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# A multi-method approach to assessing Health Information Systems end users' training needs

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# A multi-method approach to assessing Health Information Systems end users' training needs

## **Abstract**

In order to guarantee acceptance and effective usage of health information system (HIS), its end users must be appropriately trained. However many existing training programs did not adequately satisfy its user's needs and the training objectives. This is because they did not envisage the problems that users might encounter when performing specific tasks. Therefore it is essential for developing a good training program to precisely assess end users' training needs. However, applying traditional approaches for Training Needs Assessment (TNA) such as interviews or surveys alone is insufficient. These methods are limited in their capacity to understand the cognitive processes a learner follows in learning a new computer program. Usability testing, with its ability to gather rich data about human computer interaction, overcomes the deficiencies of traditional approaches. Therefore, this paper proposes a multi-method approach, which combines usability testing method, interviews and questionnaire surveys to assess HIS end users training needs. This innovative method is able to precisely reveal the training needs for different levels of HIS users. A case study, which applied this method on assessing the training needs for users of a nursing information system, demonstrates its feasibility.

## **Keywords**

Health Information Systems, end users, training needs assessment, usability testing

## **Disciplines**

Physical Sciences and Mathematics

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# A Multi-method Approach to Assessing Health Information Systems' End Users Training Needs

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## Abstract

*In order to guarantee acceptance and effective usage of health information system (HIS), its end users must be appropriately trained. However many existing training programs did not adequately satisfy its user's needs and the training objectives. This is because they did not envisage the problems that users might encounter when performing specific tasks. Therefore it is essential for developing a good training program to precisely assess end users' training needs. However, applying traditional approaches for Training Needs Assessment (TNA) such as interviews or surveys alone is insufficient. These methods are limited in their capacity to understand the cognitive processes a learner follows in learning a new computer program. Usability testing, with its ability to gather rich data about human computer interaction, overcomes the deficiencies of traditional approaches. Therefore, this paper proposes a multi-method approach, which combines usability testing method, interviews and questionnaire surveys to assