual is an agent of activity. The “cultural-historical perspectives” approach points toward a formulation of activity, not only as an individual trait, but as normative standards for activity that transcend separate individuals (Shchedrovitsky, 1995).

Lev Vygotsky (1978) formed the foundation of “cultural-historical psychology”, based on the concept of mediation. Human action is not a direct response to the environment but is mediated by culturally meaningful tools and signs that make human beings able to control them from the outside. Vygotsky in 1978 said that collaboration with other humans generated the sector of proximal development for individuals, enabling them to go beyond their current capacity by grasping and constructing new mediating tools and signs.

WBIS knowledge develops from consequential transitions and communication, where the transitions are a change in relation between an individual and one or more social activities (Galda and Beach, 2001): that technological meanings take diverse forms and cultural-historical psychology in the Activity Theory (Engeström, 1987, 1999; Leont’ev, 1959) is a useful basis for designing instructions aimed at ICU consequential transitions.

Cultural-historical psychology in Activity Theory (Engeström, 1999; Leont’ev, 1981) offers powerful ways to observe the engagement in cultural perspectives and to examine the engagement in such cultural practices. According to the Activity Theory, “activity” is directed at an object like motive or purpose, something that the collective group is seeking to achieve. A subject also undertakes “activity”.

The subject uses tools to manipulate or achieve an object, and this process leads to transforming the object into an outcome (Engeström, 1999). The “object” is individual activities as a basic unit, and gives the activity its meaning, such as, the object knowledge of technology giving meaning to the collective cooperation and interaction activity of a

WBIS technology. The “object” is also regard as the motivation for an activity and could be either concrete or abstract, like a plan or idea (Engeström, 1999). The relationship between the “subject” and the “object” of an activity is mediated by the “tool”.

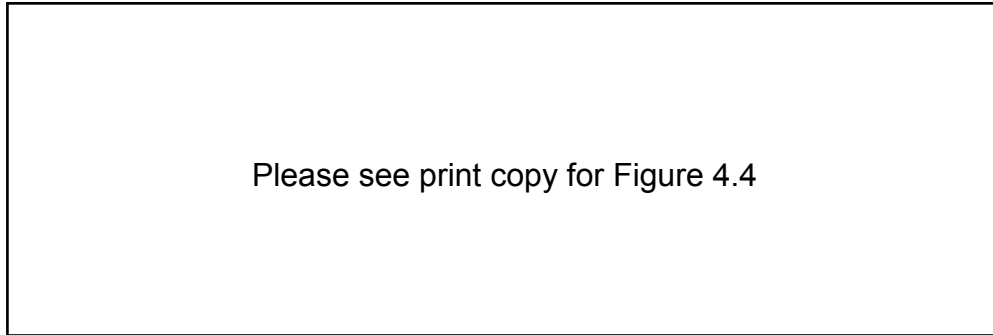


Figure 4.4: The structure of a Human Activity System (Engeström 1999)

Engeström’s (1999) description of the cultural-historical psychology in Activity Theory is collective activity to development of technology and knowledge by cultural, psychological and physical instruments such as “tools” like WBIS and computers. “Tools” could be anything used during the transformation process. The form of tools could also be concrete or abstract (Engeström, 1999).

One other way of thinking about “tools” is to consider the actual use and interactions as they occur in practice. Usually, such interactions are in offices or by a computer or for work experience, in an interdisciplinary setting. In this study, the interaction and use of WBIS are conceptualised as an activity (Engeström, 1999).

Since the structure with these three notions is too simple to explain, in terms of the relations between an individual and its environment in an activity, Engeström extended the “subject”, saying it exists in a “community”. At the same time the “community” shares the same “objects”.

In this study, “community” is in and outside of the community health care system, which seeks the same general object (Engeström, 1999). The “community” and “subject” relationship is mediated by “rules”, as also the “community” and the “object” relationship are arbitrated by “division of labour” which is what the WBIS is responsible for.

According to Kuutti, there exist a set of “rules” for the “subject” to decide how it can be a member in the “community”; these rules include implicit and explicit models, conventions and social relations within a “community”. “division of labour” under the organization mediates the relations of “community” and “object”. It refers to the explicit and implicit organization of a “community” as related to the transformation process of the “object” into the “outcome” (Kuutti, 1999).

The cultural-historical psychology’s conceptualisation in Activity Theory of WBIS as an activity system, allows one to examine the nature of the elements of the activity system. The importance is to understand the “object”, “tools” and the engaging in new activity (Kuutti, 1999), when undertaking this for the first time. The WBIS seeks to understand the tasks, the demands of the setting represented in culture which has been transformed over time, and the place of the tool and its functions in the overall scheme of things.

Activity Theory is an approach to conceptualize relationships between individuals, communities, technologies and activities, which consider the tool to be mediating human interaction with the world (Kuutti, 1999). Meaningful goal-directed activities constitute the context for both mental processes and external actions. Activity Theory sees activity as an

active, collective phenomenon, and in the importance it ascribes to collective learning, it provides an understanding of context in which computer-supported activities take place during design and evaluation, which is to validate that well-designed interface (Hasan, 1998). Clinicians should not consider the interface as a tool to achieve their goals in the organization; they are actually acting through the interface.

WBIS contain “tools” in a culturally appropriate and effective way, over time, but will, in the process, have undergone transformations with respect to social responsibilities. The development of this capacity may have been mediated by language, observation and practice (Engeström, 1999). Similarly, the practice itself will have undergone some changes, especially as a result of the person’s individual interactions with the tool and others in the setting, and the person’s knowledge will have been transformed.

In addition, there are “Tools” that can be used to mediate documentation and be directed at the health provider’s understanding of technology; the “Division of Labour”, where some possible alternative responsibilities and roles are suggested (Engeström, 1999). Overall, rules may affect activity, such as those involving accreditation and other approvals, as well as the norms of the community health care and “community”, which might extend beyond the community health care information systems.

CHAPTER 5: METHODOLOGY - Q-METHODOLOGY

5.1 Introduction

In this chapter, the discussion of the reasons behind the selection of methodologies continues. There is an emphasis on how the adoption of these methodologies, with the techniques that they include such as the concourse and Q Sort, has allowed this research to achieve its desired outcome.

As the objective of this study is the design of more effective health care WBIS, it should take into consideration the context of clinicians, and elicit and capture their distinct and indistinct demands. Through comparing the strengths and weaknesses of several theories and methodologies, Activity Theory and Q-methodology were selected and regarded as the suitable ones for the use in this research.

Q-methodology is used in this research to elicit the subjective statements of participants/clinicians (Stephenson, 1987) on the services, function, design and output, as well as provide the experimental statistics for further analysis and discussion based on an Activity Theory framework (Gould, 1998). Q-methodology also is a research technique that allows a researcher to classify, recognize and sort out individual insight and opinion, and collect groups based on their perceptions (McKeown & Thomas 1988).

Furthermore Q-methodology is one method for studying issues and their essential distinctions. The factor analysis in Q-methodology is typically based on the statements of participators, and takes the subjectivity of the individuals into consideration. Unlike other

methods, researchers using Q-methodology do not have individuals (the population) to rank pre-existing statements (provided by the researcher), and on the contrary, they typically elicit and collect the statements from the participants (Robertson et al, 2005). By the analysis of these statements, researchers sort out the core factors.

Therefore, researchers establish the focal point of the domain with their interest, and continue their study in depth. The factors and focal point, generated from Q-methodology, reflect the issues of population in the domain of researchers' interest, and therefore, the academic research and analysis can assist to solve these issues and have some practical significance (Sell and Brown, 1984). Other methodologies are less open to the views, or the population, and in this way they are contrary to Q-methodology.

The purpose of using Q-methodology in this study is to elicit and capture the subjectivity of ICUs' clinicians/participants about WBIS, not just to follow the principles and rules of designers and researchers. It is possible for one user to get and support one idea that is indistinct or unknown from the others before, through mutually (Brainstorming/Group Discussion) developing statements and through sorting in Q-methodology (Stephenson, 1987). Q-methodology, using a user-centred strategy, can draw out the main issues in current designs of WBIS and support next step analysis based on the Activity Theory framework.

5.2 Q-methodology's Background

Q-methodology was invented in 1935 by British psychologist William Stephenson (1953) and is most often associated with quantitative analysis due to its involvement with factor analysis. "Statistical procedures aside, however, what Stephenson was interested in providing, was a way to reveal the subjectivity involved in any situation such as in aesthetic judgment, poetic interpretation, perceptions of organizational role, political attitudes, appraisals of health care, experiences of bereavement, perspectives on life and the cosmos, et cetera ad infinitum" (Brown, 1996).

Q-methodology "combines the strengths of both qualitative and quantitative research traditions" and in other respects provides a bridge between the two (Dennis, 1986). Q-methodology is considered as a "new" or "innovative" strategy for conducting behavioural research (Sell & Brown 1984). It typically employs a small number of respondents, and in-depth study of single cases is not uncommon. Research can be easily conducted by anyone with a basic knowledge of research statistics through using Q-methodology. Q-methodology provides a systematic means to examine and reach understandings about personal experience, which are called a person's "internal frame of reference" (McKeown & Thomas 1988).

The way to use Q-methodology is as such: "The Q-methodology enables participants to express their viewpoints via the medium of sorting a particular set of items, usually statements written on cards, but could also be objects or photographs. Respondents are asked to systematically sort the statements according to a specific condition of instructions,

typically this would be along a continuum of agree-disagree (Brown, 1997). The resulting data is subjected to statistical analysis designed to ascertain patterns of inter-correlation between subjects (persons). Any resultant patterns of responses which are heavily loaded onto are open to interpretation” (Brown, 1999).

The following are some definitions about Q-methodology (McKeown & Thomas, 1988):

- Concourse: “The initial collection of statements regarding a particular topic of interest” (McKeown & Thomas 1988).
- Q-Technique: The Q technique uses factor analysis to find commonalities within the relationships between the sorts. In other words, factoring satisfies an important requisite of Q-methodology in that it provides a means to integration in a deterministic framework.
- Q-Sample: “A representative sample of statements that is drawn from the collection of statements regarding a particular topic of interest (concourse)” (McKeown & Thomas 1988).
- Q-Sort: “Each participant’s rank-ordered set of statements (opinion profile), Q-Sort is data” (McKeown & Thomas, 1988). The Q Sort method allows one’s own view on a topic to be presented by making decisions in regard to the statements presented in the sorting (Brown, 1996). The participants of the sort are asked to make choices amongst the statements by sorting them, and all statements are typically sorted in accordance with agreement/disagreement.
- Factor: “The cluster of participants whose Q-Sorts were similar” (McKeown &

Thomas 1988). For example, they ranked the statements into similar orders of preference. Each factor represents a different type of opinion.

“Q-methodology can allow the simultaneous study of objective and subjective issues to determine an individual’s opinion and forecast their likeliness to adapt information technologies in the health care workplace” which is suggested by Annette & Ulrike in 1997 that health care information studies could employ Q-methodology to get information about how customers access health care information, who are the most common users, what kind of health care information they really need, etc.

More recently in the UK, the method has been adopted by scholars in critical psychology as a method particularly compatible with a social constructivist research paradigm. It has been argued that the method is particularly suited to health care-related inquiry concerned with the unconstrained expression of views.

5.3 Q-methodology to create a shared understanding

While Q-methodology is not yet widely used in computer-related research, it is widely used in Communication Research, Psychology, Educational Psychology, Health Care and Political Science, and thus Q-methodology should prove useful for strategic planning (Brown, 1999). The International Society for the Scientific Study of Subjectivity (ISSSS) has papers using Q-methodology in areas including Mass Communication, Public Relations, Journalism, Advertising, Health Care Delivery, Counselling, Management, Public Policy, Gender and Privacy Research (<http://www.qmethod.org>).

Q-methodology has an ability to reveal subjectivity, peoples' views, attitudes, opinions, understandings and experiences. This accounts for its increasing popularity in a range of social sciences (Brown, 1999). When starting to use the Q-methodology, it typically involves generating statements, sorting statements, analysis of the sorts and analysis of the factors.

The first stage is a concourse or “brain storming” session when generating statements. Q-methodology, if used for statement generation, begins with a concourse where “statements” are elicited from the group (Meloche, 1999). The concourse represents what people have to say about the topic under study, such that the statements express all the possible views on the specific topic.

The eliciting activity can in practice vary from an actual discussion or interview to a review of a source (Stephenson, 1990d). However, statement generation can vary greatly where newspapers or journals, for example, are used to collect published views on a topic. The

best aspect of Q-methodology is that it is qualitative. Q also involves collecting the thoughts of people on a particular topic or issue, where the set of statements is the “collection” of what people think, and their views are collected thoughts as “short statements” and this gives Q research its richness (Meloche, 1999).

The term of “statements” warrants further explanation, as “statements” can vary from actual short statements such as pictures and images to sound and bits of colour, etc. The collection of “statements” need not occur in a single session, but may transpire over time or amongst various groups, however, it is typically on the same topic. The “key elements” would then be identified (via the concourse) as statements. The collected statements would be sorted by individual participants later (Stephenson, 1990a).

The sorts would be analysed via inter-correlations among the sorts into factors, and the results would be the factors that reflect the views of groups of participants. This method of having the participants provide their thoughts as the variable elements of study is one of the strongest arguments for the use of this Methodology; everyone in the concourse stage is able to contribute their thoughts (Stephenson, 1990b).

Secondly, the statements will consist of any set of items covering a topic that can reasonably be sorted. The Q sort method is used to shape or present a picture of one’s own view on a topic, by making decisions in regard to the statements presented in the sorting process (Stephenson, 1990c). The participant is asked to make choices amongst the statements by sorting them.

For example, the participants are asked to sort statements in accordance with a degree of concurrence/agreement with the statements, and a degree of disagreement. (+4 is high agreement and -4 is high disagreement, then the scales between -4 and +4 reflect shades/levels of agreement). The largest number of statements will be placed in the centre and the least amount of statements at each extreme point (Meloche, 1999). The following diagram is similar to the sample the participant uses to record the ranking of the statements.

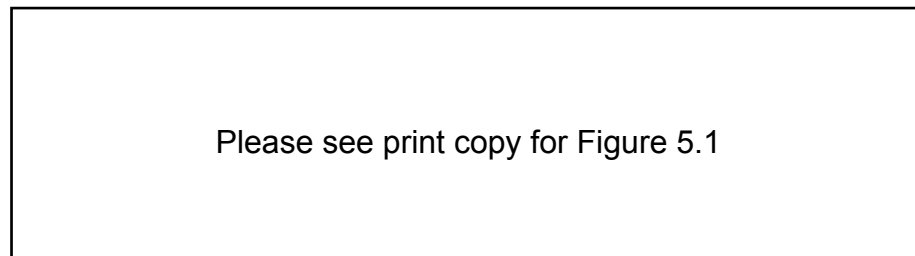


Figure: 5.1 Q-Sort triangles for ranking of the statements (Meloche, 1999)

The completed Q sort are statistically analysed to find correlations and identify factors that are common to the sorts of several individuals, which the number of factors identified depends in part upon the degree of agreement amongst subjects and in part on how much detail the researcher feels is useful to analyse. Q analysis is a way of summarizing a large number of opinions and it reaches a point in the summary where more detail yields diminishing returns (Meloche, 1999).

The final step is an analysis and interpretation of the finding (factors). The result of a Q study is a description of the diversity of coherent opinions on a particular topic, which are obtained as “factors”. It is going to become increasingly important that design and policy decisions are based upon research (Meloche, 2003). The research must acknowledge the views of the participants and provide integrated results that flow on from the conceptions of its participants, as Q-methodology is one method that achieves this outcome. However,

the researcher must assess and ask questions of the results, using knowledge of the participants and the topic as a guide (Stephenson, 1988). The analysis is the longest part of the task and the level of difficulty experienced will depend on the relative clarity of the factors that are produced. It is, however, the participants themselves, through their act of sorting, who have aligned themselves together on the different factors (McKeown, 1990).

The researcher who must study and analyse the nature of the factors, may wish to interview the subjects about their sorts and the resulting factors. These factors will represent a “shared” understanding and the analysis of the sorts tends to establish a number of factors varying from 1 to 9, and the factors represent a way of understanding the topic under investigation that is held by the individuals it represents (McKeown, 1990).

The advantage of Q-methodology is that it does not require a large population to produce meaningful results. As a rule, a Q sample of 30 individuals (or even less) can produce an accurate picture of the range of views on a topic (McKeown & Thomas, 1990). Q-methodology provides the tools for handling complexity and Q sort can give a good picture of the main trends or opinions. The data collection allows and encourages the researcher to document and investigate much subtler nuances of opinion (Miles and Huberman, 1984).

When focusing on the business objectives, Q-methodology can be applied to strategic planning. It requires input from a variety of sources and benefits from awareness of issues as well as the knowledge of “ways of seeing” a problem, opportunity, weakness, strengths and threats, etc. Q-methodology also can provide useful insights, in a consistent and valid manner (Meloche, 2003).

5.4 Q-methodology as used in this study

While the first objective was to build WBIS, the planning was designed to collect as much information as possible about harmful or potentially harmful incidents in ICUs and to apply these data to improvement efforts in patient safety. The experiment in this research consists of two parts: collecting thoughts, views and ideas about four areas, which are services, function, design and output in the current WBIS as statements, and then ranking the opinions (statements) of the current Web-based information systems with Q-methodology.

The analysis and discussion about the effective design of the WBIS's interface (services, function, design and output) are based on an Activity Theory framework.

- Step 1: Collect thoughts, views and ideas (brainstorming) from WBIS staff and ICU clinicians, as statements about the design of the current WBIS
- Step 2: Q-sort and technically rank the statements using “PQ method” program
- Step 3: Select the suitable number of factors as the solution of further analysis in four areas (services, function, design and output)
- Step 4: Analyse the characteristics of each factor summarized from the Q-sort
- Step 5: Discuss the effective design of WBIS, based on the framework of Activity Theory

CHAPTER 6: REVIEW AND ANALYSIS OF THE EXISTING WBIS

6.1 Introduction

This chapter, firstly, describes the structure of the existing ICU's WBIS in NSW, including the problems identified in the existing web services, such as functionality, content, design, security and output. In this chapter, there is an examination of the strengths and weaknesses of each identified usability criteria of the existing ICU's WBIS, so as to determine what the target users (patients' relatives or clinicians who can access and retain valuable information) understand and expect. Secondly, this chapter provides a brief introduction to possible improvements to the current ICU's WBIS, aimed at making the current offerings more effective and attractive in communicating information and providing for the user's satisfaction. This is one of the prime objectives of this thesis.

Intensive Care Coordination and Monitoring Unit (ICCMU) is a division within the New South Wales Health Department, which provides the information services for Intensive Care Units (ICUs) in New South Wales. The aim of the proposed service is to provide Web-based Information Systems (WBIS) to relatives of patients or to clinicians so they can access and retain valuable information. The WBIS also offers an invaluable communication tool to clinicians in NSW's rural areas; they can share the hot news and get more valuable information or medical knowledge.

An important aspect of WBIS will be to investigate the effectiveness of specialised instructional strategies, which create new support services for relatives of patients or

clinicians, and offer additional communication tools to clinicians in NSW's rural areas. For example, they can share the important news that directly affects them and get more access to information or medical knowledge. This study will investigate a number of issues, as the development of the current WBIS work progresses.

The first stage will be a review and analysis of the current specifications of WBIS. The system will comprise a Web-based portal that contains links to databases containing ICU related information. Therefore, an important information-capture feature of the WBIS will be to create the relationship between the evidence-based practices, work communities and work performance expectations. Simulation works best when the greatest challenge is not acquiring factual knowledge but applying knowledge skills, and beliefs in complex, unique situations (Horton, 2000:569). Ordinarily, clinicians approach their information search in many different modes. Some prefer to receive text-based material without pictorial content, while others need to have the opportunity of receiving both (McKay, 2000). Relying solely on the graphical image to convey meaning could prove to be a mistake with the WBIS, as many clinicians require reading visual messages (McNamara, 1988). From the beginning, the WBIS should be designed for easy use, and where possible be fun or interesting to use.

The possible operation will be through touch screen technology, to reduce the common and understandable apprehension towards using a WBIS. McNamara suggests that visual interfaces will primarily function by using a database loaded with intensive care prospects and touch screen interfaces, which will link work place concepts, with an employer database, for evidence-based practices, etc. (McNamara 1988)

6.2 Goal

As WBIS continue to grow as a delivery medium for health care information, the design of effective Web-based information systems becomes increasingly important. In this study, there will be an overview of current WBIS in NSW. There are clear goals for enabling WBIS to achieve its stated aims, which are centred on providing effective communication and interaction methods to its customers through its WBIS.

The ultimate aim is to provide ICU visitors and the wider community with an effective health care services system and easy access to information on intensive care services, in order to facilitate an understanding and provide access to the services of ICUs. This is done in the hope of reducing any anxiety or associated stress for the general public, while also being able to provide clinicians information and a central portal to get medical knowledge and news of interest (Leape, 1997).

This WBIS aims to help patient relatives access intensive health care information more easily, and also supports intensive care clinicians through analysis of evidence-based practices, identification of potential risks, and provision of health care recommendations. Laurel suggests that visual examples of the design process be provided to show how the use of this model results in easy-to-use WBIS that are likely to meet end-users' needs (Laurel, 1993).

The model is effective across diverse content areas and is appropriate for applications across varied media. With this in mind, this chapter conducts a specific analysis of the

existing WBIS in order to propose and design improvements, which would enhance or add value to the current WBIS in terms of its functionality and design. In addition, the WBIS supports a design that is attractive to users and encourages them to voice their opinions about the service. This WBIS will be tailored to suit the two classes of customers of WBIS, that is, the general public and clinicians or medical staff.

The goal of reviewing the current Web-based services is to provide WBIS with a means of interacting and gathering information from its customers on services, which are currently lacking, so it can meet customer needs and improve customer satisfaction (Laurel, 1990). There are seven (7) goals of ICCMU's Web-based Information Systems in 2004, ICCMU Action Plan; these are classified as:

1. Acting as an intensive care services resource for the state
2. Monitoring intensive care service provision, resources, utilization and activity
3. Assessing work force supply and demand
4. Coordinating quality activities
5. Promoting evidence-based practice
6. Enhancing consumer understanding of intensive care
7. Advancing partnerships with its stakeholders

The WBIS has been created to assist the WBIS Development Team accomplish their goals, which are defined above. The WBIS is designed for two groups of users, one being people who are not from the medical field, such as patients and their families (general public), the other group is people from the clinical field, such as doctors and nurses (clinicians).

6.2.1 User-Informed Design

In Chapter 2 has mentioned Peter Merholz observes that user-informed design is contrary to common wisdom, as user- informed design is not a simple process, but a philosophy. The primary benefit of user -informed design is that, when performed well, it ensures that the product is generally useful, usable and significantly meaningful to the end-user. A variety of low reliability methods have been developed to achieve user informed design, which allows for short development cycles (Merholz, 1996).

User-informed design is not a difficult but complex subject. With the variety of situations developers are put in, the incredible number of designs possible with today's tools and the ever-changing computer industry, designers must be ready for anything. Rarely do developers have the opportunity to create such a great interface. Rarely is everything as straightforward as the books would describe. With the emphasis on time and money, the immediate desires of the client and volume of project requirements, following user-informed design is nearly impossible.

As usability equals productivity equals profitability, many web-based information systems developers comment that good user-informed design is just common sense, however, the effective user-informed design is straightforward, but some basis knowledge is required to give the user as a tools and mindset to design with usability in mind. By creating intuitive, easy-to-use interfaces, developers create such a tool.

If ICU's user needs to constantly check the documentation or online help to figure out the interface, or is making errors that slow them down and require correction then that tool cannot be as productive and efficient as possible. If usability methods can improve a user's productivity by one second per screen, that will have a great impact when one considers the number of screens a user processes a day, the number of users, the number of days they work and their compensation.

To rate a product's quality, user-informed design should consider product functionality, efficiency, accuracy, cost, and appearance and user satisfaction. If usability is threaded throughout the design and even development process, product quality will inevitably be built in. Quality product can only come from a quality methodology. As user satisfaction is based on aesthetics, functionality and success. The first impression a user gets about a product is from the look of the user interface. If a user can interact easily and perform their job successfully, they will surely be pleased with the product.

A user-friendly product can greatly impact this satisfaction. Thus, in this chapter is putting the users at the centre of the design approach greatly improves the chances of creating an intuitive, efficient and effective interface. Different opponents have different strengths, different skill sets, and different strategies; an understanding of the ICU's users and their tasks must be the cornerstone of the design process.

6.3 Scope

The scope of this study relates to the research and analysis of current WBIS and the gathering of information from the clients, their customers and several ICU s in NSW hospitals. This will facilitate in designing enhancements to the current Web-based information systems to improve its effectiveness in communication, while also creating the design of customer feedback systems, in order to add value to existing WBIS and to provide Web-based customer opinions to improve the service. These opinions will provide a basis for potential further improvements to the WBIS.

Both the Web-based enhancements and feedback forum are aimed at improving current customer interactions, communication between all stakeholders and customer satisfaction. While the scope includes a thorough analysis of the current Web-based services with proposed recommendations, the design will be primarily based around the addition of new functionality in the customer feedback forum and changes to the aesthetics or look and feel of the current WBIS, including navigational improvements. The analysis will therefore contain detailed functional, Web-based systems application and technical modification of the proposed improvements and recommendations.

This chapter is about the reviewing and analysis of the existing WBIS, <http://www.Health.nsw.gov.au/iccmu>'s strengths and weaknesses, which will provide a solid framework and expand the functionality of the WBIS in terms of user satisfaction.

6.4 Analysis of the Current Web-based Information Systems Structure

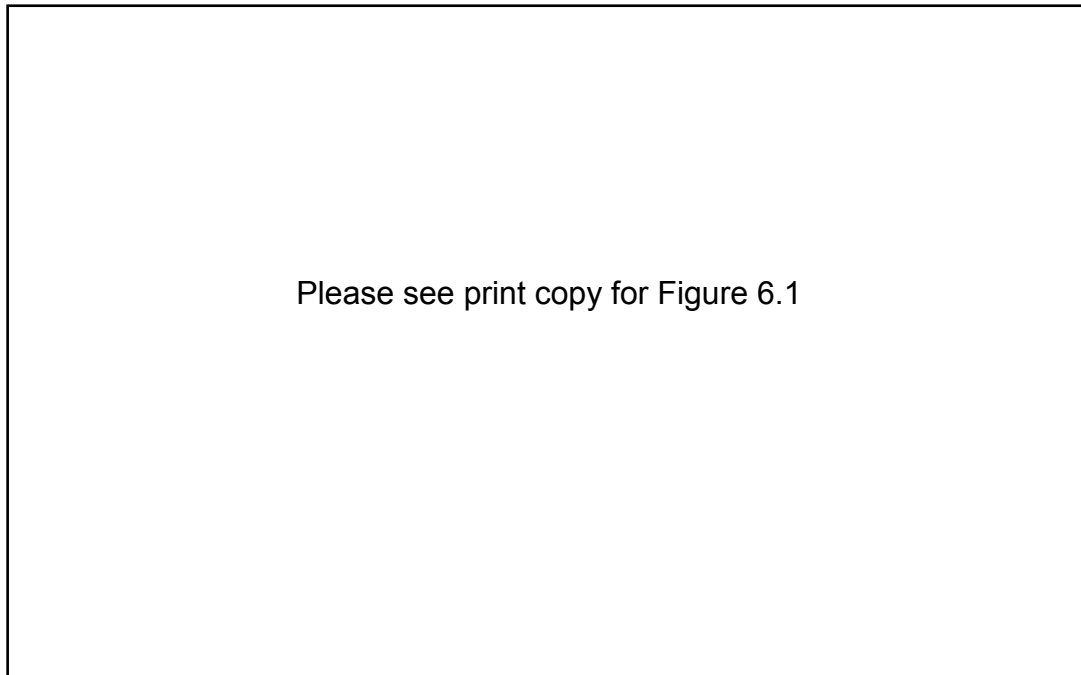


Figure 6.1: Structure of Web-based Services in 2006 (www.Health.nsw.gov.au/iccmu)

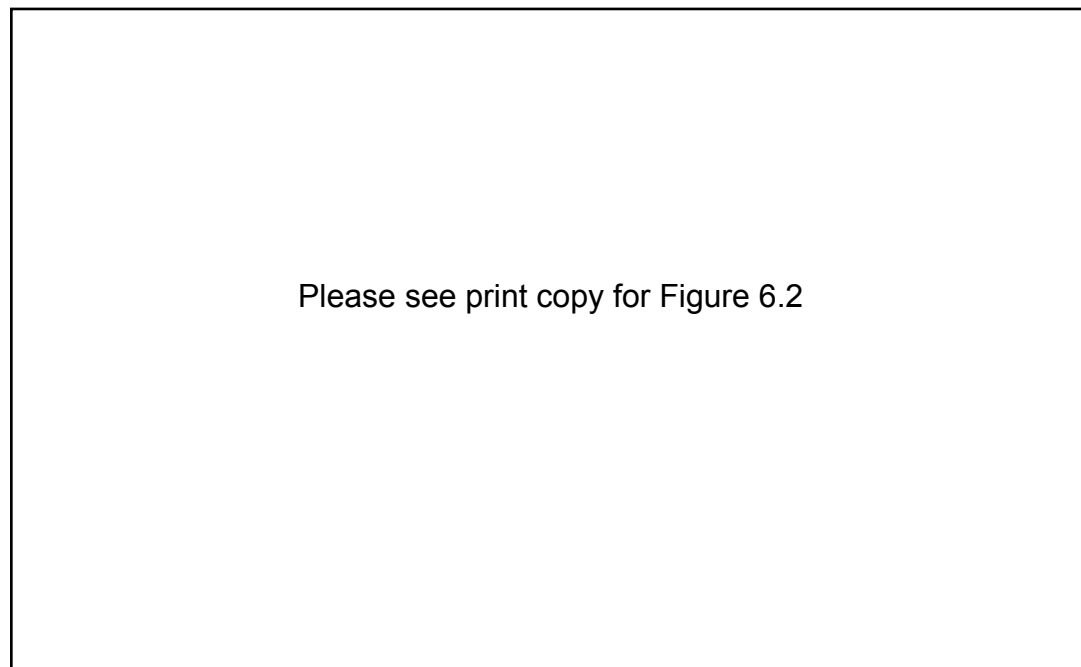
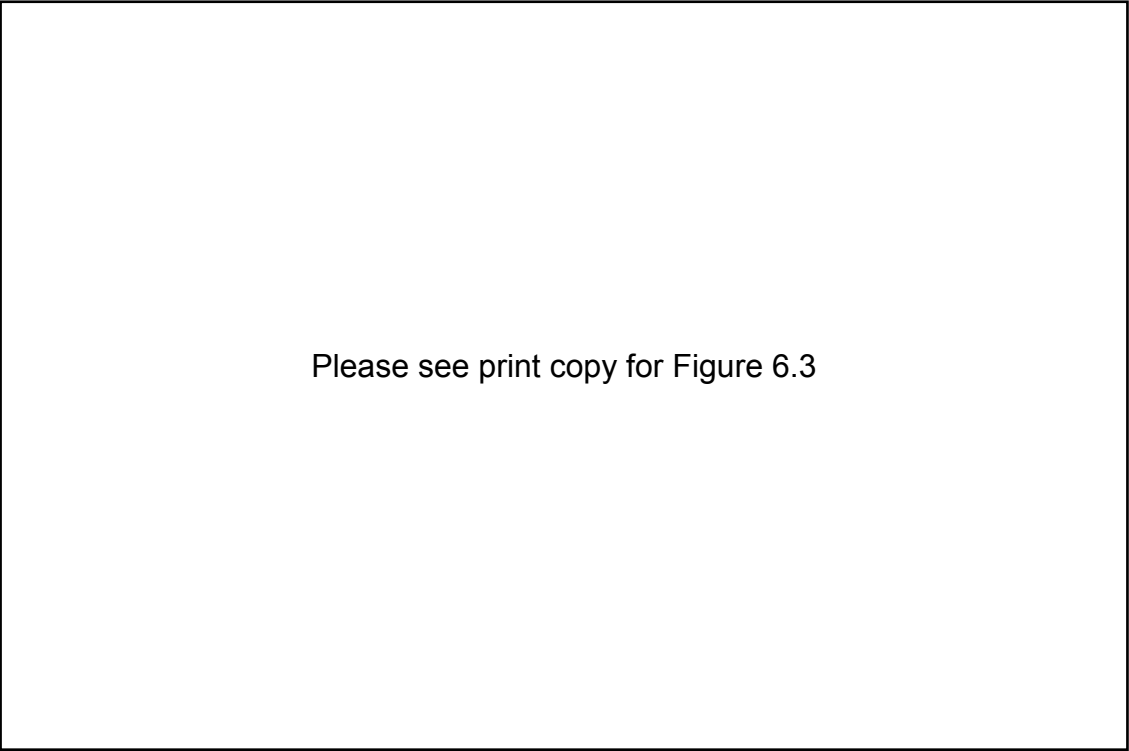
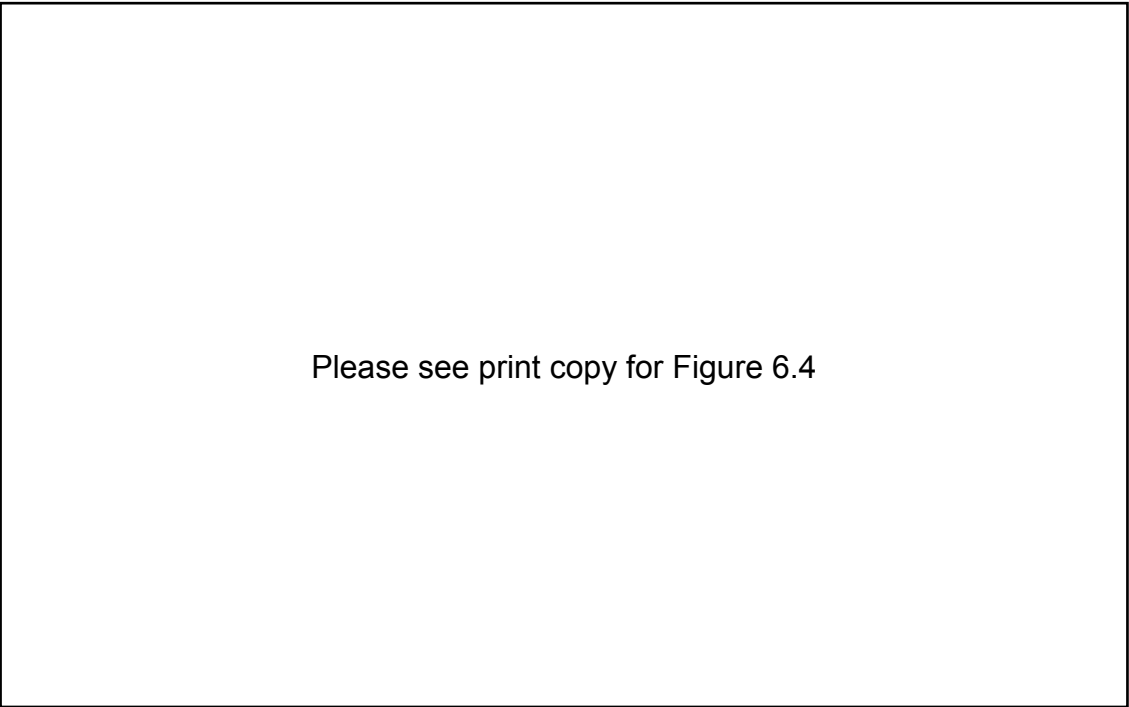


Figure 6.2: The main page interface of Web-based Information Systems in 2006



Please see print copy for Figure 6.3

Figure 6.3: The main Customer interface pages in 2006



Please see print copy for Figure 6.4

Figure 6.4: The main Clinician interface pages in 2006

6.4.1 Analysis of the Current WBIS Structure and its Design

The Web-based Information Systems (WBIS) has a simple design and the navigation design makes it easy to access general information. The WBIS itself is broken into two parts for the general public and clinicians. Users can choose whether they wish to access the general public or clinical information by clicking the links on the index page or the links on the sidebars. The left bar is for general public and the right bar is for clinicians. On the index page <http://www.health.nsw.gov.au/iccmu>, there are currently four parts:

1. Link to general public (visitor) information
2. Link to clinician information
3. Recent ICU news
4. Links to new items on the Web-based information systems

The eight links to provide quick access to the pages listed below:

1. Home – go to the index page
2. General Public (visitor) – go to the visitor information page
3. Clinician – go to the clinician information page
4. Contact – go to the page that contains contact details for ICCMU
5. Acknowledge – acknowledgements of those involved in creating this site
6. Sitemap – sitemap of the WBIS
7. Search – use the search engine on the WBIS
8. Disclaimer – disclaimer of the WBIS

All the pages were designed in the same template to create familiarity for the users. The left bar navigation, right bar navigation and the bottom navigation bar are provided on every page. Most of information presented is in the text form. At times, information can be overbearing, but using text information allows shorter loading time when links are selected. Parts of the site are still under development and there are some inactive links listed.

6.4.2 Analysis of the General Public (Visitor) Information

On the general public (visitor) information page, basic information about ICU is presented. There are eight links that belong to the WBIS and another four links to outside WBIS. The eight links are listed below:

1. What is an Intensive Care Unit? – Go to the page that explains several different types of ICU.
2. Where are all the Intensive Care Units in NSW? – Go to the page that lists all the ICUs in NSW.
3. What is wrong with me? – Go to the page that lists the links to the pages that explains technical names of symptoms in simple words.
4. What sort of technology is used in Intensive Care Unit? – Go to the page that lists the links to the page that provides a description of the equipment used in ICUs.
5. Who is caring for me? – Go to the page that lists ICU staff.
6. Procedures in Intensive Care – Provides an explanation of intensive care procedures.
7. Visiting in Intensive Care – Provides information for people who want to visit the ICU.
8. Frequently asked questions – Lists the questions that are often asked.

6.4.3 Analysis of Clinician Information

The clinician information page was created for usage as a forum for ICU issues. There are five protected links. The unprotected links are listed below:

1. Interesting links to such areas as Evidence Based Practice literature, Web-based journals etc. – This link will provide a large selection of links to other clinician Web-based information systems
2. Positions Vacant – links to the page that advertises jobs in NSW's Critical Care
3. Conferences / Seminars/ Workshops – links to the table that shows upcoming conferences, seminars and workshops
4. Education – links to the page that provides resources for Critical Care practitioners
5. Research – this link is still under construction

6.4.4 Analysis of the Current WBIS General Collation

The function of the current WBIS: it is not complex, mainly based on linking from page to page. At times finding information is slow because users have to go through all the links. Though there is a search function, it was not located in a convenient place for use. Protected area links require a username and password to access.

Another function is that it translates information from English to other languages. The translating function is used on the 'ICU Technology' page; it can translate into five languages: Arabic, Chinese, Greek, Italian and Macedonian. The output for this Web-based information system has information associated with ICUs' Clinicians' goals. Users can use this information to increase their knowledge about Intensive Care fields.

The current WBIS is an immense presentation of medical or Intensive Care information supplied in order to increase knowledge and is a good source for those working in related fields. Though its design template is fine, this Web-based information system could be improved by adding more functions to it and having it modified slightly.

6.5 Review of the Criteria of Current WBIS

As can be seen in the structure of the current WBIS there is the potential to offer a range of vital and useful information for both of its main groups of customers (general public and clinicians) pertaining to the provision of Intensive Care services in NSW.

However, there needs to be a review of the current WBIS in order to determine any deficiencies or opportunities, which may be present. The WBIS has been reviewed, based on a set of criteria formulated in consultation with the NSW Development Team.

The criteria have five main sections, functionality, content, design, security and output, as explained below. There are seen to be appropriate for analysing WBIS of this nature, i.e. health care or medical.

6.5.1 Functionality

This entails the set of resources the system provides in order to service the user. This is vital for WBIS, as users need to be able to find information quickly through the provision of services such as search engines and help pages.

In essence, the WBIS needs to be useful and contain useful services. Also, the functionality provided has to be relatively quick so as not to turn off users with slow WBIS connections, for example.

Strengths of the current service

- There is a search engine available
- Brief help information on the right hand side under navigation that dynamically changes as users access different pages
- The site offers contact services with email details linked to outlook for users to post questions and has offers of maps for other hospital ICU locations
- Services offered such as search options, appear to work and are fairly quick in returning results
- Separate navigation (i.e. left hand side is for general visitors and right hand side is for the clinicians)

Weaknesses of the current service

- While there is a search engine, it is often hard to find as it is on the bottom of the screen. This essentially means that if the current page were long (such as the case on the homepage), the user would have to scroll down to the bottom of the page in order to see that a search function is available
- Page Help does not contain information on each page users may access. This limits the functionality available to users. Also, of confusion is if the user was to click on the help page for more information, it simple takes them to another part of the WBIS, potentially unrelated to the page they were currently viewing
- Presently there is no feedback form that would allow users to offer suggestions and interact with the WBIS
- There are not user forums for the general public, such as message or chat forums which enable users to talk to each other through the WBIS
- The separate navigation can be confusing, particularly for those not familiar with the site; and makes navigation complicated at times

6.5.2 Content

This is information that is available to the user, including images, text, Web-based information systems and even software downloads. There is a fine line between good information and information overload. For example, too many images would slow down the Web-based information systems' download time, which must be taken into consideration. The content must be relevant to each specific category or user, whether it is the general public or clinicians.

For example, content should be informative, educational, of training material, and even contain reference for further information. In addition these Web-based information systems must be easy and clear to read; for example, no medical jargon for the general public and information viewing must flow so that users are able to pick up information easily.

Strengths of the current service

- Relevant content – Suitable for target audience
 - o General Public – Contains a lot of information about general ICU procedures, visiting hours and restrictions, locations of hospitals, services provided such as religious needs, medical terms, and includes relevant medical links for those that want further information. The visitor information page provides basic facts and frequently asked questions related to an ICU. This aids in reducing the anxiety and stress of the general public that require such information. Content for the general public is under links such as: what is an ICU? Where are all the ICUs in NSW? What is wrong with me? What sort of technology is used in ICU? Who is caring for me? Procedures in Intensive Care? Visiting in Intensive Care and Frequently Asked Questions (FAQ). Overall, the convergence of content for the general public is quite fine as there is an immense amount of information available. In addition to this, the language used is appropriate for the general public even though some medical jargon or terms are used. Some information is

also translated for non-English speaking users.

- Clinicians – Content for clinicians is separated from that of the general public through password protection so the right users are able to access the content applicable to them. The section for this audience provides information on a broad range of professional topics such as including relevant links about new research, job vacancies and descriptions, current policies and procedures used in NSW, conferences and seminars, research and newsletters (monthly). In addition to this there are educational resources that can be utilised. ICU Connect provides an excellent forum that professionals use to discuss Intensive Care issues and provide email summaries of popular topics.
- Coverage – Sufficient in terms of information and the specifics of details contained. Some pages have time stamps to indicate the age of the data contained on the site and clarity generally easy to read as paragraphs and headings are used well. There do not appear to be any obvious spelling mistakes. The use of pictures is adequate, as too many images would make the site rather slow to access.

Weaknesses of the current service

- In terms of the target audiences there is an attempt for multicultural communication, however, only minimally. Also, for a person who does not speak English it would be hard for them to determine how to access this, as it is not clearly visible on the front screen unless one scrolls down (and unless the user speaks English).
- Most, if not all, information should be time-stamped so that users are able to determine how relevant and recent the information is that they are reading.
- While the content is generally quite clear and easy to read, some pages become overloaded with information, which can force the user to lose focus, particularly as the information gets more technical or medical in nature. While there are images as discussed above, they need to catch the user's attention and some are quite bland and uninteresting such as the images on the homepage. This all adds to content effectiveness.

6.5.3 Design

In reviewing the WBIS, this was probably the most important aspect to consider. It entails the structure of the site in terms of how it is designed and how difficult or easy it is to navigate (able to be navigated). Also important, is the WBIS' useability and visual or artistic look and feel, all adding to the site being user friendly for the customer.

This is one of the most important aspects of reviewing the current WBIS as it is essential for users to be attracted to the site and be able to traverse the site in an organised manner so that the users know how to get the information they are looking for, and do not get lost or generally lose interest.

Strengths of the current service

- Navigation
 - o This is separated into two sections. The right hand side is for clinicians or health care professionals and most of it is of a protected nature i.e. password access only. The left hand side is for the general public. There are also some links at the bottom of the screen such as Search, Home, and Visitor etc, some of which duplicate the already existing links in the navigation bars on the sides of the Web-based information systems.
 - o The Site Map provided as a link at the bottom of the screen, is adequate to help navigate Web-based information systems.
- Reliability is fine, where most links work correctly or as expected.
- Page seems to load quite quickly so the site is quite efficient in this aspect. This is mainly due to the fact that there are no large images to slow down the site download or response time.
- Visually, there are some images, which add to the site's appeal, and the fact that there are not too many images or any large images on the site is a positive.
- Also, visually, the site uses a simple colour scheme and plain text (i.e. font size and style).

- There is some consistency in how information is displayed in terms of paragraphing and headings.

Weaknesses of the current service

- Overall, in terms of design the site is not very user friendly and is quite bland.
- Navigation is confusing and it is hard to traverse from one page to the next in a systematic fashion. This makes it hard for users, particularly those unfamiliar with the sites of the WBIS in general and those who wish to find the information they need.
- Navigation is also further complicated with links not only in the navigation bars, but also the main links at the bottom of the screen and also in the main body of the Web-based information systems. It would be better to have an expandable single and consistent navigation bar; this would improve the usability of the site.
- While most links point to where they are meant to, there are also broken links. For example clicking on the “page help” tab several times leads to a “page not found” error.
- The site is not very user friendly in design.
 - o It’s difficult to know what section of the Web-based information systems one is currently visiting, as there is no history or trail of where it came from.
 - o Some pages are too long.
 - o Links to external sites open in the same Web-based information systems, where it would be more beneficial if they opened in a separate browser window.
 - o No consistency in page layout
 - o Inconsistency in paragraphing and headers in pages.
 - o Not very visually appealing as the colour scheme is quite bland and plain. Basically the site lacks colour.
 - o The font style is small and not seems to change depending on which computer is used to view the site..
 - o Again with the font there is some inconsistency in style from page to page.

6.5.4 Security

Any medical information service is of a sensitive nature; therefore this information must be kept confidential and protected to ensure user privacy. Security is also important in terms of the WBIS so that users are able to be assured that the information that they are reading is unable to be hacked or changed in any manner by unauthorised personnel. This ensures the accuracy and integrity of the content on the WBIS.

Strengths of the current service

- Password protected areas.

Other Information of the current service

- It is difficult to provide a clear analysis on other security features that the Web server contains. While it can determine certain security features on the Web-based information systems it is unknown whether the server contains Firewall protection or Anti-Virus software. For this review of the Web-based information systems however these aspects are not relevant.

6.5.5 Output

While closely linked to design, reviewing a current WBIS on how the information can be downloaded, physically viewed, printed or stored is important. Users want to print out information clearly and they want the final product or printout to look good and fit on the computer screen or normal A4 paper.

In addition to this, the site must take into consideration other forms of output it emits, such as audio and whether users have the capability of utilising these forms of output or media.

Strengths of the current service

- Web-Based come with printer-friendly versions.
- Few graphics can be very quick to access.

Weaknesses of the current service

- The printer-friendly version of each page is in PDF format. While this is not necessarily a weakness it could be a problem for those users that do not have the software installed.
- The display size with the two navigational sidebars could be a problem for some users with small screens or who simply print out the screen view (without using the printer - friendly versions) as the navigation bars would cut out information on standard A4 paper printout (unless printed in landscape).

6.6 Problems Identified for the Current WBIS

Before starting any improvements to the WBIS, one should review the existing WBIS based on the functionality, content, design, security and output, and assess the strengths and weaknesses of each criterion. In addition, an analysis is needed to determine the target users of it and understand what they see as their needs.

Communication is an essential part to increase the efficiency among different ICUs in NSW. There should be an effective communication platform for all clinicians practising intensive care in NSW that can be use for exchanging and sharing knowledge, which aim to improve access to clinical knowledge and support for all clinical staff in different ICUs. Therefore, the information can be up-to-dated frequently.

To establish an effective communication platform, a “customer satisfaction” survey, a “clinician working environment satisfaction” survey, or feedback form of customers and clinicians should be added in the WBIS. Thus, analysis of the survey results will lead to improvement in the Web-Based Information System’s features. Besides, the functionality, content, design, security and output should be improved. The other main problems for the current WBIS details are described below.

6.6.1 ‘Protected Area’ does not indicate how people can get access

The ‘Protected Area’ limits the user to access, whilst this section only allows authorized people to log-in with a valid password. The area is stated as being protected by copyright policies and other conditions. It does not indicate how people can get access if required and

how to apply for a password or to have a password reset.

For example, an authorized person has permission to get in, but does not have a password. At this time, the person might want to find the way to apply for a password on the site. In this case, an indication of how to apply for a password or where to apply for it will help this person out.

6.6.2 Some functions do not work

Missing links have been found in some categories. It will raise the inconsistent problem between different pages among the Web-based information systems. Users are confused when they try to search information in the Web-based information systems.

6.6.3 Confusing user interface

Boring word descriptions of information and lack of attractive pictures and icons are the problem of the WBIS. It will make the user unwilling to spend their valuable time to find information from a messy pure words presentation. Additionally, the text size and colour are not suitable; the size of certain titles and headings is too small.

Besides, most of the texts are blue, grey and black in colour; these colours cannot emphasise the main point of information. It should have multimedia and suitable interface presentation, such as video and audio clips, flash animation, diagrams and 3D graphics.

6.6.4 Research field is not complete, no indication is going to be completed

The WBIS usually has some section that still needs to be implemented which is still under construction. A picture or a graphic is normally displayed to tell the user this page is still under construction. To manage user expectation it is important to indicate the date of completion.

6.6.5 Inconvenient to use search function

There's a search engine but the user will have to click on the link to get to the search page; this is sometimes an inconvenience. The existing search engine can only perform basic search, the result should be more refined. It should provide a search box on every page; it should be located either under the left or right navigation bar. The search box would only perform basic search, but underneath it the user could link to the advance search page. With the advance search, users can define search according to their need. Users can choose to search for any words that match an exact phrase. They can also specify the date of the information they want.

6.6.6 Lack of discussion service and interactive communication platform

As this site is drawing together people that are interested in the ICU's field, there should be a way for them to communicate. This site lacks this facility, so it should put in some kind of communication tool. It is better to use a discussion board to assist this communication. This will allow them to discuss all topics related to their interest. The link to the board should be put somewhere that could be easily noticed by the users. The board may be

divided into two parts: one for visitors and one for clinical staff because they might not be talking on the same topic.

The problem is to choose the place for storing data from the discussion board. The storing place will affect the data traffic. The current WBIS performs a single-way information delivery. That means users can obtain certain information from the WBIS, but they cannot ask for their unique information. What they get may not be what they want. Therefore, they should provide an interactive communication platform that lets users get exactly what they want.

6.6.7 Multicultural Translation/Communication problem

This site has translation services provided, but only for some technology used in ICU. It should provide the translation service in the “What’s wrong with me?” section. This will help people that don’t know English to understand the symptoms occurring to them. If this function is included, non-English speakers will be able to communicate with clinicians easily. This function could perform the same way as the existing translation service. Users can choose what language they want and get the output in a PDF file format.

It is important that the first page of the WBIS should be translated into different languages. This is because different users from different culture backgrounds must enter the WBIS through the first page. Therefore, it should provide a clear and concise navigation index in the first pages for the multicultural users.

6.6.8 Missing Help Page

The current WBIS does not have a “Help Page” function. This function is very important because a “Help Page” will demonstrate a typical case that users experience. This function needs to have detailed instruction or a guideline that teaches users how to navigate the WBIS step-by-step. It can act as a tutor that helps users to become familiar with all of the features and functions of the WBIS.

CHAPTER 7: RESEARCH METHODOLOGY IN SERVICES, DESIGN, FUNCTION AND OUTPUT VIEW

7.1 Introduction

The methodology and the data provided by the study are examined in greater detail, and the initial analysis of the data for understanding user perceptions of the perceived usefulness of an evolving health care Web-based services community using Q-methodology is done. The results for users were examined, thus allowing the result to contribute to the improvement of the service.

Visits to ICCMU headquarters in Penrith and the regional hospital in Wollongong, contributed to a collection of views and ideas in the form of statements in four broad areas. The view of *Services* is provided in Chapter 7 Part A, with Chapter 7, Part B looking at the results for *Function*, Chapter 7 Part C looks at the results for *Design* with Chapter 7 Part D looking at the results for *Output*.

Once the statements were collected through concourses held at the visits, the statements were refined to remove duplicates and for clarity. The importance of understanding the meaning of the resulting factors was then further explored by additional analysis of the results, and an examination of the factor solution.

This chapter is seeking to identify needs and efficient solutions using Q-methodology to improve the Web-based Information Systems (WBIS) and communication within and among Intensive Care Units (ICUs) and to provide easy access for users.

Other factors include security issues; increasing the flow of user information within the WBIS to both clinicians and the general public, as well as adopting a managerial approach to coordinate the information systems in order to be able to accommodate any long-term issues that may arise in the functions of WBIS.

The chapter will look at understandings of user perceptions of the perceived usefulness of an evolving Web-based health care community using Q-methodology to give a voice to users and thus allowing them to contribute to the improvement of the service.

Thus, visits were done at urban, regional and remote locations to achieve a collection of views and ideas in the form of statements for the four broad areas: services, functions, design and output. Once the statements were collected through the concourse visits, the statements were refined to remove duplicates and for clarity.

Then through the use of the Q Sort technique the statements, sorting instructions and a grid sheet were distributed. This sorting process allows the individual participants, including clinicians and the WBIS Development Team to more closely examine the views and make their own judgements in terms of high agreement or disagreement with the statements or the statements' lack of importance in light of the possibilities raised by the statements.

This process allows us to put all the collected thoughts on the table and for the users to make judgements between the thoughts to determine for themselves, the type of information service they believe should be provided.

The WBIS provided in NSW is currently comprised of three components, each being initiated to benefit a specific audience. These components are: the clinician's WBIS, the general public's WBIS and the ICU connect/email list. While these information services have been developed to allow the users to "keep-up" with new uses and ideas (e.g. Web-based information systems now is a knowledge repository and ICU connect now includes more practising nurses), there is, we believe, a need for research that will support further refinement in design and clarification of intention.

This study is about providing guidance for users on the additional growth paths WBIS can take, which may include new features and functions in the WBIS in order to encourage, attract and better serve clinical and public access to the ICU's related information.

7.2 Research Method

In accordance with the Methodology, the method of collecting statements was via a concourse where the members of the concourse provide statements on the topic being examined. In this case we wanted to collect statements from the WBIS Development Team and from ICUs, so a variety of methods was involved.

Four topics were addressed in the concourses, Services, Design, Function and Output view. This method of building up the set of statements allowed the researchers to easily engage with the ICU's clinicians and served to prompt them with statements arising out of their own context. This approach resulted in a large number of statements, reflecting their views on the information services that could be provided by the WBIS.

The strength and value of Q-methodology were apparent. The staff in these units has pressed for time, and it is to their credit, that they participated in the research. It is also to the credit of the Methodology, which almost immediately communicated about the importance it places on the views of the participants.

The next stage of this research involved refining the collected statements to remove duplicates, check for clarity and to examine them for possible categories to which they may belong. Four sets of statements were developed.

The four sorts were then conducted with clinicians from the ICU at the Wollongong hospital, several academic staff and students from Information Systems at Wollongong University and 3 people from the WBIS Development Team. The concourse group has been encouraged to produce as many statements as they could they fully expressed the range of their thoughts about improvement of Web-based communication in the four broad areas: Services, Function, Design and Output.

The thoughts expressed in the statements were not limited to their personal experiences but would certainly be influenced by them. The sort size was reduced to a manageable but still meaningful set of statements by confining the set of statements to each of the 4 areas.

7.3 Part A: WBIS Research in Services View

The area that has been sorted for this part, **Services**, was administered to 17 people during this period. The sort that was conducted in this study consisted of 47 statements, where every item was placed into one of 11 piles; with the instructions to place most agree/most disagree on each extreme.

The sorting was done by clinicians in the ICUs. The participants took time from their duties to sort the statements. As limited room was available, shared desks and the floor of an office were used for sorting.

The sort distribution is shown in the following table.

	<i>most disagree</i>										<i>most agree</i>	
Score	-5	-4	-3	-2	-1	0	1	2	3	4	5	
Frequency	2	3	4	5	6	7	6	5	4	3	2	

Table 7.1: Q Sort Distribution in Services View

The Q sort method allows ones own view on a topic to be presented by making decisions in regard to the statements presented in the sorting (Brown 1980). The participants of the sort were asked to make choices amongst the statements by sorting them, and all statements were typically sorted in accordance with agreement/disagreement.

The sorters, 5 males and 12 females varied in age between 25 and 55. The responses from the sorts were entered into a Q-methodology's specific application software, PCQWin Program, to analysis all the captured various data (Stricklin and Almeida 2001a). Factors were extracted using the principal component with Varimax rotation.

A 5-Factor solution was identified with five people (3 people from ICU, 1 academic and 1 student) aligned significantly with Factor 1; three people (2 people from ICU and 1 student) in Factor 2; two people (students) in Factor 3; two people (1 person from ICU and 1 student) in Factor 4 and three people (1 person from ICU and 2 students) in Factor 5. No person was located on more than one factor (confounded) and two people were found to have no significant loading on any factor.

This factor solution was selected following the review of other Factor choices as it provided the most meaningful results in that it accounted for a range of views, with 15 people of the 17 has been loading with the significance level being set with a cut off level of 38.

<i>Factor</i>	<i>Views</i>	<i>No. of sorts</i>	<i>Total</i>
<i>Factor 1</i>	Clinicians Resource	2 Females & 1 Male from ICU 1 Female - Academic 1 Female - Student	5
<i>Factor 2</i>	Communication Focus	2 Females from ICU 1 Female - Student	3
<i>Factor 3</i>	Educational Focus	2 Females - Student	2
<i>Factor 4</i>	Community Based Information View with rural focus	1 Female from ICU 1 Female - Student	2
<i>Factor 5</i>	Evidence Based Practice, Service and Communication View	1 Female from ICU 2 Males - Student	3

Table 7.2: Distributed in Sort in Services View

These participants include the ones who contributed to the statement set, but also included other clinicians, members of the public and other relevant stake holders. Once the sorts are completed and the factor solution determined the next step is the analysis process of the factor solution.

The identification of the various views and the experiences of the clinicians will be then used to inform the design and development of the service. This will be followed by further Q Sorts from the other areas; design, output and function. It is desirable that this series of sorts will be conducted again after changes have been introduced and use of the re-developed service has occurred.

Results Review - Analysis of the Factor Solution

The 3 to 5 Factor solution table also demonstrates the validity of the decision to accept the 5 Factor Solutions. The 3-Factor, which accounted for 8 of the 17 sorts, with a low level of confounded sorts 1. In contrast, a 4-Factor solution only provides for an additional 2 sorts being accounted for and a decrease in the number of non-significant sorts from 8 to 6. As can be observed, the 5 Factor solutions provide an additional advantage.

The following table provides a comparison of 3 different factor solutions. At the end, a 5 Factor solution was selected.

<i>No. of Factor</i>	<i>Variance (%)</i>	<i>No. of Confounded</i>	<i>No. of non-significant</i>	<i>No. of Sorts</i>
3	34	1	8	8
4	43	1	6	10
5	47	0	2	15

Table 7.3: Factor 3 to Factor 5's Solution in Services View

Five interpretable factors were extracted. No consensus statement has emerged that all five factors ranked similarly. The following table represents the correlations between each of the five factors and later we will examine each factor in turn and then compare each factor

with the others.

	<i>F1</i>	<i>F2</i>	<i>F3</i>	<i>F4</i>	<i>F5</i>
<i>F1</i>	0	16	16	2	8
<i>F2</i>	16	0	-6	21	-2
<i>F3</i>	16	-6	0	-16	-15
<i>F4</i>	2	20	-16	0	31
<i>F5</i>	8	21	-15	31	0

Table7.4: *Correlation between Factors in Services View*

The correlations express the relationship between factors and are derived from the statistical relationship that exists between the factors. It is helpful to consider the correlation as a very specific expression of a relationship and connection between sorts as reflected by their presence in the factors. The collections of sorted items are presented as a table of correlations that provides the basic statistical relationships from which factors are extracted (Meloche, 2006).

Thus, the high correlation between factors points to similarity between the sorts; a lower correlation points out the extent of difference between the sorts. The correlation between these factors varied from 16 for Factor one (F1) and Factor three (F3), to 2 for Factor one (F1) and Factor four (F4), to 8 for Factor one (F1) and Factor five (5). The reason for the variations in the correlations will become clearer as we review each factor in turn and then do a comparison of them.

7.3.1 Factor 1: Clinician Resource Focus

The following section includes the high agree (positive) and the high disagree (negative) statements from each of the factors as well as the factor scores, which indicate the relative level of the statements.

The reason for viewing the statements in this form is to visually represent the results so that both the continuity among the high positive statements and among the high negative statements, as well as the contrast between them, is apparent. This comparison is done with each of the factors in turn so as to allow for more rigorous examination of the factors both individually and in comparison with each other.

This was a mixed gender group, with 1 male and 4 female respondents, who are all aligned significantly, on this factor. This factor was notably different from other factors in showing strong agreement with statements 25, 46 and 30 and strong disagreement with statements 41, 29 and 15.

The following table shows the statements that are the strongest agreement statements for Factor 1; the ones following there are the strongest disagreement statements.

<i>No.</i>	<i>Statement</i>	<i>Factor Score</i>
25	provide evidence-based practice guidelines which standardize care	1.899
30	review and revise protocols	1.899
46	venue for practice guidelines	1.899
19	promote standards for evidence based practice	1.790
8	build a “knowledge” base of information	1.425
9	coordinate research activities	1.425
22	provide advice for base of alternatives	1.388
37	support the development of a research culture	1.169
36	store Q&As and be a database for ICU connect	1.059
11	facilitate efficiency	0.658

Table 7.5: Factor 1 - Strongly Agree in Services View

<i>No.</i>	<i>Statement</i>	<i>Factor Score</i>
41	to provide relatives with supportive information for their experience	-1.607
29	raise the level of understanding about ICU WBIS for the relatives of patients	-1.607
15	improve Information access for relatives	-1.607
2	a site to portray " ICU and its happenings" to relatives	-1.571
47	have services for multi-cultural patients - sources of information available	-1.534
40	to help relatives to develop realistic expectations about the outcomes	-1.461
38	to augment communication between clinician and consumer, not replace it	-1.388
16	it should provide services for critical care patients as well as ICUs	-1.352
39	to facilitate transfer of patients between ICUs	-0.986
6	advocate for rural areas and in representing them	-0.840

Table 7.6: Factor 1 - Strongly Disagree in Services View

The following table shows the statements that are important. As they are effectively unique to Factor 1, they “distinguish” Factor 1 from the other factors based on their position in Factor 1 relative to their position in the other factors. Note in all of the statements, 9 and 30 are in strong agreement in Factor 1. Yet they distinguish this factor from the others. Clearly this factor with its strong clinician makeup is not in favour of the community or relative-oriented statements.

<i>Statements</i>		<i>Factor</i>				
		<i>F1</i>	<i>F2</i>	<i>F3</i>	<i>F4</i>	<i>F5</i>
9	coordinate research activities	4	-1	0	0	-4
30	review and revise protocols	5	0	-3	-3	1

Table 7.7: Factor 1 - 2 statements that distinguish Factor 1 from the other Factors

From the above, one can begin to understand what this factor means by the term services, and of equal importance can start to see what it doesn't mean. Clearly the people reflected by this factor are confident and optimistic about reviewing or revising the protocols and coordinating research activities in WBIS.

The strong agreements statements in Factor 1 indicate that the WBIS should provide evidence-based practice guidelines which standardize health care, promote standards for evidence-based practice, and provide advice for best alternatives and facilitate efficiency. This focus is likely because they consider ICUs to often have limited resources, and a need to make the most of those resources.

This factor also gives little recognition of the need to build a “knowledge” base of information. For this factor, coordination of research activities is very important, because it can support the development of a research culture. Factor 1 clearly sees WBIS as a venue for practice guidelines.

The disagreeing statements again expand on and support this view further by explaining what Factor 1 is not.

Factor 1 sees the WBIS is not there to help relatives to develop realistic expectations about the outcomes, nor to provide broader-based services for rural units. It is not important from this factor’s view to raise the level of understanding about WBIS for the relatives of patients. The disagreeing statements show that the WBIS is not a site to portray “ICU and its happenings” to relatives. The participants do not feel its role is to augment communication between clinician and consumer.

7.3.2 Factor 2: Communication Focus

This Factor has 3 females and no male respondents who are aligned solely on this factor.

This factor was notably different from other factors in showing strong agreement with statements 20, 1 and 8 and strong disagreement with statements 3 and 33.

The following statements are the strongest agreement statements for Factor 2, the ones following there are the strongest disagreement statements.

<i>No.</i>	<i>Statement</i>	<i>Factor Score</i>
1	a 1 stop shop for clinicians and consumers of ICU WBIS	1.175
20	promote synergy amongst ICU clinicians	1.146
8	build a “knowledge” base of information	1.030
40	to help relatives to develop realistic expectations about the outcomes	0.914
38	to augment communication between clinician and consumer, not replace it	0.899
7	be a source of realistic information	0.856
19	promote standards for evidence-based practice	0.827
25	provide evidence-based practice guidelines which standardize care	0.783
15	improve information access for relatives	0.508
46	venue for practice guidelines	0.493

Table 7.8: Factor 2 - Strongly Agree in Services View

<i>No.</i>	<i>Statement</i>	<i>Factor Score</i>
3	ability to transfer patient data	-1.262
33	should coordinate courses, conference and nurse education	-1.160
31	review common state-wide “go bads”	-1.030
32	set goals and targets for clinical nurse specialists	-0.885
34	should increase its rural focus	-0.783
22	provide advice for best alternatives	-0.769
16	it should provide services for Critical Care patients as well as ICUs	-0.769
6	advocate for rural areas and in representing them	-0.740
23	provide broader-based services for rural units	-0.653
24	provide continuing education programs	-0.580

Table 7.9: Factor 2 - Strongly Disagree in Services View

The following statements are important, as they are effectively unique to Factor 2 as they “distinguish” Factor 2 from the other factors based on their position in Factor 2 relative to their position in the other factors. From the table below one can see that the degree of disagreement with statements 31 is large and can see how it distinguishes this factor from the others.

<i>Statements</i>		<i>Factor</i>				
		<i>F1</i>	<i>F2</i>	<i>F3</i>	<i>F4</i>	<i>F5</i>
<i>1</i>	a 1 stop shop for clinicians and consumers of ICU WBIS	-2	5	-1	-5	-1

Table 7.10: Factor 2 - 1 item that distinguishes Factor 2 from all other Factors

In Factor 2, the selected positive statements see the WBIS role is to promote synergy amongst ICU clinicians, and thus they consider it important to build a "knowledge" base of information, and to make it a one-stop shop for clinicians and consumers of ICU WBIS. They also recognise, as important, augmenting communication between clinician and consumer and helping relatives to develop realistic expectations about the outcomes. They are also in favour of promoting standards for evidence-based practice. Factor 2 clearly sees providing evidence-based practice guidelines which standardize care as important, as well as improving information access for relatives and being a venue for practice guidelines.

The strong disagreement statements on Factor 2 show that it does not support the ability to transfer patient data, does not see value in coordinating courses, conferences and nurse education and it is not concerned with providing a review of common state-wide “go bads”. This factor also states that it does not see a role for the WBIS in setting goals and targets for clinical nurse specialists, nor does it see WBIS having a role as an advocate for rural areas and in representing them. This factor does not support an increase in a rural focus

7.3.3 Factor 3: Educational Focus

This factor has no male and 2 females. A total of 2 respondents were aligned solely on this factor. This factor was notably different from the other factors in showing strong agreement with statements 24 and 13 and strong disagreement with statements 6 and 40.

The following statement is important, as it is effectively unique to Factor 3 as it “distinguishes” Factor 3 from the other factors based on its position in Factor 3 relative to its position in the other factors. Note in this case of Statement 29 it is in strong agreement in Factor 3 and this is very different to the positioning of this statement for Factor 2.

<i>Statements</i>		<i>Factor</i>				
		<i>F1</i>	<i>F2</i>	<i>F3</i>	<i>F4</i>	<i>F5</i>
29	raise the level of understanding about ICU WBIS for the relatives of patients	-5	-2	2	-2	-4

Table 7.11: Factor 3 - 1 item distinguishes this from all the Factors

The following statements are the strongest agreement statements for Factor 3, the ones following there are the strongest disagreement statements.

<i>No.</i>	<i>Statement</i>	<i>Factor Score</i>
24	provide continuing education programs	0.739
13	have a broader range of information	0.713
21	provide more access to the resources of city-based hospitals	0.713
8	build a “knowledge” base of information	0.607
10	coordinate state wide orientation education	0.554
12	feedback on processes and equipment	0.528
28	provide learning resources for staff/clinicians	0.528
26	provide information for nursing students	0.422
33	should coordinate courses, conferences and nurse education	0.422
41	to provide relatives with supportive information for their experience	0.422

Table 7.12: Factor 3 - Strongly Agree in Services View

<i>No.</i>	<i>Statement</i>	<i>Factor Score</i>
6	advocate for rural areas and in representing them	-0.766
40	to help relatives to develop realistic expectations about the outcomes	-0.739
25	provide evidence-based practice guidelines which standardize care	-0.686
32	set goals and targets for clinical nurse specialist	-0.660
31	review common state-wide “go bads”	-0.660
30	review and revise protocols	-0.581
34	should increase its rural focus	-0.502
22	provide advice for best alternatives	-0.475
27	provide information on current practice to rural areas	-0.370
19	promote standards for evidence -based practice	-0.343

Table 7.13: Factor 3 – Strongly Disagree in Services View

Factor 3 shows the belief that the WBIS should provide continuing education programs and provide information for nursing students. It should also provide more access to the resources of the city-based hospitals and have a broader range of information. Furthermore, WBIS should build a “knowledge” base of information and feedback on processes and equipment as well as provide learning resources for staff/clinicians. The participants also consider that coordination of state-wide orientation education is important and that WBIS should coordinates courses, conference and nurse education as well as providing relatives with supportive information for their experience.

The disagreeing statements on the Factor 3 indicate that the WBIS does not provide evidence-based practice guidelines which standardize care, nor does it provide help for relatives to develop realistic expectations about the outcomes, nor advocate for rural areas and in representing them. The participants do not support WBIS as setting goals and targets for clinical nurse specialist or review common state-wide “go bads” or review and revise protocols. They also do not support providing the advice for best alternatives and the information on current practice to rural areas. The statement which strongly distinguishes Factor 3 from the others is that ICU’s web service should raise the level of understanding about its WBIS for the relatives of patients.

7.3.4 Factor 4: Community Based Information View with Rural Focus

This Factor has 2 females, a total of 2 respondents who are aligned solely on this factor. This factor was notably different from the other factors in showing strong agreement with statements 11 and 21 and strong disagreement with statements 26 and 1. The following statements are the strongest agreement statements for Factor 4, the ones following there are the strongest disagreement statements.

<i>No.</i>	<i>Statement</i>	<i>Factor Score</i>
11	facilitate efficiency	0.636
21	provide more access to the resources of city-based hospitals	0.611
4	access to bigger centres resources i.e. specialists	0.562
16	it should provide services for critical care patients as well as ICU	0.562
36	store Q&As and be a database for ICU connect	0.562
41	to provide relatives with supportive information for their experience	0.538
3	ability to transfer patient data	0.513
27	provide information on current practice to rural areas	0.489
6	advocate for rural areas and in representing them	0.391
40	to help relatives to develop realistic expectations about the outcomes	0.342

Table 7.14: Factor 4 - Strongly Agree in Services View

<i>No.</i>	<i>Statement</i>	<i>Factor Score</i>
26	provide information for nursing students	-0.709
1	A 1 stop shop for clinicians and consumers of ICU WBIS	-0.709
42	to provide the breath of information needed by all ICU clinicians	-0.636
22	provide advice for best alternatives	-0.489
43	venue for a regional group network for regional events / news etc...	-0.464
46	venue for practice guidelines	-0.440
45	venue for nurses for information about ICU work and conditions	-0.440
30	review and revise protocols	-0.440
23	provide broader based services for rural units	-0.416
10	coordinate state wide orientation education	-0.367

Table 7.15: Factor 4 - Strongly Disagree in Services View

The following statements are important, as they are effectively unique to Factor 4 as they “distinguish” Factor 4 from the other factors based on their position in Factor 4 relative to their position in the other factors. Note in this case the distinguishing statements are in strong agreement in Factor 4, yet each distinguishes this factor from the others.

	<i>Statements</i>	<i>Factor</i>				
		<i>F1</i>	<i>F2</i>	<i>F3</i>	<i>F4</i>	<i>F5</i>
6	advocate for rural areas and in representing them	-2	-3	-5	3	-1
26	provide information for nursing students	-1	-1	2	-5	0
46	venue for practice guidelines	5	2	1	-3	5

Table 7.16: Factor 4 – 3 items distinguish this from all other Factors

In Factor 4, the selected statements see that WBIS is to facilitate efficiency, provide more access to the resources of the city-based hospitals, and it should provide services for critical care patients as well as ICU. They see services supporting the transfer of patient data and helping relatives to develop realistic expectations about the outcomes, as important. They also consider providing Information on current practice to rural areas and providing relatives with supportive information for their experience as important. Factor 4 also sees the WBIS as an advocate for rural areas and in representing them

The disagreeing statements on the Factor 4 indicate that WBIS should not be a venue for a one-stop shop for clinicians and consumers of ICU WBIS. Furthermore they do not see it as providing information for nursing students, advice for best alternatives and the breath of information needed by all ICU clinicians. They do not see WBIS as a venue for a regional group network for regional events / news etc. In this factor, most people believe that WBIS should not be a venue for practice guidelines, or not venue for nurses for information about ICU work and conditions. In addition, they believe that WBIS should not be revising protocols, or providing broader based services for rural units.

The statements that distinguish Factor 4 from the others include WBIS advocating for rural areas and in representing them and then on the other hand, it does not support having information for nursing students and do not see WBIS as a venue for practice guidelines.

7.3.5 Factor 5: Evidence Based Practice, Service and Communication Focus

This Factor has 2 male and 1 female, a total of 3 respondents who are aligned solely on this Factor. This factor was notably different from the other factors in showing strong agreement with statements 46 and 4 and strong disagreement with statements 15 and 12. The following statements are the strongest agreement statements for Factor 5, the ones following there are the strongest disagreement statements.

<i>No.</i>	<i>Statement</i>	<i>Factor Score</i>
46	venue for practice guidelines	0.934
4	access to bigger centres resources i.e. specialists	0.856
14	have an evidence-based review of the usefulness of equipment, tools etc	0.545
18	promote ICU to nurses	0.456
45	venue for nurses for information about ICU work and conditions	0.456
13	have a broader range of information	0.445
44	venue for critical and positive feedback	0.433
7	be a source of realistic information	0.422
20	promote synergy amongst ICU clinicians	0.422
39	to facilitate transfer of patients between ICUs	0.411

Table 7.17: Factor 5 - Strongly Agree in Services View

<i>No.</i>	<i>Statement</i>	<i>Factor Score</i>
15	improve Information access for relatives	-0.900
12	feedback on processes and equipment	-0.867
9	coordinate research activities	-0.778
29	raise the level of understanding about ICU WBIS for the relatives of patients	-0.567
17	make “casual in the head” tacit procedures more formal/written for casual or occasional staff	-0.545
24	provide continuing education programs	-0.533
3	ability to transfer patient data	-0.522
41	to provide relatives with supportive information for their experience	-0.467
40	to help relatives to develop realistic expectations about the outcomes	-0.456
11	facilitate efficiency	-0.422

Table 7.18: Factor 5 - Strongly Disagree in Services View

In Factor 5, the selected statements see that WBIS should be a venue for practice guidelines, and have an evidence-based review of the usefulness of equipment, tools etc. They also support WBIS as a venue for nurses for information about ICU work and conditions and have a broader range of information.

They also see a promotional role in WBIS as promoting synergy amongst ICU clinicians and promoting ICU to nurses. They also consider it important that it be a venue for critical and positive feedback and for it to facilitate transfer of patients between ICUs. Factor 5 also supports WBIS as a source of realistic information.

The disagreeing statements on the Factor 5 indicate that WBIS should not improve information access for relatives, nor should it provide the feedback on processes and equipment or raise the level of understanding about ICUs for the relatives of patients. They believe that it should not facilitate efficiency, nor is it important for WBIS to make “casual in the head” tacit procedures more formal/written for casual or occasional staff or provide continuing education programs or coordinate research activities.

In this factor, they do not see WBIS as providing relatives with supportive information for their experience nor helping relatives to develop realistic expectations about the outcomes.

7.4 Part B: WBIS Research in Function View

This part is also seeking to identify needs and efficient solutions using the Q-methodology to improve the WBIS and communication within and among ICUs and to provide easy access for users against function view. To increasing the flow of user information within the WBIS to both clinician and general public, as well as adopting a managerial approach to coordinate the information systems in order to be able to accommodate any long-term issues that may arise in the functions of WBIS.

The sorting was done by ICU clinicians, occurring in the ICU and in the Web Development Team's Head Office. It was conducted with 4 clinicians from the ICU at the Wollongong hospital and 2 people from the Web Development Team. The area that has been sorted for this part is Function view; it was administered to 8 people during this period. The sort that was conducted in this study consisted of 45 statements, where every item was placed into one of 11 piles, with the instructions most agree/most disagree placed on each extreme.

The sort distribution is shown in the following table.

	<i>most disagree</i>							<i>most agree</i>			
Score	-5	-4	-3	-2	-1	0	1	2	3	4	5
Frequency	2	3	4	5	6	6	6	5	4	3	2

Table 7.19: Q Sort Distribution in Function View

A 2-Factor solution was identified with six people, 4 people from WBIS Development Team significantly with Factor 1, two people from Wollongong Hospital's ICU in Factor 2. 3 people were located on more than one factor (confounded) and 1 person was found to have no significant loading on any factor.

<i>Factor</i>	<i>Views</i>	<i>No. of sorts</i>	<i>Total</i>
<i>Factor 1</i>	Developer Focus	2 Males from WBIS DT 2 Females from WBIS DT	4
<i>Factor 2</i>	End-user Focus	2 Females from ICU	2

Table 7.20: Distribution in Sort in Function View

Results Review - Analysis of the Factor Solution

The table below gives the correlations between the factors and it will be a useful reference when we later examine the array of differences between each of factors in turn.

	<i>F1</i>	<i>F2</i>
<i>F1</i>	0	40
<i>F2</i>	40	0

Table 7.21: *Correlation between Factors in Function View*

The following table shows the results for several different factor solutions based upon the variance that is accounted for in each case. In addition to the variance it is also useful to consider the number of sorts that are accounted for. These matters are not the only basis for judgment, however.

As the research here is based on four separate but related studies it is useful to have the same (if possible) or a similar number of factors in each case, as this facilitates comparison.

However, as the data indicates, it is useful and interesting to consider for comparison the four factor solutions, as well as for the WBIS research in function view. As can be observed, the 2 Factor solutions also provide little, if any, advantage.

<i>No. of Factor</i>	<i>Variance (%)</i>	<i>No. of Confounded</i>	<i>No. of non-significant</i>	<i>No. of Sorts</i>
2	47	1	1	6
3	54	3	1	4
4	55	2	2	4
5	59	2	1	5

Table 7.22: *Factor 2 to Factor 5's Solution in Function View*

Sixteen consensus statements emerged, whereby all 5 factors were ranked similarly. The following table represents the correlations between each factor and this is followed by an examination of each factor in turn and then by a comparison of each factor with the other.

	<i>Statements</i>	<i>Factor Scores</i>	
		F1	F2
1	a service that is up-to-dated at least weekly	3	2
6	be able to find results based on specific conditions - i.e. burns	0	-1
7	compare apache 2 scores (i.e. ventilations)	-2	-2
9	designed to capture “user” data	1	1
10	establish / coordinate network for nurse manager and support groups	1	2
14	have a search engine with open procedures (i.e. Choice)	2	1
20	link with clinical excellence commission	0	1
24	not be used for patient management	-3	-3
29	provide data on outcomes	-3	-4
31	provide information for new nurses about working in ICUs	1	1
32	provide information on “events” in ICUs across Australia	0	-1
38	show facilities available in each hospital	-1	0
39	support for research applications i.e. ethics approval	0	0
43	use the site to inform patients who are being transferred – about the place where they are going: complete phone numbers for patients & visiting hours etc...)	2	3
44	venue for flow chart samples	-1	0
45	video capture of seminars	-2	-2

Table 7.23: Consensus Statements in Function View

The following section includes the high positive and the high negative statements from each of the factors as well as its scores, which indicate the relative position/importance of the statements for the factor. The reason for viewing the statements in this form is to allow us to see both the continuity among the high positive statements, and among the high negative statements as well as the contrast between the two.

This comparison is done with each of the factors in turn to allow for rigorous examination of the factors, both individually and in comparison with each other.

7.4.1 Factor 1: Developer Focus

This factor is presenting the WBIS developer view with 4 people from the Web-based Development Teams. This factor was notably different from Factor 1 in showing strong agreement with statements 41, 23 and 15 and strong disagreement with statements 2, 19 and 3.

The following table shows the statements that are the strongest agreement statements for Factor 1, the ones following these are the strongest disagreement statements.

<i>No.</i>	<i>Statement</i>	<i>Score</i>
41	support the day-to-day operations of ICU	5
23	maximize the use of the available resources	5
15	help eliminate duplication of effort	4
27	provide access to other areas' policies and procedures	4
40	support request for policies	4
1	a service that is up-to-dated at least weekly	3
5	be a source / body that provides minimum standards	3
34	provide stock standard guidelines	3
37	share discussion boards on site with history	3
4	advertise courses that are happening	2

Table 7.24: Factor 1 - Strongly Agree in Function View

<i>No.</i>	<i>Statement</i>	<i>Factor Score</i>
2	a service that is up-to-dated daily	-5
19	information on Medicare for the patient's family	-5
3	access to patient records	-4
12	facilitate Tele-Health	-4
21	live courses	-4
22	make available beds known	-3
24	not be used for patient management	-3
29	provide data on outcomes	-3
36	ready access to live video conferencing	-3
7	compare apache 2 scores (i.e. ventilations)	-2

Table 7.25: Factor 1 - Strongly Disagree in Function View

The strong agreement statements in Factor 1 indicate that the functions of WBIS should support the day-to-day operations of ICUs, maximize the use of the available resources and help eliminate duplication of effort across NSW ICUs. They also focus on the function of WBIS providing access to other areas' policies, procedures and a service that is up-to-dated at least weekly.

Factor 1 clearly sees that the output of WBIS should provide stock standard guidelines and share discussion boards on site with history as well as advertise courses that are happening.

The disagreeing statements again expand on and support this view further by explaining what Factor 1 is not. Factor 1 indicated that WBIS is not up-to-dated daily and does not contain information on Medicare for the patient's family. The current WBIS neither provides access to patient records nor does it facilitate Tele-Health.

The disagreeing statements show that WBIS does not have the function of live courses and does not make available beds known. The group feels that it does not provide data on the outcomes and there is no ready access to live video conferencing

7.4.2 Factor 2: End-user Focus

There were 2 respondents on this factor. This factor was notably different from other factors in showing strong agreement with statements 19, 33 and 2 and strong disagreement with statements 15, 27 and 5. The following statements are the strongest agreement statements for Factor 2; the ones following these are the strongest disagreement statements.

<i>No.</i>	<i>Statement</i>	<i>Score</i>
19	information on Medicare for the patient's family	5
33	provide national and international job swap site	5
2	a service that is up-to-dated daily	4
11	facilitate staffing	4
35	raise awareness overseas about available work in Australian ICUs	4
12	facilitate Tele-Health	3
18	information about working opportunities	3
22	make available beds known	3
44	venue for flow chart samples	3
1	a service that is up-to-dated at least weekly	2

Table 7.26: Factor 2 - Strongly Agree in Function View

<i>No.</i>	<i>Statement</i>	<i>Factor Score</i>
15	help eliminate duplication of effort	-5
27	provide access to other areas' policies and procedures	-5
5	be a source / body that provides minimum standards	-4
23	maximize the use of the available resources	-4
29	provide data on outcomes	-4
16	identify core components for protocols	-3
24	not be used for patient management	-3
40	support request for policies	-3
42	use it to assist in unit business, staff & equipment acquisition	-3
7	compare apache 2 scores (i.e. ventilations	-2

Table 7.27: Factor 2 - Strongly Disagree in Function View

This Factor was significantly different from others in strongly agreeing with statements 19, 33 and 2 and strongly disagreeing with statements 15, 27 and 5. The following statements are the strongest agreement statements for Factor 1; the ones following are the strongest

disagreement statements.

In Factor 2, the selected positive statements show that the function of WBIS should be to provide information on Medicare for patients' families, and provide national and international job swap sites, as well as to be a service that is up-to-dated daily and that facilitates staffing.

The group also wants WBIS to raise awareness overseas about available work in Australian ICUs and to facilitate Tele-Health. As well as this it should focus on information about working opportunities make available beds known, be the venue for flow chart samples and provide a service that is up-to-dated at least weekly. Thus, the highest agree statements clearly represent the end-user focus on the function of WBIS.

Factor 2 states that it does not help eliminate duplication of effort, nor provide access to other area's policies and procedures and do not maximize the use of the available resources. There are 2 respondents aligned solely on Factor 1.

The strong disagreement statements on Factor 2 show that WBIS does not help eliminate duplication of effort and that it does not provide access to other areas' policies and procedures nor does it maximize the use of the available resources. This factor also states that the group does not see a role for the function of WBIS to provide data on outcomes, nor does it see WBIS to identify core components for protocols, or support request for policies.

The following statements are important, as they are effectively unique to Factor 1 as they “distinguish” Factor 1 from the other factors, based on their position in Factor 1 relative to their position in the other factors.

Note, in the case of Statements 2 and 19, they are in strong disagreement in Factor 1 and largely neutral for the Factor 2; Statement 15, 23 and 41 are in strong agreement in Factor 1 and slightly negative for the Factor 2.

<i>Statements</i>		<i>Factor Scores</i>	
		F1	F2
2	a service that is up-to-dated daily	-5	4
3	access to patient records	-4	2
5	be a source / body that provides minimum standards	3	-4
8	coordinate scholarship funding and information about funding for scholarships	-2	2
11	facilitate staffing	-2	4
12	facilitate Tele-Health	-4	3
15	help eliminate duplication of effort	4	-5
16	identify core components for protocols	2	-3
19	information on Medicare for the patient’s family	-5	5
22	make available beds known	-3	3
23	maximize the use of the available resources	5	-4
27	provide access to other areas’ policies and procedures	4	-5
33	provide national and international job swap site	-1	5
34	provide stock standard guidelines	3	-1
35	raise awareness overseas about available work in Australian ICU	-1	4
40	support request for policies	4	-3
41	to be a memory aid with reference information available	5	0
42	use it to assist in unit business, staff & equipment acquisition	1	-3

Table 7.28: *Factors 1 & 2 - 18 items distinguished from all other Factors*

7.5 Part C: WBIS Research in Design View

This part is also seeking to identify the needs and efficient solutions using the Q-methodology to improve the design of the WBIS.

The sorting was done by ICU clinicians in their hospitals and WBIS DT's head office in Penrith Hospital. It was conducted with 4 clinicians from the ICU at Wollongong hospital and 4 people from the WBIS Development Team. The area that has been sorted for this part is Design view.

The sort that was conducted in this study consisted of 26 statements, where every item was placed into one of 9 piles, with the instructions most agree/most disagree placed on each extreme. The sort distribution is shown in the following table.

	<i>most disagree</i>						<i>most agree</i>		
Score	-4	-3	-2	-1	0	1	2	3	4
Frequency	1	2	3	4	6	4	3	2	1

Table 7.29: *Q Sort Distribution in Design View*

A 5-Factor solution was identified with eight people, 1 person from WBIS development team and 1 person from Wollongong Hospital's ICU are significantly with Factor 1, two people from ICU in Factor 2, one ICU clinician and one person from WBIS development team in Factor 3, one person from WBIS development team in Factor 4 and one person from WBIS development team in Factor 5.

No person was located on more than one factor (confounded) and no person was found to have no significant loading on any factor.

<i>Factor</i>	<i>Views</i>	<i>No. of sorts</i>	<i>Total</i>
<i>Factor 1</i>	Responsive Focus	1 Male from WBIS DT 1 Female from ICU	2
<i>Factor 2</i>	End-user Focus	1Male and 1 Female from ICU	2
<i>Factor 3</i>	Advance User Focus	1 Female from WBIS DT 1 Female from ICU	2
<i>Factor 4</i>	User Friendly Focus	1 Female from WBIS DT	1
<i>Factor 5</i>	Specific Focus	1 Male from WBIS DT	1

Table7.30: Distributed in Sort in Design View

Results Review - Analysis of the Factor Solution

The following table provides a comparison of 4 different factor solutions. At the end, a 5-factor solution was selected.

<i>No. of Factor</i>	<i>Variance (%)</i>	<i>No. of Confounded</i>	<i>No. of non-significant</i>	<i>No. of Sorts</i>
2	38	0	3	5
3	44	0	1	7
4	51	0	0	8
5	55	0	0	8

Table 7.31: Factor 2 to Factor 5's Solution in Design View

Five interpretable factors were extracted. No consensus statement has emerged that all 5 factors ranked similarly. The following table represents the correlations between each of the four factors and later we will examine each factor in turn and then compare each factor with the others.

	<i>F1</i>	<i>F2</i>	<i>F3</i>	<i>F4</i>	<i>F5</i>
<i>F1</i>	0	57	-8	28	13
<i>F2</i>	57	0	19	46	44
<i>F3</i>	-8	19	0	30	34
<i>F4</i>	28	46	30	0	8
<i>F5</i>	13	44	34	8	0

Table 7.32: Correlation between Factors in Design View

7.5.1 Factor 1: Responsive Focus

This was a mixed gender group, with 1 male and 1 female respondent, who are all aligned significantly, on this factor. This factor was notably different from other factors in showing strong agreement with statements 2, 16 and 18 and strong disagreement with statements 19, 1 and 24. The following table shows the statements that are the strongest agreement statements for Factor 1; the table following this show the strongest disagreement statements.

<i>No.</i>	<i>Statement</i>	<i>Score</i>
2	be an evolving site that is responsive to the demands of the users	4
16	provide information for like minded ICUs- Level 4, staffing information HDU etc	3
18	provide protocol folders	3
4	be user friendly	2
8	have links to relevant information that they do not wish to manage	2
26	use the site to improve networking with other services	2
7	have a means to raise its own profile and interest	1
10	information about changes in the service for the end-users - a WHAT'S NEW Section	1
14	provide "help" information	1
25	use it to increase the "Ready" access to other services	1

Table 7.33: Factor 1 - Strongly Agree in Design View

<i>No.</i>	<i>Statement</i>	<i>Factor Score</i>
19	review terms of reference	-4
1	be able to manage what they have	-3
24	use issue from "go bads" as basis for education	-3
5	designed for advanced users	-2
15	provide a standard (view) across site	-2
17	provide lay descriptions and images of ICU services	-2
12	links with other ICU sites around the world	-1
20	sections on services for relatives - financial services, emotional counselling etc...	-1
22	to provide all the background information	-1
23	to work in common with Tele-Health	-1

Table 7.34: Factor 1 - Strongly Disagree in Design View

The strong agreement statements in Factor 1 indicate that the WBIS should be an evolving site that is responsive to the demands of the users, should provide protocol folders and information for like-minded ICUs - Level 4, Staffing Information HDU etc. They also focus on the design of WBIS and show that it should have links to relevant information that they do not wish to manage as well as information about changes in the service for the end-users - WHAT'S NEW Section. Factor 1 clearly sees that the design of WBIS should be user friendly and the site should be used to improve networking with other services.

The disagreeing statements again expand on and support this view further by explaining what Factor 1 is not.

Factor 1, sees the design of WBIS as not reviewing terms of reference, nor being able to manage what they have. It is not important from this factor's view to use issues from "go bads" as a basis for education nor important to be designed for advanced users. The disagreeing statements do not see the design of WBIS as a site to provide a standard (view) across sites, and they see it does not have a section on services for relatives-financial services, emotional counselling.

7.5.2 Factor 2: End-user Focus

This factor has 1 female and 1 male as respondents. This factor was notably different from other factors in showing strong agreement with statements 6, 4 and 18 and strong disagreement with statements 20, 8 and 24. The following statements are the strongest agreement statements for Factor 2; the ones following these are the strongest disagreement statements.

<i>No.</i>	<i>Statement</i>	<i>Score</i>
6	have a deceptively simple design	4
4	be user friendly	3
18	provide protocol folders	3
9	have sections that are completely current and others that are stable	2
12	links with other ICU sites around the world	2
14	provide “help” information	2
1	be able to manage what they have	1
11	links with organizations ie. Cancer Care, Women’s Health	1
16	provide information for like minded ICUs - Level 4, Staffing Information HDU etc	1
26	use the site to improve networking with other Services	1

Table 7.35: Factor 2 - Strongly Agree in Design View

<i>No.</i>	<i>Statement</i>	<i>Factor Score</i>
20	section on services for relatives - financial services, emotional counselling etc...	-4
8	have links to relevant information that they do not wish to manage	-3
24	use issue from “go bads” as basis for education	-3
3	be sophisticated in the service it provides	-2
13	prioritise goals and management within resources	-2
23	to work in common with Tele-Health	-2
5	designed for advanced users	-1
7	have a means to raise its own profile and interest	-1
22	to provide all the background information	-1
25	use it to increase the “Ready” access to other services	-1

Table 7.36: Factor 2 - Strongly Disagree in Design View

In Factor 2, the selected positive statements show that the design of WBIS should have a deceptively simple design, be user friendly, and have sections that are completely current and others that are stable. They also recognise that it is important to provide protocol folders and “help” information.

They are also in favour of links with other WBIS around the world. Factor 2 clearly sees providing the links with organizations i.e. Cancer Care, Women’s Health and providing information for like-minded ICUs - Level 4, Staffing Information HDU etc., as important.

The strong disagreement statements on Factor 2 show that it does not support the sections on services for relatives - financial services, emotional counselling and that this factor does not have links to relevant information that they do not wish to manage and also it does not use issues from “go bads” as a basis for education.

This factor also states that it does not see a role for the design of WBIS as being sophisticated in the service it provides, nor does it see WBIS having priority goals and management within resources. This factor also states that it does not work in common with Tele-Health and is not designed for advanced users.

7.5.3 Factor 3: Advance User Focus

This factor has no male and 2 female, a total of 2 respondents who are aligned solely on this factor. This factor was notably different from the other factors in showing strong agreement with statements 4, 3 and 21 and strong disagreement with statements 20, 17 and 19. The following statements are the strongest agreement statements for Factor 3; the ones following these are the strongest disagreement statements.

<i>No.</i>	<i>Statement</i>	<i>Score</i>
4	be user friendly	4
3	be sophisticated in the service it provides	3
21	to be a Web-Based library	3
5	designed for advanced users	2
10	information about changes in the service for the end-users - a WHAT'S NEW Section	2
18	provide protocol folders	2
2	be an evolving site that is responsive to the demands of the users	1
12	links with other ICU sites around the world	1
13	prioritise goals and management within resources	1
15	provide a standard (view) across site	1

Table 7.37: Factor 3 - Strongly Agree in Design View

<i>No.</i>	<i>Statement</i>	<i>Score</i>
20	sections on services for relatives - financial services, emotional counselling etc	-4
17	provide lay descriptions and images of ICU	-3
19	review terms of reference	-3
1	be able to manage what they have	-2
8	have links to relevant information that they do not wish to manage	-2
11	links with organizations such as Cancer Care, Women's Health	-2
6	have a deceptively simple design	-1
23	to work in common with Tele-Health	-1
24	use issue from "go bads" as basis for education	-1
25	use it to increase the "Ready" access to other Services	-1

Table 7.38: Factor 3 - Strongly Disagree in Design View

In Factor 3, the belief is that the design of WBIS should be user friendly and sophisticated in the service it provides. It can be a Web-based library and designed for advanced users. Furthermore, the design of WBIS should provide more information about changes in the service for the end-users - WHAT'S NEW section, as well as provide protocol folders.

It is also considered that it is an evolving site that is responsive to the demands of the users and the sites should links with other WBIS around the world as well as prioritise goals and management within resources.

The disagreeing statements on Factor 3 indicate that they do not support the design of WBIS sections on services for relatives - financial services, emotional counselling, nor do they see the design of WBIS as providing lay descriptions and images of ICU services as well as reviewing terms of reference and being able to manage what they have.

It is not seen to have links to relevant information that they do not wish to manage, or links with organizations such as Cancer Care and Women's Health. It also does not have a deceptively simple design and is not working in common with Tele-Health.

7.5.4 Factor 4: User Friendly Focus

This factor has 1 female respondent who is aligned solely on this factor. This factor was notably different from the other factors in showing strong agreement with statements 2, 3 and 4 and strong disagreement with statements 24, 22 and 23. The following statements are the strongest agreement statements for Factor 4; the ones following these are the strongest disagreement statements.

<i>No.</i>	<i>Statement</i>	<i>Score</i>
2	be an evolving site that is responsive to the demands of the users	4
3	be sophisticated in the service it provides	3
4	be user friendly	3
6	have a deceptively simple design	2
9	have sections that are completely current and others that are stable	2
10	information about changes in the service for the end-users - a WHAT'S NEW Section	2
14	provide "help" information	1
16	provide Information for like minded ICUs - Level 4, staffing information HDU etc	1
17	provide lay descriptions and images of ICU services	1
18	provide protocol folders	1

Table 7.39: Factor 4 - Strongly Agree in Design View

<i>No.</i>	<i>Statement</i>	<i>Score</i>
24	use issue from "go bads" as basis for education	-4
22	to provide all the background information	-3
23	to work in common with Tele-Health	-3
5	designed for advanced users	-2
7	have a means to raise its own profile and interest	-2
8	have links to relevant information that they do not wish to manage	-2
12	links with other ICU sites around the world	-1
19	review terms of reference	-1
25	use it to increase the "Ready" access to other services	-1
26	use the site to improve networking with other services	-1

Table 7.40: Factor 4 - Strongly Disagree in Design View

In Factor 4, the selected statements see that the design of WBIS is to be an evolving site that is responsive to the demands of the users, and it should be sophisticated in the service it provides as well as being user friendly. They see that the design of the site should have a deceptively simple design and have sections that are completely current and others that are stable.

They also consider it important to provide information about changes in the service for the end-users - WHAT'S NEW Section. Factor 4 also sees that the design of WBIS should provide "help" information, the lay descriptions and images of ICU services and provide the protocol folder as well as available information for like-minded ICU's - Level 4, Staffing Information HDU etc.

The disagreeing statements on Factor 4 indicate that the design of WBIS should not be to use issues from "go bads" as a basis for education nor to provide all the background information. Furthermore they do not see it as having to work in common with Tele-Health, or designing for advanced users and do not have a means to raise its own profile and interest. They do not see the design of WBIS having links to relevant information that they do not wish to manage, nor links with other WBIS around the world.

In this factor, most people believe that the design of WBIS should not be reviewed in terms of reference be used to increase the "Ready" access to other services and should not use the site to improve networking with other services.

7.5.5 Factor 5: Specific Focus

This factor has 1 male respondent who is aligned solely on this factor. This factor was notably different from the other factors in showing strong agreement with statements 18, 17 and 21 and strong disagreement with statements 3, 5 and 23.

The following statements are the strongest agreement statements for Factor 5; the ones following these are the strongest disagreement statements.

<i>No.</i>	<i>Statement</i>	<i>Score</i>
18	provide protocol folders	4
17	provide lay descriptions and images of ICU	3
21	to be an Web-Based library	3
16	provide information for like-minded ICUs - Level 4, Staffing Information HDU etc	2
20	sections on services for relatives-financial services, emotional counselling	2
26	use the site to improve networking with other services	2
4	be user friendly	1
11	links with organizations such as Cancer Care, Women's Health	1
12	links with other ICU sites around the world	1
25	use it to increase the "Ready" access to other services	1

Table 7.41: Factor 5 - Strongly Agree in Design View

<i>No.</i>	<i>Statement</i>	<i>Score</i>
3	be sophisticated in the service it provides	-4
5	designed for advanced users	-3
23	to work in common with Tele-Health	-3
7	have a means to raise its own profile and interest	-2
13	prioritise goals and management within resources	-2
15	provide a standard (view) across site	-2
1	be able to manage what they have	-1
14	provide "help" information	-1
19	review terms of reference	-1
24	use issue from "go bads" as basis for education	-1

Table 7.42: Factor 5 - Strongly Disagree in Design View

In Factor 5, the selected statements see that the design of WBIS should provide protocol folders, and provide lay descriptions and images of ICU services. They also focus on the design of WBIS as providing information for like-minded ICUs - Level 4, Staffing Information HDU etc and being a Web-based library. They also see sections on services for relatives -financial services, emotional counselling-in the design of the site as well as the site to improve networking with other services.

They also consider it important that it be user friendly, and links with organizations such as Cancer Care and Women's Health. Factor 5 also supports that the design of WBIS should link with other ICU sites around the world and be used to increase the "Ready" access to other services.

The disagreeing statements on Factor 5 indicate that the design of WBIS should not be sophisticated in the service it provides, nor be designed for advanced users nor work in common with Tele-Health. The people believe that it should not have a means to raise its own profile and interest, nor is it important for the design of WBIS to prioritise goals and management within resources. In this factor, they do not see the design of WBIS providing a standard (view) across the site, nor being able to manage what they have as well as not being able to provide "help" information and review terms of reference.

7.6 Part D: WBIS Research in Output View

This part is seeking to identify needs and efficient solutions using the Q-methodology to improve the outcome of WBIS and communication within and among ICUs and to provide easy access for users.

The sorting was done by ICU clinicians and occurred in the ICU and WBIS Development Team's head office in Penrith Hospital. It was conducted with 4 clinicians from the ICU at the Wollongong Hospital, 4 people from the WBIS development team. The area that has been sorted for this part is Output view; it had been administered to 8 people during this period.

The sort that was conducted in this study consisted of 25 statements, where every item was placed into one of 9 piles, with the instructions most agree/most disagree placed on each extreme. The sort distribution is shown in the following table.

	<i>most disagree</i>						<i>most agree</i>		
Score	-4	-3	-2	-1	0	1	2	3	4
Frequency	1	2	3	4	5	4	3	2	1

Table 7.43: *Q Sort Distribution in Output view*

A 4-Factor solution was identified with eight people, three from WBIS Development Team and one from Wollongong Hospital's ICU are significantly with Factor 1, one from ICU in Factor 2, two ICU clinicians in Factor 3 and one person from ICU in Factor 4. No person was located on more than one factor (confounded) and no person was found to have no significant loading on any factor.

<i>Factor</i>	<i>Views</i>	<i>No. of sorts</i>	<i>Total</i>
Factor 1	Quality Focus	2 Females & 1 Male from WBIS DT 1 Female from ICU	4
Factor 2	Education Focus	1 Male from ICU	1
Factor 3	Patients and their relatives' Focus	1 Female & 1 Male from ICU	2
Factor 4	Information Focus	1 Female from ICU	1

Table 7.44: *Distributed in Sort in Output View*

Results Review - Analysis of the Factor Solution

The following table provides a comparison of 4 different factor solutions. At the end, a 4-factor solution was selected.

<i>No. of Factor</i>	<i>Variance (%)</i>	<i>No. of Confounded</i>	<i>No. of non-significant</i>	<i>No. of Sorts</i>
2	51	0	2	6
3	58	1	1	6
4	63	0	0	8
5	67	1	0	7

Table 7.45: *Factor 2 to Factor 5's Solution in Output view*

Four interpretable factors were extracted. There were two consensus statements that emerged with all 4 factors ranked similarly. The following table represents the correlations between each of the four factors and later we will examine each factor in turn and then compare each factor with the others.

	<i>F1</i>	<i>F2</i>	<i>F3</i>	<i>F4</i>
<i>F1</i>	0	66	63	53
<i>F2</i>	66	0	45	68
<i>F3</i>	63	45	0	46
<i>F4</i>	53	68	46	0

Table 7.46: *Correlation between Factors in Output view*

<i>Statements</i>		<i>Factor Scores</i>			
		F1	F2	F3	F4
6	Decrease patient disability at discharge	1	1	2	1
16	Increase to a national service connecting ICUs as a network across Australia	0	0	0	0

Table 7.47: *Consensus Statements in Output view*

7.6.1 Factor 1: Quality Focus

This was a mixed gender group; with 1 male and 3 female as respondents, who are all aligned significantly, on this factor. This factor was notably different from other factors in showing strong agreement with statements 10, 11 and 14 and strong disagreement with statements 22, 19 and 21.

The following table shows the statements that are the strongest agreement statements for Factor 1; the ones following these are the strongest disagreement statements.

<i>No.</i>	<i>Statement</i>	<i>Score</i>
10	improve quality of patient care	4
11	improve quality of service for the patients	3
14	improve the level of care across NSW ICUs	3
2	as an advocate for education, access to information service	2
4	bring standards up through sharing information	2
7	decrease the length of stay for ICU patients	2
1	advocate for minimal standards and conditions	1
3	be a research resource - to support research	1
6	decrease patient disability at discharge	1
17	Information sheets for various conditions	1

Table 7.48: Factor 1 - Strongly Agree in Output view

<i>No.</i>	<i>Statement</i>	<i>Factor Score</i>
22	provide project information for school students	-4
19	provide educational information to schools for students	-3
21	provide more fluid exchange of patients for need levels such as Taking patients back to “home” region	-3
12	improve relations within Area Health Service	-2
15	increase communication amongst Area Health Units	-2
18	print out details of procedures / visitor hours / locations / parking	-2
5	decrease distress of relatives	-1
8	encourage clinicians to do research	-1
9	focus on time savings	-1
20	provide image-based answers for relatives’ questions	-1

Table 7.49: Factor 1 - Strongly Disagree in Output view

The strong agreement statements in Factor 1 indicate that the output of WBIS should improve quality of patient care and that of service for the patients and improve the level of care across NSW ICUs. They also focus on the output of WBIS as an advocate for education and access to information service and bringing standards up through sharing information. Factor 1 clearly sees the output of WBIS should be to decrease the length of stay for ICU patients and to advocate for minimal standards and conditions.

The disagreeing statements again expand on and support this view further by explaining what Factor 1 is not.

Factor 1 sees that the output of WBIS does not provide project information for school students or non educational information to schools for students. It does not provide more fluid exchange of patients for need levels such as taking patients back to “home” region and it does not improve relations within the Area Health Service. The disagreeing statements do not see the output of WBIS to increase communication amongst Area Health Units or to focus on timesaving. They do not feel it provides image-based answers for relatives’ questions and it does not encourage clinicians to do research.

7.6.2 Factor 2: Education Focus

In this factor there is 1 male respondent. This factor was notably different from other factors in showing strong agreement with statements 22, 9 and 19 and strong disagreement with statements 11, 1 and 18.

The following statements are the strongest agreement statements for Factor 2; the ones following these are the strongest disagreement statements.

<i>No.</i>	<i>Statement</i>	<i>Score</i>
22	provide project information for schools students	4
9	focus on time savings	3
19	provide educational information to schools for students	3
8	encourage clinicians to do research	2
20	provide image-based answers for relatives' questions	2
21	provide more fluid exchange of patients for need levels i.e. Taking patients back to "home" region	2
6	decrease patient disability at discharge	1
7	decrease the length of stay for ICU patients	1
16	increase to a national service connecting ICUs as a network across Australia	1
25	provide unbiased information	1

Table 7.50: Factor 2 - Strongly Agree in Output view

<i>No.</i>	<i>Statement</i>	<i>Factor Score</i>
11	improve quality of service for the patients	-4
1	advocate for minimal standards and conditions	-3
18	print out details of procedures / visitor hours / locations / parking	-3
4	bring standards up through sharing information	-2
12	improve relations within Area Health Service	-2
13	improve the community awareness of ICUs	-2
5	decrease distress of relatives	-1
14	improve the level of care across NSW ICUs	-1
15	increase communication amongst Area Health Units	-1
23	provide text-based answers to relatives' questions	-1

Table 7.51: Factor 2 - Strongly Disagree in Output view

In Factor 2, the selected positive statements see that the output of WBIS should provide project information for school students; educational information to schools for students; image-based answers for relatives' questions and unbiased information. They also recognise that WBIS should focus on time savings and provide more fluid exchange of patients for need levels i.e. taking patients back to "home" region. They also realise the importance to decrease patient disability at discharge and decrease the length of stay for ICU patients.

The strong disagreement statements on Factor 2 show that it does not improve the quality of service for the patients, nor advocate for minimal standards and conditions as well as not bringing standards up through sharing information. This factor also states that it does not see a role for the output of WBIS as improving relations within the Area Health service, nor as improving the community awareness of ICUs and not decreasing distress of relatives. This factor does not see it to increase communication amongst Area Health Units nor to provide text-based answers to relatives' questions.

7.6.3 Factor 3: Patients and their Relatives' Focus

This factor has 1 male and 1 female, a total of 2 respondents who are aligned solely on this factor. This factor was notably different from the other factors in showing strong agreement statements 5, 20 and 21 and strong disagreement with statements 3, 2 and 14.

The following statements are the strongest agreement statements for Factor 3; the ones following these are the strongest disagreement statements.

<i>No.</i>	<i>Statement</i>	<i>Score</i>
5	decrease distress of relatives	4
20	provide image-based answers for relatives' questions	3
21	provide more fluid exchange of patients for need levels such as Taking patients back to "home" region	3
6	decrease patient disability at discharge	2
22	provide project information for schools students	2
23	provide text-based answers to relatives' questions	2
13	improve the community awareness of ICU	1
17	Information sheets for various conditions	1
19	provide educational Information to schools for students	1
24	raise the profile of ICU WBIS	1

Table 7.52: Factor 3 - Strongly Agree in Output view

<i>No.</i>	<i>Statement</i>	<i>Score</i>
3	be a research resource - to support research	-4
2	as an advocate for education, access to information service	-3
14	improve the level of care across NSW ICUs	-3
10	improve quality of patient care	-2
11	improve quality of service for the patients	-2
15	increase communication amongst Area Health Units	-2
4	bring standards up through sharing information	-1
9	focus on time savings	-1
18	print out details of procedures / visitor hours / locations / parking	-1
25	to provide unbiased information	-1

Table 7.53: Factor 3 - Strongly Disagree in Output view

Factor 3 believes that the output of WBIS should decrease distress of relatives and provide image-based answers for relatives' questions. It can provide a more fluid exchange of patients for need levels such as taking patients back to "home" region and decrease patient disability at discharge. Furthermore, the output of WBIS should provide project information for school students as well as provide text-based answers to relatives' questions.

They also consider that an evolving site should improve the community awareness of ICUs and information sheets for various conditions as well as provide educational information to schools for students.

The disagreeing statements on Factor 3 indicate that the output of WBIS is neither as an advocate for education nor an access to information service and it is not to improve the level of care across NSW ICUs nor improve quality of patient care as well as the quality of service for the patients.

They do not see that the output of the WBIS increases communication amongst Area Health Units nor that it brings standards up through sharing information. They also see that it does not focus on timesaving and does not provide unbiased information.

7.6.4 Factor 4: Information Focus

This factor has 1 female respondent. This factor was notably different from the other factors in showing strong agreement with statements 10, 17 and 18 and strong disagreement with statements 23, 4 and 15.

The following statements are the strongest agreement statements for Factor 4; the ones following these are the strongest disagreement statements.

<i>No.</i>	<i>Statement</i>	<i>Score</i>
10	improve quality of patient care	4
17	information sheets for various conditions	3
18	print out details of procedures / visitor hours / locations / parking	3
5	decrease distress of relatives	2
11	improve quality of service for the patients	2
25	to provide unbiased information	2
6	decrease patient disability at discharge	1
7	decrease the length of stay for ICU patients	1
9	focus on time savings	1
14	Improve the level of care across NSW ICUs	1

Table 7.54: Factor 4 - Strongly Agree in Output view

<i>No.</i>	<i>Statement</i>	<i>Score</i>
23	provide text-based answers to relatives' questions	-4
4	bring standards up through sharing information	-3
15	increase communication amongst Area Health Units	-3
1	advocate for minimal standards and conditions	-2
13	improve the community awareness of ICU	-2
20	provide image-based answers for relatives' questions	-2
3	be a research resource - to support research	-1
8	encourage clinicians to do research	-1
22	provide project information for school students	-1
24	raise the profile of ICU WBIS	-1

Table 7.55: Factor 4 - Strongly Disagree in Output view

	<i>Statements</i>	<i>Factor</i>			
		<i>F1</i>	<i>F2</i>	<i>F3</i>	<i>F4</i>
18	print out details of procedures / visitor hours / locations / parking	-2	-3	-1	3

Table 7.56: Factor 4 -1 item Distinguish from all other Factors

In Factor 4, the selected statements see that the output of WBIS is to improve quality of patient care, and it should have information sheets for various conditions as well as the print out details of procedures, visitor hours, locations and parking. They see that the output of the site should decrease distress of relatives, improve quality of service for the patients and provide unbiased information. Factor 4 also sees that the output of WBIS should decrease patient disability at discharge and decrease the length of stay for ICU patients as well as improve the level of care across NSW ICUs.

The disagreeing statements on Factor 4 indicate that the output of WBIS does not provide the text-based answers to relatives' questions and does not bring standards up through sharing information. Furthermore they do not see it as: having to increase communication amongst Area Health Units; advocating for minimal standards and conditions; and improving the community awareness of ICUs.

They do not see that the output of WBIS has provided image-based answers for relatives' questions, nor for it to be a research resource to support research. In this factor, most people believe that the output of WBIS should not be to encourage clinicians to do research nor to provide project information for school students nor to raise the profile of WBIS.

CHAPTER 8: REVIEW AND REPORT OF THE RESEARCH RESULTS

8.1 Overview of the Chapters

In this chapter, the analysis uses cross factor comparisons and summaries from all the factors from the areas of Services, Function, Design and Output in order to highlight the cultural differences that occur, and, through this, offer structural improvements to the look and feel of the health care WBIS.

This chapter will indicate the predominate issues WBIS faced for increased information sharing. These issues are identified as: an increase in information flow between the regional and rural ICUs, a need for an efficient, private and secure communication medium for the WBIS, and most notably, the need for a venue for evidence-based procedures.

At the end of this chapter, a brief discussion of the research results in Chapter 7 includes suggestions for improvements enabling clinicians or patients to traverse the WBIS more efficiently. By making it more user- friendly, clinicians or patients would be able to find the information they require with greater ease. In summary, this study has been examining the WBIS. In doing so it draws upon the literature of Activity Theory and Q-methodology. The literature and methods chosen for this study were selected for their combined ability to probe, uncover and enhance analysis in an area that is largely intangible.

In Chapter 1, the research's framework is introduced to form and support the basis for this study. The main question addressed by this study is: What are the perceived information needs of clinical professionals working in Intensive Care Units (ICUs) in New South Wales,

Australia, which can usefully be improved with Web-based Information Systems (WBIS)? This study seeks to examine the perceptions of the service provided by a purpose-built website over nine months of its introduction. Chapter 1 presents the research questions and discusses how the research can contribute to improving health care through WBIS, with the aim of bringing health care closer to the standard of information services provided in other industries. Substantial benefits are also possible in health care, through a purposely-specific designed Web-based information system with the capability to deliver a variety of clinical, educational, professional development and administrative applications. The background of the study and significance are also explored and refined.

Chapter 2 covers the main literature review on the Web-based Information Systems (WBIS). Due to rapid increase in the availability of WBIS there is an increasing expectation for health care services to be provided in the same manner as other industries. WBIS in health care has already had a significant impact in promoting a more uniform approach to using information and communications technologies in the health sector. This chapter also introduces WBIS, which is used for diffusing, processing and managing information over the Web-based systems, which are discussed in depth. The chapter ends with a review of how WBIS can provide Web-based information to individuals, in the context of their work environment. At the end of Chapter 2, a brief introduction to WBIS specifically designed for health care is provided, and an explanation of how user informed design in Activity Theory can be used, in order to understand and explain the nature of information in terms of exploring its relevance to current practices. This is one of the prime objectives of this thesis.

In Chapter 3, the main literature review covers the literature on health care Web-based Information Systems (WBIS). It introduces the health care Web-based services that are currently using the web-base to provide health care information and services. It also gives consideration to WBIS, which enables medical clinicians or even relatives of patients to gain information about individual patients. The study analyses how the current development of health care services may enable clinicians to gain access to various services, including second opinions for decision- making, letting health consumers know about their state of health, access to real-time health care advice, and to gain a higher quality of individual care.

There will also be suggestions of possible future improvements to these services. In addition, as the development of health care places high and unique demands on the provision of information services, this chapter also provides some brief background on the intensive care environments in the state of New South Wales (NSW), Australia. The NSW Intensive Care Coordination and Monitoring Unit (ICCMU) and the Service Development Team share valuable knowledge gained in the experience of their practices and in the provision of evidence-based material across the state.

In Chapter 4, there is a longer discussion about the use of Activity Theory in this study, in terms of its usefulness for the investigation, and its applicability to the study of Web-based Information Systems (WBIS) in general and Web-based health services in particular. The Activity Theory is examined in greater detail, including a brief review of its history, as well as an exploration of some of the key theorists so as to provide a context and a clarification of its purpose in this study.

Chapter 5 discusses the reasons behind the selection of methodologies. There is an emphasis on how the adoption of these methodologies, with the techniques that they include such as the concourse and Q Sort, has allowed this research to achieve its desired outcome.

In Chapter 6, there is a description of the structure of the existing ICU's WBIS in NSW, including the problems identified in the existing web services, such as functionality, content, design, security and output. In this chapter, there is an examination of the strengths and weaknesses of each identified usability criteria of the existing ICU's WBIS, so as to determine what the target users (patients' relatives or clinicians who can access and retain valuable information) understand and expect. At the end of Chapter 6 there is a brief introduction of possible improvements to the current ICU's WBIS, aimed at making the current offerings more effective and attractive in communicating information and providing for the user's satisfaction. This is one of the prime objectives of this thesis.

In Chapter 7, the Methodology and the data provided by the study are examined in greater detail, and the initial analysis of the data for understanding user perceptions of the perceived usefulness of an evolving health care Web-based services community using Q-methodology is done. The results for users were examined, thus allowing the result to contribute to the improvement of the service. Visits to ICCMU headquarters in Penrith and the regional hospital in Wollongong, contributed to a collection of views and ideas in the form of statements in four broad areas. The view of Services is provided in Chapter 7 Part A, with Chapter 7 Part B looking at the results for Function, Chapter 7 Part C looks at the

results for Design with Chapter 7 Part D looking at the results for Output. Once the statements were collected through concourses held at the visits, the statements were refined to remove duplicates and for clarity. The importance of understanding the meaning of the resulting factors was then further explored by additional analysis of the results, and an examination of the factor solution.

In Chapter 8, the analysis uses cross factor comparisons and summaries from all the factors from the areas of Services, Function, Design and Output in order to highlight the cultural differences that occur, and, through this, offer structural improvements to the look and feel of the health care WBIS. This chapter reports the predominate issues WBIS faced for increased information sharing. These issues are identified as: an increase in information flow between the regional and rural ICUs, a need for an efficient, private and secure communication medium for the WBIS, and most notably, the need for a venue for evidence-based procedures. At the end of Chapter 8 a brief discussion of the research results in Chapter 7 includes suggestions for improvements enabling clinicians or patients to traverse the WBIS more efficiently. By making it more user- friendly, clinicians or patients would be able to find the information they require with greater ease.

Chapter 9 contains an evaluation of the findings and implications gathered from the previous chapters. There is a discussion of insights drawn from the results that may be useful for future Health Care WBIS Development.

8.2 Overview of the Research

To summarise the research, the design of effective health care-related WBIS is becoming increasingly important as the Internet continues to grow as a delivery medium for health care information. As these health WBIS are developed, groups producing information materials are recognising the importance of a user-informed design.

In health care, these services' process must start with needs being defined by clinicians, and then provided to management information based on precise systematic reviews, and involve clinicians in developing and testing the material provided.

This study is using a user-informed research process to inform a WBIS design. This study is also able to identify any predominate issues that WBIS face. These included a need for increased information sharing, an increase in information flow between the regional and rural ICUs, and a need for an efficient, private and secure communication medium for WBIS, and most notably the need for a venue for evidence-based procedures.

Most clinicians do not currently make use of the WBIS. Instead, they scan text for specific pieces of information to achieve information retrieval. With user informed design to support development of the WBIS, there can be improved usefulness (relevance) and usability (ease of use) by considering information retrieval processes and other factors.

This study captured the clinicians' expectations, in four different areas (Design, Function, Services and Output) of WBIS development. The potential of WBIS to meet the pressing

needs for health care, continuing medical education, and consumer health care information is substantial. These WBIS have been used for decision support, patient management, evidence-based procedures and higher level of patient self-management and self-care.

WBIS can offer the potential to simplify the collection and interpretation of conditions and referral with the use of evidence-based guidelines and make possible complicated continuing education, including the provision of “Real Time” support during the course of patient care for clinicians. Thus, suggestions were provided by clinicians for finding solutions to meet the information needs of clinicians, staff, and patients, through improving the accessibility and sharing of information between and amongst ICUs

This study reviewed all the collected statements/experiences, and their thinking as expressed in the statements that arose in the concourse, and then, through their sorts and the resulting factors, found that while there are competing, conflicting views, there are also strong areas of agreement. The strongest area of agreement is the provision of practice-based guidelines. While the views expressed in the different factors, do differ, they clearly represent the main streams of concern and will be useful in informing the design of WBIS.

8.3 Overview of the Factors

The following pages provide an overview of the factor results and a brief explanation of the important difference between positive and negative rankings in terms of accessing their respective meanings.

The factors, when compared, show that the practitioners who are represented on the factors have clear groupings as expressed in their positioning of the statements.

<i>Topic Areas</i>	<i><u>Services</u></i>	<i><u>Function</u></i>	<i><u>Design</u></i>	<i><u>Output</u></i>
Factors	5	2	5	4

Table 8.1 Overview of the 4 different Terms/Areas

The purpose of this section is to look at each factor group, in turn, to better understand their thinking. It is clear when the factors are seen together that they are largely consistent with each other, even though they were generated as 4 separate sorts.

8.4 Review of the Services Views

The first area that will be looked at is **Services View**, where a **5 Factor** solution was selected.

<i>Topic</i>	<i><u>Services View</u></i>	<i>Participants in Q Sort</i>
Factor 1	Clinician Resource Focus	5
Factor 2	Communication Focus	3
Factor 3	Educational Focus	2
Factor 4	Community Based Information View with Rural Focus	2
Factor 5	Evidence based Practice, Service And Communication Focus	3

Table 8.2: Overview for the Services Views

8.4.1 Factor 1 in Services View – Clinician Resource Focus

The title given to each factor is descriptive and used to aid discussion of that particular factor. There are 5 respondents aligned solely on Services View Factor 1, *Clinician Resources Focus*. This factor was significantly different from others in strongly agreeing with statements 25, 30 and 46 and strongly disagreeing with statements 41, 29 and 15. The following statements are the strongest agreement and disagreement statements for Factor 1.

Strongly Agree Statements in Factor 1 – (Services View)		Strongly Disagree Statements in Factor 1 – (Services View)	
<i>No.</i>	<i>Statement</i>	<i>No.</i>	<i>Statement</i>
25	provide evidence-based practice guidelines which standardize Care	41	to provide relatives with supportive Information for their experience
30	review and revise protocols	29	raise the level of understanding about ICU WBIS for the relatives of patients
46	venue for practice guidelines	15	improve Information access for relatives

Table 8.3: Significantly different strongly Agreeing & Disagreeing Statements in Factor 1, Services View – Clinician Resource Focus

In the Factor 1, the high agree statements clearly represent what the services view want such as the provision of evidence-based practice guidelines, which standardize care. Furthermore this factor sees the WBIS as a venue for practice guidelines and a forum to review and revise protocols. The high disagreement statements further clarify what this factor means by services.

For example, the respondents on this factor are not concerned with increased contact with patients' relatives; they do not want the information systems to increase or facilitate further contact. They do not wish to provide relatives with supportive information for their experience and do not wish to raise the level of understanding about WBIS for the relatives of patients. Factor 1 also states that it does not improve information access for relatives.

This focus is likely because they consider the ICU to often have limited resources, and a need to make the most of those resources. Factor 1 also gives little recognition of the need to build a "knowledge" base of information. For this factor, coordination of research activities is very important, because it can support the development of a research culture. Factor 1 clearly sees the WBIS as a venue for practice-based guidelines

8.4.2 Factor 2 in Services View – Communication Focus

There are 3 respondents aligned solely on Services View Factor 2 Communication Focus. This factor was significantly different from others in strongly agreeing with statements 1, 20 and 8, and strongly disagreeing with statements 3, 33 and 31. The following statements are the strongest agreement and disagreement statements for Factor 2.

Strongly Agree Statements in Factor 2 – (Services View)		Strongly Disagree Statements in Factor 2 – (Services View)	
<i>No.</i>	<i>Statement</i>	<i>No.</i>	<i>Statement</i>
1	a 1 stop shop for clinicians and consumers of ICU WBIS services	3	ability to transfer patient data
20	promote synergy amongst ICU clinicians	33	should coordinate courses, conference and nurse education
8	build a “knowledge” base of Information	31	review common state wide “go bads”

Table 8.4: *Significantly different strongly Agreeing & Disagreeing Statements in
Factor 2, Services View – Communication Focus*

There is little similarity between what Factor 1 and Factor 2 represent as Services View. It is clear, however, that Services View Factor 2, Communication Focus, still holds a different interpretation of Services from Factor 1. For example, the positive statements in Factor 2 express a desire for WBIS to be a one-stop shop for clinicians and consumers of ICU WBIS, to promote synergy amongst ICU clinicians and build a “knowledge” base of information. Here we are seeing service recommendations that the WBIS should focus on communication rather than information and should seek to provide a knowledge resource.

The high disagreement statements support the notion of communication focus. They also inform us that this factor’s respondents are not viewing the WBIS for administrative purposes; they are not concerned with its ability to transfer patient data or coordinate courses, conferences and nurse education. They also feel that the WBIS should not contain common statewide “go bads” indicating again the focus on communication rather than information provision.

Clinicians in Services View, Factor 2 Communication Focus suggested that a knowledge base be constructed and that the WBIS could be a *one-stop shop* for clinicians and

consumers of the WBIS. They also saw the WBIS as an opportunity to promote synergy amongst the ICU clinicians. The disagreeing statements do not see the WBIS as a site to portray “ICU and its happenings” to relatives. They do not feel its role is to augment communication between clinician and consumer; the service should make it easy for clinicians to skim and provide clues that allow users to find the information by scanning rather than reading.

8.4.3 Factor 3 in Services View – Education Focus

We can now look at the Services View Factor 3, for Factor 3, which has an Education Focus. There are 2 respondents aligned solely on Factor 3. This factor was significantly different from others in strongly agreeing with statements 24, 13 and 21 and strongly disagreeing with statements 6, 40 and 25. The following statements are the strongest agreement and disagreement statements for Factor 3.

Strongly Agree Statements in Factor 3 – (Services View)		Strongly Disagree Statements in Factor 3 – (Services View)	
<i>No.</i>	<i>Statement</i>	<i>No.</i>	<i>Statement</i>
24	provide continuing education programs	6	advocate for rural areas and in representing them
13	have a broader range of Information	40	to help relatives to develop realistic expectations about the outcomes
21	provide more access to the resources of the city based hospitals	25	provide evidence-based practice guidelines which standardize Care

Table 8.5: *Significantly different strongly Agreeing & Disagreeing Statements in Factor 3, Services View – Education Focus*

This Service View Factor (F3) differentiates itself in placing the statement, “provide continuing education programs” as its highest agreement statement. This factor also supports the provision of a broader range of information as well as more access (for rural hospitals) to the resources of the city-based hospitals.

The negative statements are also very informative for this factor and they do not advocate for rural areas nor do they wish to represent them or help relatives to develop realistic expectations about the outcomes. Furthermore they do not support the use of evidence-based practice guidelines, which standardize care.

8.4.4 Factor 4 in Services View – Community Based Information View with Rural Focus

We can now look at the Services View Factor 4, Community Based Information View with Rural Focus. There are 2 respondents aligned solely on Factor 4. This factor was significantly different from others in strongly agreeing with statements 11, 21 and 4 and strongly disagreeing with statements 26, 1 and 42. The following statements are the strongest agreement and disagreement statements for Factor 4.

Strongly Agree Statements in Factor 4 – (Services View)		Strongly Disagree Statements in Factor 4 – (Services View)	
<i>No.</i>	<i>Statement</i>	<i>No.</i>	<i>Statement</i>
11	facilitate efficiency	26	provide Information for nursing students
21	provide more access to the resources of the city based hospitals	1	A 1 stop shop for clinicians and consumers of ICU WBIS services
4	access to bigger centres resources ie. Specialists	42	to provide the breath of Information needed by all ICU clinicians

Table 8.6: *Significantly different strongly Agreeing & Disagreeing Statements in Factor 4, Services View – Community Based Information View with Rural Focus*

The Services View Factor (F4) differentiates itself in placing the statement, “facilitate efficiency” as its highest agreement statement. They also indicated a desire to provide more access to the resources of the city-based hospitals and access to bigger centres; resources i.e.

Specialists. The negative statements are also very informative for this factor and they include a desire to provide information for nursing students and not to be a one-stop shop for clinicians and consumers of ICU WBIS. They do not see the WBIS's role as that of providing the breath of information needed by all ICU clinicians.

Overview for Factor 4 in services views sees accessibility as important to clinicians' needs, as clinicians need to find information quickly and easily. As well as this, it sees the WBIS is not there to help relatives to develop realistic expectations about the outcomes, nor to provide broader based services for rural units.

It recommends a few ways for clinicians to find information such as navigational elements, search functions, or a site map. However, they suggest only a few options to be available at any time to avoid confusion.

8.4.5 Factor 5 in Services View – Evidence Based Practice, Service and Communication Focus

There are 3 respondents aligned solely on Services View Factor 5. This factor was significantly different from others in strongly agreeing with statements 46, 4 and 14, and strongly disagreeing with statements 15, 12 and 9.

The following statements are the strongest agreement and disagreement statements for Factor 5. There is little similarity between what Factor 4 and Factor 5 represent as services views. It is clear that Factor 5, has Evidence based Practice, Service & Communication as its focus.

Strongly Agree Statements in Factor 5 – (Services View)		Strongly Disagree Statements in Factor 5 – (Services View)	
<i>No.</i>	<i>Statement</i>	<i>No.</i>	<i>Statement</i>
46	venue for practice guidelines	15	improve Information access for relatives
4	access to bigger centres resources ie. Specialists	12	feedback on processes and equipment
14	have a evidence based review of the usefulness of equipment tools etc	9	coordinate research activities

Table 8.7: *Significantly different strongly Agreeing & Disagreeing Statements in Factor 5, Services View – Evidence Based Practice, Service & Communication Focus*

In the Services View Factor 5, the high agree statements clearly represent services view as a venue for practice guidelines, which would provide access to bigger centres' resources i.e. Specialist services, and they would have an evidence based review of the usefulness of equipment and tools provided by the WBIS. The high disagree statements further clarify what this factor means by services. They do not want the WBIS to improve information access for relatives or to provide feedback on processes and equipment. Factor 5 also states that it does not want the WBIS used to coordinate research activities.

Overall, Factor 5 in services view shows that the clinicians indicate that the WBIS should have high visibility to make important elements, such as navigational aids, more visible, so users can determine at a glance what they can and cannot do, as increased visibility helps users predict the effects of their actions. They thought the WBIS should provide evidence-based practice guidelines for standardized care, promote standards for evidence-based practice, and provide advice for best alternatives and facilitate efficiency.

8.4.6 Cross Factor comparisons

When compared the people who are represented on the factors, since some factors are

almost entirely represented by a particular group. The purpose of this section is to look at each factor in services view, so as to understand their thinking. It is clear when the factors are seen together that they are largely consistent with each other, even though they were generated as five separate sorts. The following table is given as a quick overview of the factors for reference in the review that follows.

	<u>Service View</u>	<u>No. of sorts</u>	<u>Total</u>
Factor 1	Clinicians Resource	2 Females & 1 Male from ICU 1 Female - Academic 1 Female - Student	5
Factor 2	Communication Focus	2 Females from ICU 1 Female - Student	3
Factor 3	Educational Focus	2 Females - Student	2
Factor 4	Community Based Information View with rural focus	1 Female from ICU 1 Female - Student	2
Factor 5	Evidence based Practice, Service and Communication View	1 Female from ICU 2 Males - Student	3

Table 8.8: Sort in Services View

Below, the findings from the 5 factors in the services view have been placed in an Activity Theory triangle to represent the relationship between each factor. In mapping the factor results on the triangle below, the services view were placed against corresponding sections of the triangle to allow for the relationship of each to be seen in light of the others within the activity theoretical framework, i.e. tools, process, and object.

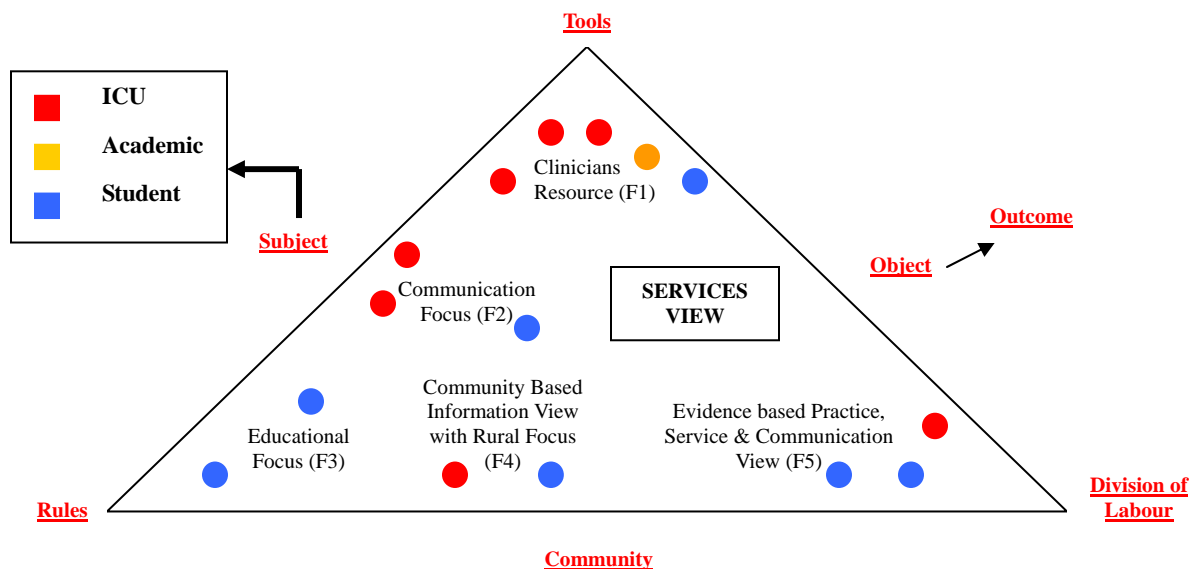


Figure: 8.1 Activity Theory Triangle applied on Services View

8.5 Review of the Function Views

The second area that will be looked at is **Function View**, where 2 **Factor** solutions were selected.

<i>Terms/Areas</i>	<i><u>Function View</u></i>	<i>Participants in Q Sort</i>
Factor 1	Developer Focus	4
Factor 2	End-user Focus	2

Table 8.9: Overview for the Function View

8.5.1 Factor 1 in Function View – Developer Focus

There are 4 respondents aligned solely on the Function View’s Factor 1, Developer Focus. This factor was significantly different from others in strongly agreeing with statements 41, 23 and 15 and strongly disagreeing with statements 2, 19 and 3. The following statements are the strongest agreement and disagreement statements for Factor 1.

Strongly Agree Statements in Factor 1 – (Function View)		Strongly Disagree Statements in Factor 1 – (Function View)	
<i>No.</i>	<i>Statement</i>	<i>No.</i>	<i>Statement</i>
41	support the day to day operations of ICUs	2	a service that is up-to-dated daily
23	maximize the use of the available resources	19	Information on Medi-Care for patients family
15	help eliminate duplication of effort	3	access to patient records

Table 8.10: Significantly different strongly Agreeing & Disagreeing Statements in Factor 1, Function View – Developer Focus

In the function view Factor 1, the high agreement statements clearly represent the function view in supporting the day-to-day operations of ICUs, and a desire to maximize the use of the available resources. There is also a desire to increase efficiency, in suggesting that the WBIS would help eliminate duplication of effort.

The high disagreement statements further clarify what this function view factor means by “Function”. It is not a service that should be up-to-dated daily, nor do they wish for the

WBIS to provide information on Medicare for patients' families nor do they want it to provide access to patient records.

8.5.2 Factor 2 in Function View – End-user Focus

The Function View Factor 2 takes an End-user Focus. There are 2 respondents aligned solely on function view Factor 2. This factor was significantly different from others in strongly agreeing with statements 19, 33 and 2, and strongly disagreeing with statements 15, 27 and 5. The following statements are the strongest agreement and disagreement statements for Factor 2.

Strongly Agree Statements in Factor 2 – (Function View)		Strongly Disagree Statements in Factor 2 – (Function View)	
No.	Statement	No.	Statement
19	Information on Medic-Care for patients family	15	help eliminate duplication of effort
33	provide national and international job swap site	27	provide access to other area's policies and procedures
2	a service that is up-to-dated daily	5	be a source / body that provides minimum standards

Table 8.11: Significantly different strongly Agreeing & Disagreeing Statements in Factor 2 in Function View – End-user Focus

The Function View Factor 2, End-user Focus holds a very different interpretation of functions from Factor 1. These factors' respondents would have the WBIS providing information on Medicare for patients' families, and would also have the WBIS acting as a national and international job swap site. They would also like to have the WBIS up-to-dated daily. Here we are seeing a factor group that wants functions in WBIS to focus on extended users' needs.

The high disagreement statements support the notion that these factors' respondents do not see the WBIS as a source of efficiency or as an administrative tool. They inform us of this from their selection of statements: that the WBIS not be employed to *help eliminate duplication of effort*, nor, that it be used to *provide access to other area's policies and procedures*. They also feel that the WBIS should not be a source or body that would provide minimum standards indicating that the ICU needs independence.

8.5.3 Cross Factor comparisons

The factors when compared show the views of the people who are represented on the factors. The purpose of this section is to look at each factor in function view, so as to understand their thinking. It is clear when the factors are seen together with each other, even though they were generated as two separate sorts. The following table is given as a quick overview of the factors for reference in the review that follows.

<i>Factor</i>	<i><u>Function View</u></i>	<i>No. of sorts</i>	<i>Total</i>
<i>Factor 1</i>	Developer Focus	2 Males from WBIS DT 2 Females from WBIS DT	4
<i>Factor 2</i>	End-user Focus	2 Females from ICU	2

Table 8.12: Distributed the Sort in Function View

In summary, Factor 1 in function view clearly represents the developer focus on the function of WBIS showing that it should be a memory aid with reference information available, and should support request for policies and procedures. Factor 1 also states that it does not seek information-up-to-dated daily as well as information on Medicare services for patients' families, nor does it have access to patient records.

Thus, Factor 1 in function view is developer focused; it expresses that WBIS should support the day-to-day operations of ICUs, maximize the use of the available resources and help eliminate duplication of effort across NSW ICUs. The group also wants WBIS to provide access to other areas' (ICUs) policies and procedures, and support request for policies as well as be a service that is up-to-dated at least weekly. Factor 1 clearly sees that the function of health care WBIS is to provide stock standard guidelines, share discussion

boards on site keeping a history, as well as to advertise courses that are happening.

Factor 2 in function view is end-user focused. The highest agreement statements clearly represent the end-user focus on the function of WBIS in that the WBIS should provide a national and international job swap site and provide information on Medicare for patients' families as well as raise awareness overseas about available work in Australian ICU. The end-user sees the function of WBIS should facilitate staffing, focus on information about working opportunities and should make available beds known, as well as be a venue for flow chart samples and a services that is up-to-dated at least weekly.

Below, the findings have been placed in an Activity Theory triangle, to represent the relationship between each of the three areas of study. In mapping the factor results on the triangle below, the factors from the function view were placed against corresponding sections of the triangle to allow for the relationship of each to be seen in light of the others within the activity theoretical framework. i.e. tools, process and object.

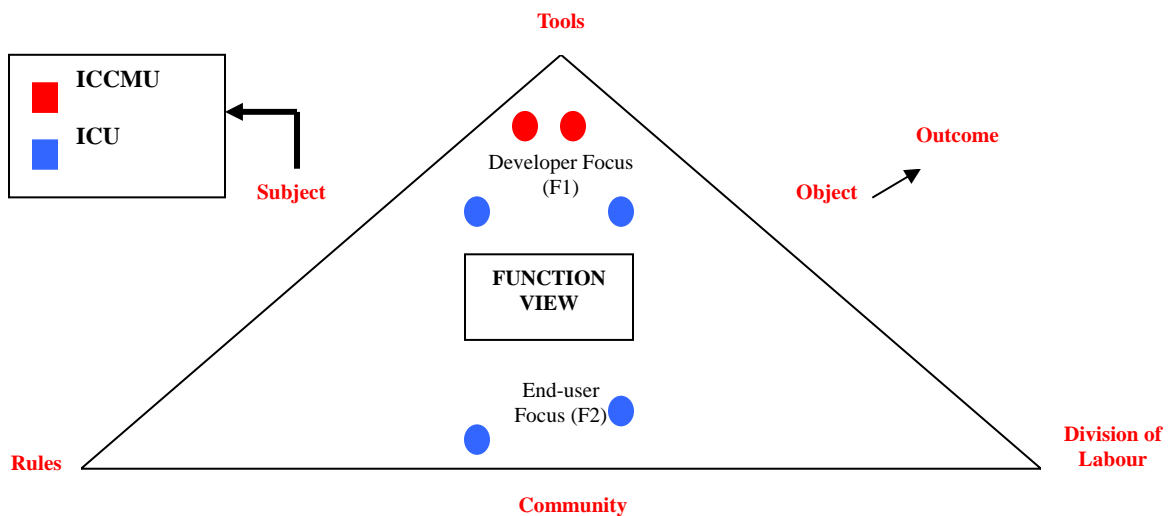


Figure: 8.2 Activity Theory Triangle applied on Function View

8.6 Review of the Design Views

The third area that will be looked at is **Design View**, where a **5 Factor** solution was selected.

<i>Terms/Areas</i>	<i>Design View</i>	<i>Participants in Q Sort</i>
Factor 1	Responsive Focus	2
Factor 2	End-user Focus	2
Factor 3	Advanced User Focus	2
Factor 4	User Friendly Focus	1
Factor 5	Specific Focus	1

Table 8.13: Overview for the Design View

8.6.1 Factor 1 in Design View – Responsive Focus

There are 2 respondents aligned on Design View Factor 1, Responsive Focus. This factor was significantly different from others in strongly agreeing with statements 2, 16 and 18 and strongly disagreeing with statements 19, 1 and 24. The following statements are the strongest agreement and disagreement statements for Factor 1.

Strongly Agree Statements in Factor 1 – (Design View)		Strongly Disagree Statements in Factor 1 – (Design View)	
<i>No.</i>	<i>Statement</i>	<i>No.</i>	<i>Statement</i>
2	be an evolving site that is responsive to the demands of the users	19	review terms of reference
16	provide available of Information for like minded ICUs - Level 4, Staffing Information HDU etc	1	be able to manage what they have
18	provide protocol folders	24	use issue from “go bads” as basis for education

Table 8.14: Significantly different strongly Agreeing & Disagreeing Statements in Factor 1, Design View – Responsive Focus

In Factor 1, the high agreement statements clearly represent design view as being an evolving site that is responsive to the demands of the users, and being able to provide

available information for like-minded ICUs, such as Level 4, Staffing Information HDU etc. The high disagreement statements further clarify what this factor means by design. It does not review terms of reference, and it is not able to manage what they have or use issues from “go bads” as a basis for education.

8.6.2 Factor 2 in Design View – End-user Focus

There are 2 respondents aligned on Design View Factor 2, End-user Focus. This factor was significantly different from others in strongly agreeing with statements 6, 4 and 18, and strongly disagreeing with statements 20, 8 and 24. The following statements are the strongest agreement and disagreement statements for Factor 2.

Strongly Agree Statements in Factor 2 – (Design View)		Strongly Disagree Statements in Factor 2 – (Design View)	
<i>No.</i>	<i>Statement</i>	<i>No.</i>	<i>Statement</i>
6	have a deceptively simple design	20	sections on services for relatives - financial services, emotional counselling etc...
4	be user friendly	8	have links to relevant Information that they do not wish to manage
18	provide protocol folders	24	use issue from “go bads” as basis for education

Table 8.15: *Significantly different strongly Agreeing & Disagreeing Statements in Factor 2 in Design View – End-user Focus*

Factor 2, design view, holds a very different interpretation of services from Factor 1. For example, services in WBIS should have a deceptively simple design, and be user friendly, as well as provide protocol folders. Here we are seeing the design in WBIS, which should focus on the end-user. The high disagreement statements in Factor 2 indicate that the WBIS should not provide a section on services for relatives - financial services, or emotional counselling and that it should not have links to relevant information that they do not wish

to manage. They also feel that the WBIS should not provide access to “go bads” as a basis for education.

8.6.3 Factor 3 in Design View – Advanced User Focus

There is some similarity between what Factor 2 and Factor 3 Advanced User Focus represented as design view. There are 2 respondents aligned on Factor 3. This factor was significantly different from others in strongly agreeing with statements 4, 3 and 21 and strongly disagreeing with statements 20, 17 and 19. The following statements are the strongest agreement and disagreement statements for Factor 3.

Strongly Agree Statements in Factor 3 – (Design View)		Strongly Disagree Statements in Factor 3 – (Design View)	
<i>No.</i>	<i>Statement</i>	<i>No.</i>	<i>Statement</i>
4	be user friendly	20	sections on services for relatives - financial services, emotional counselling etc
3	be sophisticated in the service provision it provides	17	provide lay descriptions and images of ICU services
21	to be an online library	19	review terms of reference

Table 8.16: *Significantly different strongly Agreeing & Disagreeing Statements in Factor 3, Design View – Advanced User Focus*

Design view advanced user focus has “user friendliness” as its highest agreement statement, and it also indicated a sophisticated service is being provided, and that this includes a Web-based library and is designed for advanced users. The negative statements also are very informative for this factor and they include, the recommendation that it not have sections on services for relatives - financial services, emotional counselling etc that it not provide lay descriptions and images of ICU services expectations and that it not review terms of reference for an ICU.

8.6.4 Factor 4 in Design View – User Friendly Focus

Design view Factor 4, User Friendly Focus. There is 1 respondent aligned solely on Factor 4. This factor was similar to Factors 2 and 3, in strongly agreeing with statements 2, 3 and 4, and strongly disagreeing with statements 24, 22 and 23.

The following statements are the strongest agreement and disagreement statements for Factor 4.

Strongly Agree Statements in Factor 4 – (Design View)		Strongly Disagree Statements in Factor 4 – (Design View)	
<i>No.</i>	<i>Statement</i>	<i>No.</i>	<i>Statement</i>
2	be an evolving site that is responsive to the demands of the users	24	use issue from “go bads” as basis for education
3	be sophisticated in the service provision it provides	22	to provide all the background Information
4	be user friendly	23	to work in common with Tele-Health

Table 8.17: *Significantly different strongly Agreeing & Disagreeing Statements in Factor 4, Design View – User Friendly Focus*

This design view factor, user-friendly focus, is very similar in its positive statements to Factor 3. Factor 4 has also put “be an evolving site that is responsive to the demands of the users” as its highest agreement statement. Factor 3 also indicated to be sophisticated in the service it provides and user friendly.

The negative statements are different and help to define this factor. The negative statements recommend that the WBIS not use “go bads” as a basis for education and not provide all the background information about the outcomes nor to contribute to Tele-Health care.

8.6.5 Factor 5 in Design View – Specific Focus

In the Design View Factor 5, the Specific Focus, there is only 1 respondent aligned solely on Factor 5. This factor was significantly different from others in strongly agreeing with statements 18, 17 and 21, and strongly disagreeing with statements 3, 5 and 23.

The following statements are the strongest agreement and disagreement statements for Factor 5.

Strongly Agree Statements in Factor 5 – (Design View)		Strongly Disagree Statements in Factor 5 – (Design View)	
<i>No.</i>	<i>Statement</i>	<i>No.</i>	<i>Statement</i>
<i>18</i>	provide protocol folders	<i>3</i>	be sophisticated in the service provision it provides
<i>17</i>	provide lay descriptions and images of ICU services	<i>5</i>	designed for advanced users
<i>21</i>	to be an online library	<i>23</i>	to work in common with Tele- Health

Table 8.18: *Significantly different strongly Agreeing & Disagreeing Statements in Factor 5, Design View – Specific Focus*

In Factor 5, the high agreement statements clearly represent design view as a venue for more specific services, such as, provision of protocol folders and lay descriptions and images of ICU services and they show that the WBIS should be Web-based library.

The high disagreement statements further clarify what this factor means by design. The WBIS is neither to be sophisticated in the service it provides, nor be designed for advanced users. It is also not to work in common with Tele-Health care.

8.6.6 Cross Factor comparisons

When compared the people who are represented on the factors, since some factors are almost entirely represented by a particular group. The purpose of this section is to look at each factor in design view, so as to understand their thinking. It is clear when the factors are seen together that they are largely consistent with each other, even though they were generated as five separate sorts.

The following table is given as a quick overview of the factors for reference in the review that follows.

<i>Factor</i>	<i>Views</i>	<i>No. of sorts</i>	<i>Total</i>
<i>Factor 1</i>	Responsive Focus	1 Male from WBIS DT 1 Female from ICU	2
<i>Factor 2</i>	End-user Focus	1Male and 1 Female from ICU	2
<i>Factor 3</i>	Advance User Focus	1 Female from WBIS DT 1 Female from ICU	2
<i>Factor 4</i>	User Friendly Focus	1 Female from WBIS DT	1
<i>Factor 5</i>	Specific Focus	1 Male from WBIS DT	1

Table 8.19: Distributed the Sort in Design View

For the overall design views, Factor 2, the end-user focus, show WBIS should have a deceptively simple design, and be user friendly, to have sections that are completely current and others that are stable as well as make the screen elements meaningful and consistent across the site to reduce memory load. In this way, Factor 3 uses design features so that advanced users don't have to remember what the elements mean from one page to another.

They want to relate new items and functions to ones the user already knows. They also recognise that it is important to provide protocol folders and "help" information. They are

also in favour of links with other health care WBIS sites around the world. Factor 3 clearly sees providing the links with organizations such as Cancer Care and Women's Health Care and providing information for like-minded ICUs - Level 4, Staffing Information HDU etc, as important.

With the current design of WBIS, most clinicians in design view think it should not support the sections on services for relatives - financial services, emotional counselling and that it does not need to have links to relevant information that they do not wish to manage, and the clinicians do not want “go bads” as a basis for education. They are concerned that the WBIS provide the immediate feedback when a user performs an action.

Below, the findings have been placed in an Activity Theory triangle to represent the relationship between each of the factors. In mapping the factor results on the triangle below for the design view, the factors were placed against corresponding sections of the triangle to allow for the relationship of each to be seen in light of the others within the activity theoretical framework, i.e. tools, process and object.

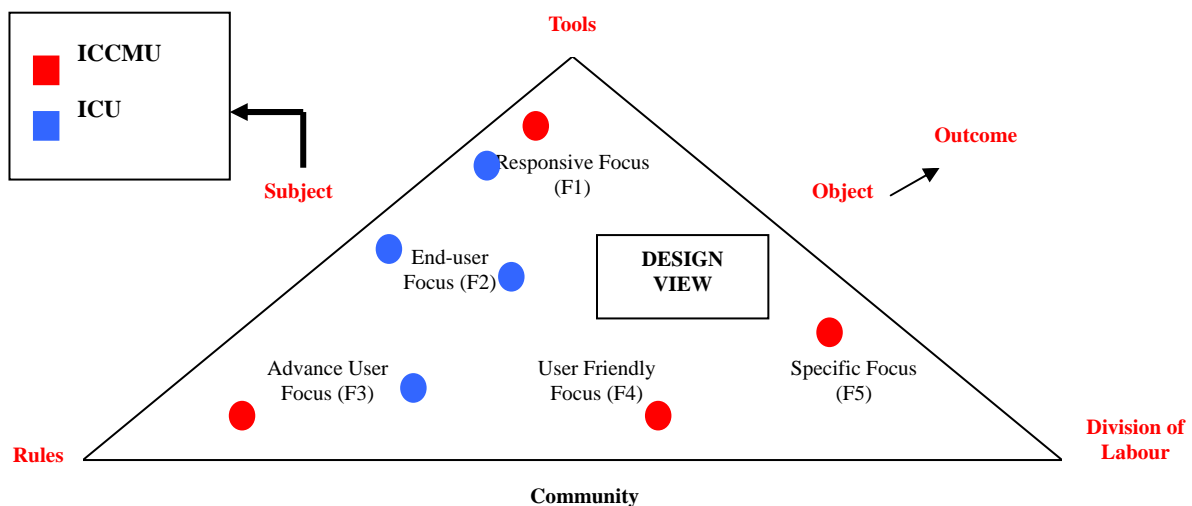


Figure: 8.3 Activity Theory Triangle applied on Design View

8.7 Review of the Output Views

The forth area that will be looked at is **Output View**, with **4 Factor** solutions selected.

<i>Terms/Areas</i>	<i><u>Output View</u></i>	<i>Participants in Q Sort</i>
Factor 1	Quality Focus	4
Factor 2	Education Focus	1
Factor 3	Patients and their Relatives' Focus	2
Factor 4	Information Focus	1

Table 8.20: Overview for the Output View

8.7.1 Factor 1 in Output View – Quality Focus

There are 4 respondents aligned on Output Factor 1, Quality Focus. This factor was significantly different from others in strongly agreeing with statements 10, 11 and 14 and strongly disagreeing with statements 22, 19 and 21. The following statements are the strongest agreement and disagreement statements for Factor 1.

Strongly Agree Statements in Factor 1 – (Output View)		Strongly Disagree Statements in Factor 1 – (Output View)	
<i>No.</i>	<i>Statement</i>	<i>No.</i>	<i>Statement</i>
10	improve quality of patients Care	22	provide project Information for schools students
11	improve quality of service for the patients	19	provide educational Information to schools for students
14	improve the level of Care across NSW ICUs	21	provide more fluid exchange of patients for need levels such as Taking patients back to “home” region

Table 8.21: Significantly different strongly Agreeing & Disagreeing Statements in Factor 1, Output View – Quality Focus

In the Factor 1, the high agreement statements clearly represent the output view as they show it to be an evolving site that is to improve quality of patient care service for the patients. The high disagreement statements further clarify what this factor means by output

that it is not to provide project information for school students, that it should not provide educational information to schools for students and not provide more fluid exchange of patients for need levels such as taking patients back to “home” region.

8.7.2 Factor 2 in Output View – Education Focus

There is only 1 respondent aligned on Factor 2. This factor was significantly different from others in strongly agreeing with statements 22, 9 and 19, and strongly disagreeing with statements 11, 1 and 18. The following statements are the strongest agreement and disagreement statements for Factor 2.

Strongly Agree Statements in Factor 2 – (Output View)		Strongly Disagree Statements in Factor 2 – (Output View)	
<i>No.</i>	<i>Statement</i>	<i>No.</i>	<i>Statement</i>
22	provide project Information for schools students	11	improve quality of service for the patients
9	focus on time savings	1	advocate for minimal standards and conditions
19	provide educational Information to schools for students	18	print out details of procedures / visitor hours / locations / parking

Table 8.22: *Significantly different strongly Agreeing & Disagreeing Statements in
Factor 2, Output View – Education Focus*

What Factor 2 represents as output education view is a very different interpretation of output from Factor 1. For example, output in WBIS is to provide project information for school students and focus on time saving, as well as provide educational information to schools for students. Here one can see that output in WBIS should focus on community users.

The high disagreement statements in Factor 2 do not support improving the quality of service for the patients and not advocate for minimal standards and conditions. They also

feel that the services need not print out details of procedures, visitor hours, locations or parking.

8.7.3 Factor 3 in Output View – Patients and their relatives’ Focus

In Factor 3, there are 2 respondents aligned on Factor 3. This factor was significantly different from others in strongly agreeing with statements 5, 20 and 21 and strongly disagreeing with statements 3, 2 and 14. The following statements are the strongest agreement and disagreement statements for Factor 3.

Strongly Agree Statements in Factor 3 – (Output View)		Strongly Disagree Statements in Factor 3 – (Output View)	
<i>No.</i>	<i>Statement</i>	<i>No.</i>	<i>Statement</i>
5	decrease distress of relatives	3	be a research resource - to support research
20	provide image-based answers for relatives’ questions	2	as an advocate for education, access to Information service
21	provide more fluid exchange of patients for need levels such as Taking patients back to “home” region	14	improve the level of Care across NSW ICUs

Table 8.23: *Significantly different strongly Agreeing & Disagreeing Statements in Factor 3, Output View – Patients and their relative’s Focus*

In this Factor (F3) the patients and their relatives’ focus, in output view, has “decrease distress of relatives” as its highest agreement statement, and it also supports provision of image-based answers for relatives’ questions, to achieve a more fluid exchange of patients based upon need levels, such as, taking patients back to “home” region.

The negative statements also are very informative for this output factor and they include, not being a research resource - to support research and not being an advocate for education.

8.7.4 Factor 4 in Output View – Information Focus

We can now look at Output Factor 4, Information Focus. There is only 1 respondent aligned solely on Factor 4, in strongly agreeing with statements 10, 17 and 18, and strongly disagreeing with statements 23, 4 and 15.

The following statements are the strongest agreement and disagreement statements for Factor 4.

Strongly Agree Statements in Factor 4 – (Output View)		Strongly Disagree Statements in Factor 4 – (Output View)	
No.	Statement	No.	Statement
10	improve quality of patients Care	23	provide text-based answers to relatives' questions
17	Information sheets for various conditions	4	bring standards up through sharing Information
18	print out details of procedures / visitor hours / locations / parking	15	increase communication amongst Area Health Units

Table 8.24: *Significantly different strongly Agreeing & Disagreeing Statements in Factor 4, Output View – Information Focus*

The highly positive statements for output factor (F4), the information focus includes: “improve quality of patient care”, providing information sheets and having facilities to print out details of procedures, visiting hours, location for parking etc. The factor has placed patient care and the provision of information to relatives of patients as its major focus.

The negative statements selected, indicate that this factor group is not concerned with providing text-based answers to relatives, questions not with bringing standards up through sharing information as well as increasing communication amongst Area Health Care Units.

8.7.5 Cross Factor comparisons

When compared the people who are represented on the factors, since some factors are almost entirely represented by a particular group. The purpose of this section is to look at each factor in output view, so as to understand their thinking. It is clear that when the factors are seen together they are largely consistent with each other, even though they were generated as five separate sorts.

The following table is given as a quick overview of the factors for reference in the review that follows.

<i>Factor</i>	<i>Views</i>	<i>No. of sorts</i>	<i>Total</i>
<i>Factor 1</i>	Quality Focus	2 Female & 1 Male from WBIS Management 1 Females from ICU	4
<i>Factor 2</i>	Education Focus	1 Male from ICU	1
<i>Factor 3</i>	Patients and their Relatives' Focus	1 Female & 1 Male from ICU	2
<i>Factor 4</i>	Information Focus	1 Female from ICU	1

Table 8.25: Distributed the Sort in Output View

In the overview for the Output view, Factor 1 Quality Focus indicates that the output of WBIS should improve quality of patient care, improve quality of service for the patients and improve the level of care across NSW ICUs. They have different views in Output Factor 2 Education Focus which selected positive statements that support WBIS providing project information for school students, and providing educational information to schools for students, as well as image-based answers for relatives' questions consisting of unbiased information.

However, Output Factor 1 Quality Focus does not support the provision of project information for school students, nor would it provide educational information to schools for

students. Factor 1 does not seek more fluid exchange of patients with regard to need levels, such as taking patients back to “home” region nor does it show the WBIS to improve relations within the Area Health Care Service. This factor does not see it advocating for minimal standards and conditions as well as bringing standards up through sharing information

Output Factor 3, Patients and their relatives’ Focus believe that the WBIS should be used to decrease the stress of relatives and to provide image-based answers for relatives’ questions. It also shows that the WBIS should provide more fluid exchange of patients for need levels such as taking patients back to “home” region and decrease patient disability at discharge. In Output Factor 4, the selected statements see practitioners focus on information that the WBIS can use to improve quality of patient care, including having formatted information sheets for various conditions as well as being able to print out details of procedures, visitor hours, locations and parking.

However, Output Factor 3 Patients and their relatives’ Focus, indicates that the WBIS is not a research resource to support research nor is it an advocate for education, in providing access to information service. In Output Factor 4 Information focus, clinicians indicate that the output of WBIS should not provide the text-based answers to relatives’ questions or be used to bring standards up through sharing information. They do not see it as having a role in increasing communication amongst Area Health Care Units, nor would they like the WBIS to be an advocate for minimal standards and conditions and it does not seek to improve the community awareness of ICUs.

The findings suggest that the output of WBIS use visual design because practitioners agreed the interface plays an important role in communicating information and tone to users effectively. They suggested output should create pages that are interesting, yet simple and uncluttered, and use graphics to illustrate, inform and increase the user's satisfaction and motivation, as well as to aid navigation. The WBIS should avoid using graphics that only serve as decoration and better use graphics that are small in file size so they download quickly.

Output Factor 4 Information Focus also shared their ideas regarding how best to overlay the ICU with existing reporting systems and how to facilitate staff reporting. While reporting to one system was preferable, the ability to print each report and attach to existing incident reporting forms was also seen to provide equal benefit. Suggestions for facilitating reporting included incorporating a reminder rounds or checklists, training and educating staff on why and how to report incidents, and sharing data and examples of incidents with ICUs via the WBIS.

While study teams are encouraged to share data from the monthly reports with frontline ICU clinicians, they believe posting on staff bulletin boards and discussing the monthly reports excellent educational tools for all ICU clinicians. Factor 4 Information Focus also recommended that the WBIS publish a quarterly newsletter and forward copies for all ICU clinicians.

Below, the findings have been placed in an Activity Theory triangle to represent the relationship between each of the factors studied. In mapping the factor, results on the

triangle below, the output view, were placed against the Process, to allow the relationship of each to be seen in light of the other areas, i.e. tools, process and object.

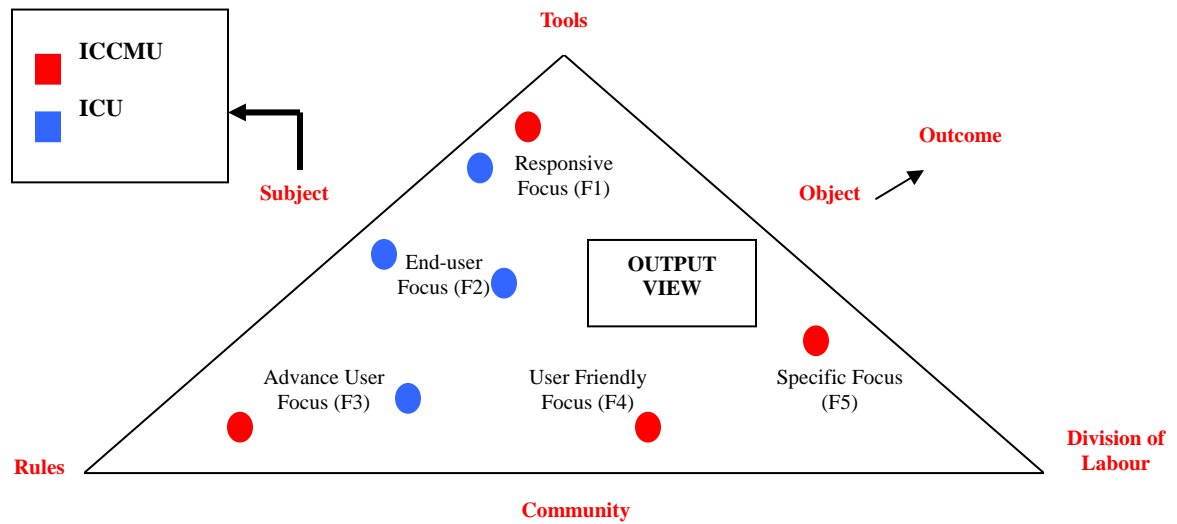


Figure: 8.4 Activity Theory Triangle applied on Output View

8.8 Discussion in four difference views

When WBIS was launched, one of the key premises was that everyone benefits when patients take charge of their own health care. In addition to WBIS access, the WBIS has focused on giving patients access to health care information. This approach has resulted in more comprehensive WBIS, one that is shared with patients and provides a more patient-focused approach to health care.

WBIS provides a safe and efficient electronic system for ICU to exchange information via the Internet, and thus to improve health care access which means efficiency. Access to the WBIS is provided via a standard web browser on an Internet connected computer. Clinicians require no additional software or product support. A key feature of the WBIS is that it allows for evidence-based practice data accumulated and accessed from a secure computer server, whenever and wherever it is required.

Access to the WBIS will eventually be controlled by both regional and national ICUs. The ICUs in NSW desire to use the service to improve the current health care model, hoping to make a significant contribution to the provision of evidence-based practice. Experienced clinical and WBIS teams are contributing to the knowledge and skill base and contributing to the change management processes.

Current ICU clinicians use list-servers as a means of providing free consultation and the evidence-based practice. One of the commonly asked questions relates to security. The WBIS has been working to improve understanding of the social, technical, ethical and

professional questions surrounding the introduction of WBIS, including privacy, confidentiality, security, redundancy, reliability and quality (Nardi and O'Day, 1999).

Recently, rural communities have embraced the Internet and undertaken many of everyday activities on the Web-based services. Rural communities are already adding health care to the Web-based information systems and the services being accessed; this is a logical and necessary addition to their service provision.

Numerous people perceive rural life as having many advantages over city dwelling and the Internet may enable and encourage many more to move to the country as Web-based work continues to develop more virtual services (Marton and Booth, 1997). Health care WBIS must play a role in this area.

8.9 Initial Recommendation of WBIS Design Improvements

This study has taken the position that information and knowledge-based systems, including, the Web-based information systems, are at their best when the design process is informed, accepted and even owned by those who actively use the services. The current web services were reviewed in order to identify the wishes of the users for opportunities or any problem areas in *Services, Function, Design and Output*.

The current Web-based Information Systems (WBIS), is designed to be used by clinicians and community members who are involved in some way in ICUs and Intensive Care staff. Communication is the main priority of WBIS, and this was always kept in mind. The recommendation for improvements, changes and activities for the WBIS have come from the expressed statements and the choices made in the sorting process.

CHAPTER 9: EVALUATION AND IMPLICATION FOR FURTHER STUDY

9.1 Introduction

This chapter contains an evaluation of the findings and implications gathered from the previous chapters. There is a discussion of insights drawn from the results that may be useful for future Health Care WBIS Development and provides a reflective review of both the research process and the research outcomes.

From the research process perspective, it includes a review of weaknesses and strengths, as well as the potential for future research from the multiple methods used in this research. The implications for effective research design and targeted directions for current and further study on the topic of Web-based Information Systems (WBIS) are also discussed.

9.2 Review and Evaluation

There are many methods undertaken in research studies including qualitative and quantitative approaches. Qualitative approaches generally include examining existing materials and sites, conducting interviews and focus groups, and observing practice, whereas Quantitative approaches include surveys and rating scales, among others. These methodologies are also regularly used. When it is not clear what needs exist and how they might be measured, however, qualitative methods are the most useful.

The principal source of information for this research came from four Q Methodological studies that were on Services, Function, Design and Output for a state based on the health care WBIS. As the researcher attended each data collection event, there was over a 90% return of Q Sorts and a high level of interest and active involvement by participants.

This level of interest and participation is a noted strength of the methodology, and is supportive of the effort taken to actually travel to each place and to personally introduce the research, its purpose, and to conduct the sorts. As the participants were from across the state they were only visited on one occasion as circumstances allowed.

The set of the participants, while geographically diverse, were similar in terms of education and experience, and thus interesting to study. The study was of interest to the participants, partly because it was grounded in their field of study, and also because it allowed them to reflect on, and make decisions about, their thoughts and to query their understandings, and their future career.

The choice of the methodology and its application in the discipline of information studies, while not completely unique, is not particularly common, nor is the combination of Q-methodology and Activity Theory. These two methods, at least in this case, worked well together as it allowed for a connection of the 4 separate Q Studies, through the framework provided by Activity Theory (Meloche, 2006).

The use of Activity Theory in the research process allowed for the development of an informative visual representation of the relationship of the four areas studied. As depicted in Figures 8.1 – 8.4, the triangular representations of the subject, object and tool elements of an activity, provide a useful framework to visualise findings of the study across all four areas in a holistic and integrated way where the tool mediates the subject-object dialectic and building on the representation of these on the Activity Theory framework (Kuuti, 1999).

9.3 The Significance of this Study in Review

This study provided an analysis of the current WBIS and through this has offered suggestions for design improvements to organisation, content and delivery of the WBIS. The study gave voice to interested clinicians and allowed them to discuss and actively partake in the development of a service for their needs.

The goal of providing satisfaction to the clinicians has been achieved. This was by enhancing information access to providing a means for clinicians to offer constructive feedback that will be used to improve services and by also improving the current site so that clinicians are able to access information more effectively. The WBIS should base design decisions on the clinician's needs

The Web-based Information Systems (WBIS) has responsibility to provide up-to-dated information to medical and health care workers and the relevant communities. The collecting, processing, maintenance, and dissemination of health care information currently include the health care statistics and more general health care. The WBIS also needs to be concerned with the ongoing quality improvement of data entering the national health care information systems and the continuing maintenance and development of related national health care and disability information systems.

The provision of access to appropriate databases, systems and information products and the development and provision of health care and disability information standards and quality-audit programs are among other issues on the table, as also the analysis of health care

information, performance monitoring, benchmarking, and advice on the use of information obtained from the WBIS.

When information is collected by concourses in Q-methodology, the needs analysis has already started. Once the concourse is completed the statements from the concourse are assembled into Q Sorts. The sorting makes it possible to identify the relationships among the individual sorter's factors and then to be able to make comparisons between them for different groups of respondents. It is also possible to identify various themes in the results. These analysis techniques are standard for qualitative data and lend themselves well to needs analysis.

Finally, the data from the sorts are analysed, using conventional descriptive techniques. These outcomes add meaning to the qualitative findings, providing indications of degree and illuminating aspects of the situation that would not otherwise be apparent. The WBIS should base its developments on the clinicians' needs and desire to provide and promote excellence in the standard of care, improving the provision of accurate information and enhancing communication. It is the task of research such as being done here to contribute to the understanding of the goals, activities and actions that can be supported by a health care WBIS.

This study has suggested guidelines for research informed user interface designs which address content design and the design of navigation which includes Services, Function, Design and Output, evaluation and reviews of the literature on instructional design, interface design, and usability testing.

ICU clinicians have identified their need to be able to quickly access and review the evidence-based practices for patients and review the resulting prevention and treatment recommendations generated by the WBIS which is also to provide educational opportunities for both patients and clinicians. References for diseases and recommendations were provided, as were glossary entries for many medical terms.

The design of the WBIS also concerns the public and this study, while speaking with clinicians, who are involved with the public, did not hear from the public directly. As the WBIS seeks to serve the larger community as well as clinicians, it will need to be supported by more community-based research.

The potential of WBIS is great and this is recognised by the health care community; patients can benefit from improved quality health care and 24 hour access to services. Clinicians would also benefit from increased productivity through reduced time off for medical appointments and emergencies; and health care professionals would benefit from more effective decision making practices and higher performance through readily available evidence based information.

A critical time period for ICU clinicians occurs early in their use of WBIS. If they perceive that some short-term needs are met, they are likely to more likely to use the site. If they are able to successfully access the WBIS and use it, there is a reasonable probability that their long-term needs can be met, if not completely met; at least positively influenced. This is the success for which every WBIS aims.

9.4 Recommendations - The Opportunities for further study

This study has reviewed the current Web-based Information Systems (WBIS) in NSW. Most of the future studies may to be applied to more specific areas in the community use of health care WBIS. This approach, where the unit of study is the activity in a specific domain, is suggested. The following view is taken from Engestrom's triangle to give a quick view of the key components of an Activity Theory study.

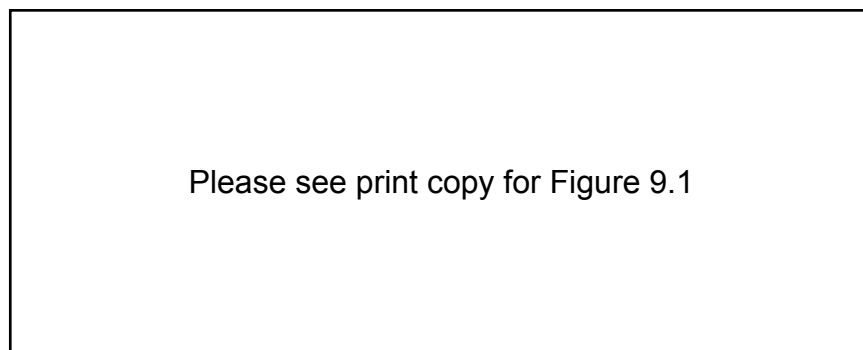


Figure 9.1: A holistic model of human activity (Engestrom)

Using a model such as the one above allows us to usefully study the activities such as the provision of WBIS. When the methods used in this study are applied, it can and has been clearly demonstrated that there is considerable variation in the views held by individual participants, even where the participants have a similar educational and working experience background.

Further, the variation in views increases with the addition of multicultural participants, different resource allocations, geography, educational levels, and most importantly, purpose. Thus, as was done in this study, there is a strong need to study, not only the core subject, but the related areas such as purpose and resources, as each of these areas, will impact on each other and on the final result.

CHAPTER 10: BIBLIOGRAPHY

- ABS (1988). 4120.0 Disability and Handicap, Australia. Australian Bureau of Statistics.
- ABS (2003). 4430.0 Disability, Ageing and Carers. Australian Bureau of Statistics.
- Anderson D, Webster C. A systems approach to the reduction of medication error on the hospital ward. *J Adv Nurs*. 2001;35:34–41.
- Andrews L, Stocking C, Krizek T, et al. (1997) An alternative strategy for studying adverse events in medical care. *Lancet*. 1997;349(9048):309–13.
- Annette L. V, and Ulrike W.,(1997), Q-methodology Definition and Application in Health Care Informatics, *Journal of the American Medical Informatics Association* 4:501-510 (1997)
- Anon. (2002a). Feature story: Finding a way into the working world. Janssen Site: Mentalwellness.com.
- Anon. (2002b). Mental Health Services for Kids & Youth, North Western Health, Women's and Children's Health Care Network. In conversation with Dr McKay. Melbourne, Australia.
- Arnheim, Rudolph. Visual Thinking. University of California Press.1989
- Aronson, E., Blaney, N., Stephin, C., Sikes, J., & Snapp, M. (1978). The jigsaw classroom. Beverly Hills, CA: Sage Publishing Company.
- Ash, D., Burvill, B., Davies, J., Meadows, G., Nagle, T., Pargiter, A. R., Hughson, B., Singh, B. & Weir, W. (2001). Mental health services in Australian states and territories. In G. Medows & B. Singh (Eds.), *Mental Health in Australia* (pp. 67-90). Melb., Australia: Oxford University Press.
- Australian Government Productivity Commission. (2005). Impacts of Medical Technology: Productivity Commission Report, Melbourne.
- Bagian J, Lee C, Gosbee J, et al. (2001) Developing and deploying a patient safety program in a large health care delivery system: you can't fix what you don't know about. *The Joint Commission*. 2001;27(10):522–32.
- Bagian J. (2001), Promoting patient safety at VA: Learning from close calls. *Forum, VA: Health Services Research & Development*; 2001, October:1,2–8.
- Bandura, A., Jeffery, R. W., & Bachicha, D. L. (1974). Analysis of memory codes and cumulative rehearsal in observational learning. *Journal of Research in Personality*, 7, 295-305.
- Bannon, L. (1997) From human factors to human actors: the role of psychology and human computer interaction studies in system design, in J. Greenbaum and M. Kyng (eds.), *Design at work: cooperative design of computer systems*, Lawrence Erlbaum & Associates, Hillsdale, NJ, 25-44.
- Bannon, L., and Bødker, S. (1991) Beyond the interface: encountering artefacts in use, in J.M.Carroll (ed.), *Designing interaction: psychology at the human computer interface*, Cambridge University Press, Cambridge, UK, 227-253.
- Barlow, D. L. Educational Psychology (1985). The Teaching-Learning Process. The Moody Bible Institute of Chicago.
- Bates D, Spell N, Cullen D, et al. (1997) The costs of adverse drug events in hospitalized patients. *JAMA*. 1997;277(4):307–11.
- Beckmann U, West L, Groombridge G, et al.(1996),The Australian Incident Monitoring Study in Intensive Care: AIMS-ICU. The development and evaluation of an

- incident reporting system in intensive care. *Anaesthesia and Intensive Care*. 1996;24(3):314-9
- Beer, T., Anodenko, T., & Sears, A. (1997) A pair of techniques for effective interface evaluation: cognitive walkthroughs and think-aloud evaluations. *Proceedings of The Human Factors and Ergonomics Society, 41st Annual Meeting*, pp.380-384. 1997
- Bellinger, G. (2004). Modeling. Available Website: <http://www.systems-thinking.org/simulation/model.htm>.
- Benbasat, Izak, Lim, Kai H., and Todd, Peter A. (1996) An experimental investigation of the interactive effects of interface style, instructions, and task familiarity on user performance. *ACM Transactions on Computer-Human Interaction* 3:1 (March, 1996), pp. 136-161
- Berglund, A. & Booth, S. (2002). "Are you guys really concerned about the grades?": On the experience of grading systems as contextual to learning in an internationally distributed computer science project course. Poster presented at the ISCRAT Conference, Amsterdam, Netherlands.
- Berglund, A. (2002). Learning computer networks: content and context. (In preparation)
- Bernard, Ryan. *The Corporate Intranet*. John Wiley and Sons, 1996
- Berryman, S. E. (1990). *Designing Effective Learning Environments: Cognitive Apprenticeship Models*. Institute on Education and The Economy, Columbia University, New York.
- Bias, Randall G., and Mayhew, Deborah J., Eds.(1994) *Cost-Justifying Usability*. Academic Press Professional. 1994
- Biggs, J. (1987). *Student approaches to learning and studying*. Hawthorn, Victoria: Australian Council for Education Research.
- Billard, Trish. (1997) Human factors for web design. *Proceedings of Society for Technical Communication 44th Annual Conference*, p.322. 1997
- Blattner, M. M., and Dannenberd, R. B., Eds. (1992) *Multimedia Interface Design*. Addison-Wesley. 1992
- Branaghan, Russell J., and Simeral, Elizabeth J. A comparative analysis of heuristic and usability evaluation methods. *Proceedings of Society for Technical Communication 44th Annual Conference*, p.307. 1997
- Brand, S. *The Media Lab: Inventing the Future at MIT*. Viking Penguin. 1987
- Brill, J., Kim, B., & Galloway, C. (2001). Cognitive apprenticeships as an instructional model. In M. Orey (Ed.), *Emerging perspectives on learning, teaching, and technology*.
- Brown, S.R. (1980). *Political subjectivity: Applications of Q-methodology in political science*. New Haven, CT: Yale University Press.
- Brown, S.R. (1996). *Q-methodology and qualitative research*. *Qualitative Health Research*
- Brown, S.R. (1997). *History and principles of Q-methodology in psychology and social sciences*.
- Brown, S.R. (1999). On the taking of averages: Variance and Factor analyses compared. *Operant Subjectivity*, 22, 31-37
- Card, S. K., Moran, T.P., and Newell, A (1983). *The Psychology of Human-Computer Interaction*. Lawrence Erlbaun Associates. 1983
- Carroll, John. M. (1998) *Minimalism Beyond The Nurnberg Funnel*. MIT Press w/ Society for Technical Communication. 1998
- Carroll, John. M. (1990) *The Nurnberg Funnel: Designing Minimalist Instruction for*

- Practical Computer Skill. MIT Press. 1990
- Carroll, John. M., ED. (1987) *Interfacing Thought: Cognitive Aspects of Human-Computer Interaction*. MIT Press. 1987
- Chueh H, Banett GO. (1997) "Just in time" clinical information. *Acad Med*. 1997; 72:512-7.
- Clark, R. C., (1995) *How to Design and Develop Effective CBT*. Center for Performance Technology. 1995
- Classen D, Metzger J. (2003) Improving medication safety: the measurement conundrum and where to start. *Int J Qual Health Care*. 2003;15(I):41-7.
- Connell L. (2000) Statement before the Subcommittee on Oversight and Investigations. Veterans' Affairs, Oversight and Investigations; 2000.
- Conway, J. (1997), Educational Technology's Effect on Models of Instruction, <http://copland.udel.edu/~jconway/EDST666.htm>
- Cooper, Alan. (1995) *About Face: The Essentials of User Interface Design*. IDG Books Worldwide. 1995
- Covvey, H. D., Carven, N. H., & McAlister, N. H. (1985). *Concepts and Issues in Health Care Computing*. St. Louis: C.V. Mosby.
- Crawford, K., Gordon, S., Nicholas, J., & Prosser, M. (1994). Conceptions of mathematics and how it is learned: the perspectives of students entering university. *Learning and Instruction*, 4, 331 – 345.
- Crawford, K., Gordon, S., Nicholas, J., & Prosser, M. (1998). Qualitatively different experiences of learning mathematics at university level. *Learning and Instruction*, 8, 455 – 468.
- Cullen D, Bates D, Small S, Cooper J, Nemeskal A, Leape L. (1995) The incident reporting system does not detect adverse drug events: a problem for quality improvement. *Jt Comm J Qual Improv*. 1995;21:541-8
- Daniels, H. (2001) *Vygotsky and Pedagogy*, London, Routledge.
- Davis, R. H. and Alexander, L. T., and Yelon S. L. (1974). *Learning System Design: An approach to the improvement of instruction*. McGraw-Hill, Inc.
- Davydov, V. V. (1993). The perspectives of Activity Theory. *Multidisciplinary Newsletter for Activity Theory* No. 13/14, pp50-53.
- Decker, P. J. and Nathan, B. R. (1985). *Behavior Modeling Training*. Praeger Publishers.
- Dennen, V. P. (2001). *Cognitive Apprenticeship in Educational Practice: Research on Scaffolding, Modeling, Mentoring, and Coaching as Instructional strategies*. Florida State University, Tallahassee, FL.
- Dennis, K.E. (1986). Q-methodology: Relevance and application to nursing research. *Advances in Nursing Science*, 8(3), 6-17.
- Dick, W., Carey, L., & Carey, J. O. (2005). *The systematic design of instruction* (6th ed.). Boston: Allyn and Bacon.
- Disability Online, Victoria (2001). <http://www.disability.vic.gov.au/>
- Donchin Y, Gopher D, Olin M, et al. (1995) A look into the nature and causes of human errors in the intensive care unit. *Crit Care Med*. 1995;23:294-300
- Driscoll, M. M. (2001). Developing synchronous Web-based training for adults in the workplace. In B. H. Khan (Ed), *Web-based Training* (pp. 173-183). New Jersey: Educational Technology Publications.
- Dumas, Joseph S., and Redish, Janice C. (1994) *A Practical Guide to Usability Testing*. John Wiley & Sons. 1994
- Ehn, P. (1988) *Work-Oriented Design of Computer Artifacts*. Arbetslivscentrum (Stockholm). 1988

- Ellis, W. N. (2000). Community life-long learning centres. In R. Miller (Ed), *Creating Learning Communities: Models, Resources, and New Ways of Thinking About Teaching and Learning* (pp. 14-21). Brandon, VT: The Foundation for Educational Renewal, Inc.
- Engeström, (1987). *Learning by Expanding: an Activity-Theoretical Approach to Developmental Research*. Helsinki: Orienta-Konsultit Oy.
- Engeström, (1992). *Interactive Expertise: Studies in Distributed Working Intelligence*. (Department of Education Research Bulletin 83). Helsinki: University of Helsinki, Department of Education.
- Engeström, Y. (1996). Developmental studies of work as a testbench of Activity Theory: the case of primary care medical practice. In S. Chaiklin and J. Lave *Understanding Practice: Perspectives on Activity and Context*. (pp XX - XX) Cambridge: Cambridge University Press.
- Engeström, Y. (1999b). Expansive visibilization of work: an activity-theoretical perspective. *Computer Supported Cooperative Work*, 8, 63-93.
- Engstrom, Y. (1996). *Perspective on Activity Theory*, Cambridge University Press, Cambridge.
- Engeström, Y. (1998). Reorganizing the motivational sphere of classroom culture: An activity-theoretical analysis of planning in a teacher team. In F. Seeger, J. Voigt, U. Waschescio, (eds) *The Culture of the Mathematics Classroom*. (pp 76 – 103). Cambridge: Cambridge University Press.
- Engeström, Y. (1999) Activity Theory and individual and social transformation in Engeström, Y. et al (1999) (Eds) *Perspectives on Activity Theory*. Cambridge: Cambridge University Press.
- Engeström, Y. (1999a). Activity Theory and individual and social transformation. In Y. Engeström, R. Miettinen, and R. Punamaki, *Perspectives on Activity Theory*. (pp 19 – 38). Cambridge, U.K., Cambridge University Press.
- Enser, P. G. B. Query analysis in a visual information retrieval context. *Journal of Documentaiton and Text Management*, 1:1, pp. 25-52. 1993
- Epstein, M., & Olsen, A. (2001). Mental illness: Responses from the community. In G. Medows & B. Singh (Eds), *Mental Health in Australia*. Melb., Australia: Oxford University Press.
- Eysenbach G, Powell J., Kiss O, et al. (2002) Empirical studies assessing the quality of health information for consumers on the World Wide Web: a systematic review. *JAMA*. 2002; 287 (20):2691
- Felkey BG, Fox BI. (2001) Using the Internet to enhance pharmacy-based patient care services, *J AM Pharm Assoc*, 2001;51(6);570.
- Fisher, M. (1991). Computerphobia in adult learners. *Computer Education*, 14-19.
- Friedland, Lewis, (1996) 'Electronic democracy and the new citizenship', *Media, Culture and Society*, volume 18 (1996), pp185-212
- Frj, Eric and Hertzum, Morten, (1996) Browsing and querying in online documentation: a study of user interfaces and the interaction process. *ACM Transactions on Computer-Human Interaction* 3:2 (June, 1996), pp. 136-161
- Fuchs, R. (1996). "Economics, values and health care reform", *The American Economic Review*, 86(1), pp. 1-24.
- Galda, L., & Beach, R. (2001). Response to Literature as a Cultural Activity. *Reading Research Quarterly*, 36(1), 64-73. doi: 10.1598/RRQ.36.1.4
- George G. Robertson G., Cameron, K., Czerwinski, M.P., Robbins, D.C (2005), *System and*

- method to display and manage data within hierarchies and polyarchies of information , Current U.S. Classification
- Gibbons, A., & Fairweather, P. (1998). Computer-Based Instruction: Design and development. New Jersey: Educational Technology Publications.
- Goethe JW: "Denken und Tun". Maximen und Reflexionen 1833.
- Gordon, S. (1998). Understanding students learning statistics: an Activity Theory approach. Unpublished doctoral dissertation, University of Sydney, Sydney.
- Gould, E. (1998). Psychological information systems frameworks: a contrast between cognitive science and Activity Theory. In H. Hasan, E. Gould, and P. Hyland, (Eds) Information Systems and Activity Theory: Tools in Context. (pp. 39 – 58). Wollongong, University of Wollongong Press.
- Greenberg, Saul and Tauscher, Linda. (1997) How people revisit web pages: empirical findings and implications for the design of history systems. *Human-Computer Studies*, 47, pp. 97-137 (1997)
- Gregory Bedny, Waldemar Karwowski, (2003), A Systemic-Structural Activity Approach to the Design of Human-Computer Interaction Tasks. *International Journal of Human-Computer Interaction* 16:2, 235-260
- Hackos, Joann T, and Stevens, Dawn M. (1997) Standards for Online Communication: Publishing Information for the Internet/World Wide Web/Help Systems/Corporate Internets. John Wiley and Sons. 1997
- Hackos, Joann T. and Redish, Janice. (1998) User Interface Task Analysis. John Wiley & Sons. 1998
- Haenen, J. (2001). Outlining the teaching-learning process: Piotr Gal'perin's contribution. *Learning and Instruction*, 11, 157 – 170.
- Hardman, J. (2005). Activity Theory as a Potential Framework for Technology research in an Unequal Terrain, *SAHJE* 19 (2). Unisa Press.
- Harris, J. B. and Jones, G. A Descriptive Study of Telementoring Among Students, Subject Matter Experts, and Teachers. University of Texas at Austin.
- Hasan, H. (1998). Activity Theory: a basis for the contextual study of information systems in organizations. In H. Hasan, E. Gould, and P. Hyland (eds), *Information Systems and Activity Theory: Tools in Context*. (pp19-38).Wollongong: University of Wollongong Press.
- Hasan, H. (1999) Integrating IS and HCI using Activity Theory as a philosophical and theoretical basis, *Australian Journal of Information Systems*, 6, 2, 44-55.
- Hasan, H., Gould, E., & Hyland ,P. (eds), (1998). *Information Systems and Activity Theory: Tools in Context*. Wollongong: University of Wollongong Press.
- Hasan, H., Gould, E., and Hyland, P. (1998) *Information systems and Activity Theory: tools in context*, University of Wollongong Press, Wollongong, N.S.W.
- Hasan, H., Gould, E., Larkin, P. & Vrazalic, L. (eds), (2001). *Information Systems and Activity Theory: Volume 2 Theory and Practice*. Wollongong: University of Wollongong Press.
- Health Science. (2005). "Health Science". Wikipedia, the free encyclopaedia. retrieved October 2, 2002
- Henry, Rodriguez, (1998), Activity Theory and Cognitive Sciences, <http://www.nada.kth.se/~henrry/papers/ActivityTheory.html>
- Hmelo, C. E., Ramakrishnan, S., Day, R. S., Shirey, W. E, Huang, Qingshou (1999). Scaffolded use of a modeling tool to support scientific inquiry. *International Conference on Computers in Education*.

- Horton, W. (2000). *Designing Web-based Training*. New York: Wiley.
- Horton, William. *Secrets of User-Seductive Documentation*, 2nd Edition. John Wiley & Sons. 1998
- Horton, William (1997). *The Icon Book: Visual Symbols for Computer Systems and Documentation*. Society for Technical Communication. 1997
- Huitt, W. (2004). *Observational (social) learning: An overview*. Educational Psychology Interactive. Valdosta, GA: Valdosta State University.
- Human Services (1996). *General Adult Community Mental Health Services: Guidelines for service provision*. Melbourne, Australia: Victorian Government Department of Human Services.
- Human Services (1998). *Victoria's Mental Health Service: The framework for service delivery*. Melbourne, Australia: Victorian Government Department of Human Services.
- Human Services (2000). *Standards for Psychiatric Disability Support Services, Aged, Community and Mental Health Division*. Melbourne, Australia: Victorian Government Department of Human Services.
- Hyland, P. (1998) Exploring some problems in information retrieval: an activity-theory approach, in H. Hasan, E. Gould, and P. Hyland (eds.), *Information systems and Activity Theory: tools in context*, University of Wollongong Press, Wollongong, N.S.W., 93-108.
- Hyppönen, H. (2004). *Technology develops, what about services. A case study of development of home care services in a technology project*, Academic dissertation. National Research and Development Centre for Welfare and Health (STAKES), Helsinki.
- Ilyenkov, E. V. (1977). *The concept of Ideal*. In *Philosophy in the U.S.S.R., Problems of Dialectical Materialism*. Moscow: Progress Publishers.
- In July 1998, Australian Health Ministers agreed to establish the National Health Information Advisory Council (NHIMAC)
- Issroff, K., & Scanlon, E., (2002). Using technology in Higher Education: an Activity Theory perspective. *Journal of Computer Assisted Learning*, 18, 77 – 83.
- Jonassen, D. H., Meyers, J. M., & McKillop, A. M. (1996). From constructivism to constructionism: Learning with hypermedia/multimedia rather than from it. In B. G. Wilson (Ed), *Constructivist Learning Environments: Case studies in instructional design* (pp. 93-106). New Jersey: Educational Technology Publications.
- Kakutani, K. (1998). *New life espresso: Report on a business run by people with psychiatric disabilities*. *Psychiatric Rehabilitation Journal*, 22(3, Fall).
- Kasper, Gabriele and Kellerman, Eric, Eds. (1987) *Communication Strategies: Psycholinguistic and Sociolinguistic Perspectives*. Longman Publication Group. 1987
- Kieras, David E., Wood, Scott D., & Meyer, David E. (1997) Predictive engineering models based on the EPIC architecture for multimodal high-performance human-computer interaction task. *ACM Transactions on Computer-Human Interaction* 4:3 (September, 1997), pp. 230-275
- Kivlahan C, Sangster W, Nelson K, Buddenbaum J, Lobenstein K. (2002) Developing a comprehensive electronic adverse event reporting system in an academic health center. *Journal of Quality Improvement*. 2002;28(11):583–94.
- Kohn L, Corrigan J, Donaldson M, editors. (1999) *To err is human: building a safer health*

- system. Institute of Medicine Report. Washington, DC: National Academy Press, 1999.
- Kumar, K., Dissel, H.G.v., and Bielli, P. (1998) The merchant of Prato revisited: toward a third rationality of information systems, *MIS Quarterly*, 22, 2, 199-226.
- Kuuti, K. (1999). Activity Theory as a potential framework for human-computer interaction research. In B. Nardi, (ed) *Context and Consciousness: Activity Theory and Human-Computer Interaction*. (pp 17 – 44) Cambridge, Massachusetts: The MIT Press.
- Kuutti, K. (1991) Activity Theory and its applications to information systems research and development, in H.E. Nissen, H.K. Klein, and R.A. Hirschheim (eds.), *Information systems research: contemporary approaches & emergent traditions*, North-Holland, Amsterdam, 529-549.
- Kuutti, K. (1999) Activity Theory, transformation of work, and information systems design, in Y. Engeström, R. Miettinen, and R.-L. Punamäki-Gitai (eds.), *Perspectives on Activity Theory*, Cambridge University Press, New York, 360-376.
- Kuutti, K., and Molin-Juustilla, T. (1998) Information system support for 'loose' coordination in a network organisation: an Activity Theory perspective, in H. Hasan, E. Gould, and P. Hyland (eds.), *Information systems and Activity Theory: tools in context*, University of Wollongong Press, Wollongong, N.S.W., 73-92.
- Lajoie, S. P., Wiseman, J., and Faremo, S. (1999). *Tutoring Strategies for Effective Instruction in Internal Medicine*. McGill University, Department of Educational and Counseling Psychology.
- Landa, R. (2001). *Graphic Design Solutions* (2nd ed.). Stamford: Thomson Learning.
- Landauer, Thomas K. (1995) *The Trouble with Computers: Usefulness, Usability, and Productivity*. MIT Press. 1995
- Langefors B. (1973) *Theoretical Analysis of Information Systems*. Fourth edition, Studentlitteratur, Lund.
- Laurel, Brenda, Ed. (1990) *The Art of Human-Computer Interface Design*. Addison-Wesley. 1990
- Laurel, Brenda. *Computers as Theater*. Addison Wesley, 1993
- Leape L. (1997) A systems analysis approach to medical error. *J Eval Clin Pract*. 1997;3:213–22.
- Leape L. (2001) Foreword: Preventing medical accidents: Is “systems analysis” the answer? *Am J Law Med*. 2001;27:145–8.
- Leape LL, Brennan TA, Laird N, et al. (1991) The nature of adverse events in hospitalized patients. Results of the Harvard Medical Practice Study II. *N Engl J Med*. 1991;324(6):377–84.
- Leape LL. (2002) Reporting of adverse events. *N Engl J Med*. 2002;347(20):1633–8.
- Leont’ev, A. N. (1979). The problem of activity in psychology. In T. V. Wertsch, (Ed) *The Concept of Activity in Soviet Psychology*. (pp 37 – 71). New York: Sharpe Inc. Note: originally published in 1972 in Russian in *Voprosy filosofii*.
- Leont'ev, A. N. (1978), *Activity, consciousness, and personality*. Englewood Cliffs: Prentice Hall.
- Leont'ev, A. N. (1981), *Problems of the development of the mind*. Moscow: Progress.
- Martin, J. (1999). *In-Patient Mental Health Program for Women: An issues paper*. Melb., Australia: Victorian Institute of Forensic Mental Health.
- Marton, F. & Booth, S. (1997). *Learning and Awareness*. Mahwah, New Jersey: Lawrence Erlbaum Associates.

- Marton, F. (1981). Phenomenography – Describing conceptions of the world around us. *Instructional Science*, 10, 177 – 200.
- Marton, F., Dall’Alba, G., & Beaty, E. (1993). Conceptions of learning. *International Journal of Educational Research*, 19, 277 – 300.
- McGee, S., Howard, B. C., & Hong, N. (1998). Cognitive Apprenticeship, Activity Structures, and Scientific Inquiry. NASA Classroom of the Future. Annual Conference of the American Educational Research Association, Sand Diego, CA.
- McKay, E. & Martin, B. (2002). The scope of e-learning: Expanded horizons for life-long learning. In B. Boyd (Ed), *Conference Informing Science 2002 + IT Education*.
- McKay, E. (2000a). Breaking down the mythology surrounding cognitive style and instruction format. *Computer Education*, June(95), 3-9.
- McKay, E. (2000b). Measurement of cognitive performance in computer programming concept acquisition: Interactive effects of visual metaphors and the cognitive style construct. *Journal of Applied Measurement*, 1(3), 257-286.
- McKay, E. (2002). Cognitive skill acquisition through a meta-knowledge processing model. *Interactive Learning Environments*, 10(3) (In print for June).
- McKeown, B.F. & Thomas, D.B. (1988). *Q-methodology. (Quantitative Applications in the Social Sciences, Vol. 66.)* Newbury Park, CA: Sage.
- McKeown, B.F. (1990). *Q-methodology, communication, and the behavioral text.* *Electronic Journal of Communication/La Revue Electronique de Communication*, 1.
- McNamara, S. E. (1988). Designing visual analysis training for the individual learner: An examination of individual learner differences and training content and procedures. Doctor of Philosophy, Monash, Victoria, Australia.
- Medical errors and patient safety in Massachusetts: What is the role of the commonwealth? Massachusetts Health Policy Forum; 2000.
- Mekhjian H, Bentley T, Ahmad A, Marsh G. (2004) Development of a Web-based event reporting system in an academic environment. *JAMIA*. 2004;11(1):11–8
- Meloche J. and Mok M. (2004) Local Perspectives on the Nature of Small and Medium Size Enterprises with specific reference to what differentiates them from large enterprises. *International Society for the Scientific Study of Subjectivity*, Athens Georgia, USA.
- Meloche, J. (1999) *Q-methodology as a Research Methodology for Human Computer Interaction. OzCHI’99 Interfaces for the Global Community.* Charles Sturt University, Wagga Wagga.
- Meloche, J. (2003). The Application of Activity Theory to Investigate Information Seeking: Why is Information Seeking an activity? In H. Hasan, I. Verenikina & E. Gould (Eds) *Information Systems and Activity Theory: Volume 3 Expanding the Horizon.* (pp233 - 242). University of Wollongong Press, Australia.
- Merholz, P, (1996), *User-Centered Information Design*, www.peterme.com
- Meyer, Eric K. (1997) *Designing Info graphics: Theory, Creative Techniques, and Practical Solutions.* Hayden Books. 1997
- Mica R. Endsley, Betty Bolté, Debra G. Jones (2003), *Designing for Situation Awareness: An Approach to User-centered Design*, Taylor & Francis Group, London
- Mijksenaar, Paul. (1997) *Visual Function: An Introduction to Information Design.* Princeton Achitectura Press. 1997
- Miles, M. B., Huberman, A. M., (1984) *Qualitative data analysis: a sourcebook of new methods*, Beverly Hills : Sage Publications

- Nardi, B. (1996). Activity Theory and human-computer interaction. In B. A. Nardi, (Ed) Context and Consciousness – Activity Theory and Human-Computer Interaction. (pp 7 – 15). Cambridge, Massachusetts: The MIT Press.
- Nardi, B. A., & O'Day, L. (1999). Information ecologies: Using technology with heart. Cambridge, MA: MIT Press.
- Nardi, B., Ed. (1996) Context and Consciousness: Activity Theory and Human-Computer Interaction. Cambridge, MA, MIT Press, 1996
- Nardi, Bonnie A, Ed. (1995) Context and Consciousness: Activity Theory and Human-Computer Interaction. AP Professional. 1995
- National Health Information Management Advisory Council (Australia). (2001). Health online: a health information action plan for Australia (2nd ed.). Canberra: Dept. of Health and Aged Care.
- Newhouse, P. (1992) 'Medical care costs: how much welfare loss?', Journal of Economic Perspectives, 6(3), pp. 3–21.
- Newman, I. A., Parks, L. M., and Smith, P. A., (1997) Virtual hierarchies and virtual networks: some lessons from hypermedia usability research applied to the World Wide Web. Human-Computer Studies 47, pp. 67-95 (1997). Academic Press Limited
- Nielsen, Jacob. (1995) Multimedia and Hypertext: The Internet and Beyond. Academic Press. 1995
- Nielsen, Jacob. (1995) Usability Engineering. AP Professional. 1995
- Norman, Donald. (1998) The Psychology of Everyday Things. HarperCollins, 1988
- Norman, Donald. (1993) Things That Make Us Smart. Addison Wesley, 1993
- Norman, Donald. (1992) Turn Signals Are the Facial Expressions of Automobiles. Addison Wesley. 1992
- Okamoto, T., Matsui, T., Inoue, H., & Cristea, A. (2000). A distance-education self-learning support system based on a VOD server. In Kinshuk & C. Jesshope & T. Okamoto (Eds.), International Workshop on Advanced Learning Technologies (IWALT 2000): Advanced Learning Technology: Design and Development Issues, (pp. 71-72) Palmerston North, New Zealand: IEEE Computer Society.
- Pappo, H. A. (2001). Simulations for Web-based training. In B. H. Khan (Ed), Web-based Training (pp. 225-228). New Jersey: Educational Technology Publications.
- Parsaye, K., and Chignell, M. (1993) Intelligent Database Tools and Applications: Hyperinformation Access, Data Quality, Visualization, Automatic Discovery. John Wiley and Sons. 1993
- Peal, D., & Wilson, B. (2001). Activity Theory and Web-based training. In B. H. Khan (Ed), Web-based Training (pp. 147-153). New Jersey: Educational Technology Publications.
- Personal communication (2001). Interact job plus: Case manager. In conversation with Dr McKay. Melbourne, Australia.
- Prail, A. (1992) Why usability engineering is not an option. Proceedings of the Third Conference on Quality in Documentation, Waterloo, Ontario. 1992
- Pronovost PJ, Nolan T, Zeger S, Miller M, Rubin H. (2004) How can clinicians measure safety and quality in acute care? Lancet. 2004;363(9414):1061–7.
- Pronovost PJ, Weast B, Schwartz M, et al. (2003) Medication Reconciliation: a practical tool to reduce the risk for medication errors. J Crit Care. 2003;18(4):2001–205.
- Quality Interagency Coordination Task Force to the President. Doing what counts for patient safety: Federal actions to reduce medical errors and their impact.

- Washington, DC: 2000, pp 29–31.
- Reason J. (1990) *Human Error*. Cambridge, England: Cambridge University Press; 1990.
- Reason J. (2000) Human error: models and management. *BMJ*. 2000;320:768–70
- Reason J. (2000) *Managing the Risks of Organizational Accidents*. Burlington, VT: Ashgate Publishing Company; 2000.
- Reggia, J. A., & Tuhim, S. (1985). *Computer-Assisted Medical Decision Making*. New York: Springer Verlag.
- Regier, Terry. (1996) *The Semantic Potential: Spatial Language and Constrained Connectionism (Neural Network Modeling and Connectionism)*. MIT Press. 1996
- Ridell, Seija (2005) Mediating the Web as a Public Space. A Local Experiment in the Creation of Online Civic Genres. *Nordicom Review* 26(1): 31-48.
- Rosenberg, M. J. (2001). *E-Learning: Strategies for delivering knowledge in the digital age*. NY: McGraw-Hill.
- Rubin, Jeffrey. (1994) *Handbook of Usability Testing*. John Wiley & Sons, 1994
- Rubinshtein, S.L. (1957). *Existence and consciousness*. Moscow: Academy of Pedagogical Science.
- Sackett DL, Rosenberg WM, Gray JAM, et al. (1996) Evidence based medicine: what it is and what it isn't *BMJ*. 1996;312 (7023):71-2
- Sano, Darrell. (1996) *Designing Large-scale Web Sites: A Visual Design Methodology*. John Wiley and Sons. 1996
- Savolainen, R & Anttiroiko, A (1999): *The Communicative Potentials and Problems of Teledemocracy*. Publication series 6/1999. University of Tampere. Department of Local Government Studies, Tampere.
- Scanlon, Spool, Snyder, and DeAngelo. (1997) *Web Site Usability: A Designer's Guide*. User Interface Engineering. 1997
- Sears, A. (1996) Visualizing efficiency: A technique to help designers judge interface efficiency. *CHI '96 Conference Companion*. Pp.311-312
- Sears, A., Jacko, J.A., & Borella, M.S. (1997) Internet Delay Effects: How Users Perceive Quality, Organization, and Ease of Use of Information. *Proceedings of CHI '97*, 2, 353-354. 1997
- Section 508. (2001). *Workforce Investment Act of 1998, Electronic and Information Technology*.
- Sell, D.K. & Brown, S.R. (1984). Q-methodology as a bridge between qualitative and quantitative research: Application to the analysis of attitude change in foreign study program participants. In J.L. Vacca & H.A. Johnson (Eds.), *Qualitative research in education* (pp. 79-87). Kent, OH: Bureau of Educational Research and Service, Kent State University.
- Shchedrovitskii, G. P. (1995). *Izbrannye trudy [Selected works]*. Moscow: Shkola kul'turnoi politiki.
- Shedroff, N (2001), *Temporal GIS: Advanced Functions for Field-based Applications*, www.nathan.com
- Shneiderman, Ben, Byrd, Don, and Croft, Bruce W. (1997) Clarifying Search: A User-Interface Framework for Text Searches. *D-Lib Magazine*. January, 1997
- Shneiderman, Ben. (1997) *Designing the User Interface: Strategies for Effective Human-Computer Interactions*. Addison Wesley Longman. 1997
- Soderston, C., and Kleid, N. (1997) Concept mapping: a job-performance aid for hypertext developers. *SIGDOC 1997, Conference Proceedings*
- Solmon, L. C. (1996) *Technology, Corporate Training, and Education*. Milken Institute

- Monograph Series.
- Stanhope N, Crowley-Murphy M, Vincent C, O'Connor A, Taylor-Adams S. (1995) An evaluation of adverse incident reporting. *J Eval Clin Pract.* 1999;5:5–12.
- Stephanidis, C. Akoumianakis, Antona, M., Bannon, L., (2001), *User Interfaces for All: concepts, methods, and tools*, Lawrence Erlbaum Associates
- Stephenson, W. (1987). Q-methodology: Interbehavioral and quantum theoretical connections in clinical psychology. In D.H. Ruben & D.J. Delprato (Eds.), *New ideas in therapy* (pp. 95-106). Westport, CT: Greenwood.
- Stephenson, W. (1988). Quantum theory of subjectivity. *Integrative Psychiatry*, 6, 180-187.
- Stephenson, W. (1990). Fifty years of exclusionary psychometrics: I-II. *Operant Subjectivity*, 13, 105-120, 141-162.
- Stephenson, W. (1990). My self in 1980: A study of culture. *Operant Subjectivity*, 14, 1-19.
- Stephenson, W. (1990). Fifty years of exclusionary psychometrics: I. Q technique. *Operant Subjectivity*, 13, 105-120.
- Stephenson, W. (1990). Fifty years of exclusionary psychometrics: II. Developments. *Operant Subjectivity*, 13, 141-162.
- Stephenson, W. (1991). *Ulysses_ and _Finnegans Wake_*: A Q-methodological look at profundity (I-II). *Operant Subjectivity*, 14, 89-105 and forthcoming.
- Stricklin, M. (1990), *Factor analysis programs for Q-technique*, Lincoln, NE: 3234 South 17th Street, Lincoln, NE 68502.
- Svensson, L. (1994). Theoretical foundations of phenomenography. In R. Ballantyne, & C. Bruce, (Eds.). *Phenomenography: Philosophy and Practice*. (pp. 9 – 20). Brisbane: Queensland University of Technology.
- The Sentinel Event Policy. Specific Research Needs and Questions. 00 Sep 11; JCAHO, 2000.
- Theng, Y. L., Marsden, G., (1998), *Authoring tools: Towards continuous usability testing of web documents* (1998), 1st International Workshop on Hypermedia Development
- Tsagarousianou, R (1999): *Electronic democracy: Rhetoric and Reality*. Communications 24.
- Tudor, L. G., Muller, M.J., Dayton, T, and Root, R.W. (1993) A participatory design technique for high-level task analysis, critique, and redesign: the CARD method. *Proceedings of the Human Factors and Ergonomics Society 37th Annual Meeting*, Santa Monica, Ca:1993
- Tufte, Edward R. (1990) *Envisioning Information*. Graphics Press. 1990
- Tufte, Edward R. (1983) *The Visual Display of Information*. Graphics Press. 1983
- Vanderheiden, G. C. (1990). Thirty-something (million): Should they be exceptions?
- Verenikina, I. & Gould, E. (1998). Cultural-historical psychology and Activity Theory. In H. Hasan, E. Gould, and P. Hyland, (Eds) *Information Systems and Activity Theory: Tools in Context*. (pp. 7 – 18). Wollongong, University of Wollongong Press.
- Verenikina, I. & Gould, E. (1998). Cultural-historical psychology and Activity Theory. In H. Hasan, E. Gould, and P. Hyland, (Eds) *Information Systems and Activity Theory: Tools in Context*. (pp. 7 – 18). Wollongong, University of Wollongong Press.
- Verenikina, I. (2002) *Activity Theory: an Overview*. Paper presented at the 7th Workshop on Activity Theory and Information Systems, University of Wollongong, Australia.
- Villanova, M.O., Gensel, J., Martin, H (2001), *Stratification of the Information Space in Web-based Information Systems*, the 10th European Conference on Information, 2002
- Vincent C. (2003) Understanding and responding to adverse events. *N Engl J Med*.

- 2003;348(11):1051–6
- Vygotsky, L. S. (1979). The genesis of higher mental functions. . In J. V. Wertsch, (Ed) *The Concept of Activity in Soviet Psychology*. (pp. 144 - 188). New York: Sharpe Inc.
- Wearing, M. (1998). *Working in Community Services*. NSW, Australia: Allen & Unwin.
- Weinman, Lynda. (1996) *Designing Web Graphics 2*. New Riders. 1996
- Wertsch, J. V. (1979). The concept of activity in soviet psychology: an introduction. In J. V. Wertsch, (Ed) *The Concept of Activity in Soviet Psychology*. (pp. 3-36). New York: Sharpe Inc.
- Wolfensberger, W. (1972). *Normalisation: The principle of normalisation in human service*. Toronto: National Institute of Mental Retardation.
- Wu AW, Pronovost P, Morlock L. (2002) ICU incident reporting systems. *J Crit Care*. 2002;17(2):86–94.
- Yates, B. L. (1999) *Modeling Strategies for Prosocial Television: A Review*. Paper presented to the Open Paper Competition. AEJMC Southeast Colloquium. Lexington, Kentucky March 4-6.

APPENDIX A: 47 STATEMENTS IN SERVICES VIEW

No.	Statement
1	a 1 Stop Shop for clinicians and consumers of WBIS services
2	a site to portray “ICU and it’s happenings” to relatives
3	ability to transfer patient data
4	access to bigger centres’ resources i.e. Specialists
5	advertise ICU from other promotional material
6	advocate for rural areas and in representing them
7	be a source of realistic information
8	build a “knowledge” base of information
9	coordinate research activities
10	coordinate state wide orientation education
11	facilitate efficiency
12	feedback on processes and equipment
13	have a broader range of information
14	have a evidence based review of the usefulness of equipment tools etc
15	improve information access for relatives
16	it should provide services for critical care patients as well as ICU
17	make “casual in the head” tacit procedures more formal/written for casual or occasion staff
18	promote ICU to nurses
19	promote standards for Evidence Based Practice
20	promote synergy amongst ICU clinicians
21	provide more access to the resources of the city based hospitals
22	provide advise for best alternatives
23	provide broader based services for rural units
24	provide continuing education programs
25	provide evidence-based practice guidelines which standardize care
26	provide information for nursing students
27	provide information on current practice to rural areas
28	provide learning resources for staff/clinicians
29	raise the level of understanding about ICU WBIS for the relatives of patients
30	review and revise protocols
31	review common state wide “go bads”
32	set goals and targets for clinical nurse specialist
33	should coordinate courses, conference and nurse education
34	should increase its rural focus
35	state wide courses for new staffs
36	store Q&As and be a database for ICU connect
37	support the development of a research culture
38	to augment communication between clinician and consumer, <u>not</u> replace it
39	to facilitate transfer of patients between ICUs
40	to help relatives to develop realistic expectations about the outcomes
41	to provide relatives with supportive information for their experience
42	to provide the breath of information needed by all ICU clinicians
43	Venue for a regional group network for regional events / news etc...
44	venue for critical and positive feedback
45	venue for nurses for information about ICU work and conditions
46	venue for practice guidelines
47	have services for multi-cultural patients – sources of information available

APPENDIX B: 45 STATEMENTS IN FUNCTION VIEW

No.	Statement
1	a service that is up-to-dated at least weekly
2	a service that is up-to-dated daily
3	Access to patient records
4	advertise courses that are happening
5	be a source / body that provides minimum standards
6	be able to find results based on specific conditions - ie. Burns
7	compare apache 2 scores (ie. Ventilations
8	coordinate scholarship funding and information about funding for scholarships
9	designed to capture “user” data
10	establish / coordinate network for nurse manager and support groups
11	facilitate staffing
12	facilitate Tele-health
13	focus on needs of regional centers
14	have a search engine with open procedures (ie. Choice)
15	help eliminate duplication of effort
16	Identity core components for protocols
17	information about What’s On Where – such as conference meeting (Local)
18	information about working opportunities
19	information on Medic-Care for patients family
20	link with clinical excellence commission
21	live courses
22	make available beds known
23	maximize the use of the available resources
24	not be used for patient management
25	provide more access to publications
26	provide a one search option
27	provide access to other area’s policies and procedures
28	provide access to peer support groups
29	provide data on outcomes
30	provide easy access for all information on staffing data
31	provide information for new nurses about working in ICUs
32	provide information on “events” in ICUs across Australia
33	provide national and international job swap site
34	provide stock standard guidelines
35	raise awareness overseas about available work in Australian ICU
36	ready access to live video conferencing
37	share discussion boards on site with history
38	show facilities available in each hospital
39	support for research applications ie. Ethics approval
40	support request for policies
41	to be a memory aid with reference information available
42	use it to assist in unit business, staff, & equipment acquisition
43	use the site to inform patient who are being transferred – about the place where they are going: complete phone numbers for patients & visiting hours etc...)
44	venue for flow charts samples
45	video capture of seminars

APPENDIX C: 26 STATEMENTS IN DESIGN VIEW

No.	Statement
1	be able to manage what they have
2	be an evolving site that is responsive to the demands of the users
3	be sophisticated in the service provision it provides
4	be user friendly
5	designed for advanced users
6	have a deceptively simple design
7	have a means to raise its own profile and interest
8	have links to relevant information that they do not wish to manage
9	have sections that are completely current and others that are stable
10	information about changes in the service for the end-users - a what's NEW Section
11	links with organizations ie. Cancer care, Women's health
12	links with other ICU sites around the worlds
13	priorities goals and management within resources
14	provide "help" information
15	provide a standard (view) across site
16	provide available of information for like minded ICUs - Level 4, Staffing information HDU etc
17	provide lay descriptions and images of ICU services
18	provide protocol folders
19	review terms of reference
20	sections on services for relatives -financial services, emotional counselling etc...
21	to be an online library
22	to provide all the background information
23	to work in common with Tele-health
24	use issue from "go bads" as basis for education
25	use it to increase the "Ready" access to other services
26	use the site to improve networking with other services

APPENDIX D: 25 STATEMENTS IN OUTPUT VIEW

No.	Statement
1	advocate for minimal standards and conditions
2	as an advocate for education, access to information service
3	be a research resource - to support research
4	bring standards up through sharing information
5	decrease distress of relatives
6	decrease patient disability at discharge
7	decrease the length of stay for ICU patients
8	encourage clinicians to do research
9	focus on time savings
10	improve quality of patients care
11	improve quality of service for the patients
12	improve relations within Area Health Service
13	improve the community awareness of ICUs
14	improve the level of care across NSW Intensive Care Units
15	increase communication amongst Area Health Units
16	increase to a national services connecting ICUs as a network across Australia
17	information sheets for various conditions
18	print out details of procedures / visitor hours / locations / parking
19	provide educational information to schools for students
20	provide image-based answers for relatives' questions
21	provide more fluid exchange of patients for need levels ie. Taking patients back to "home" region
22	provide project information for schools students
23	provide text-based answers to relatives' questions
24	raise the profile of WBIS
25	to provide unbiased information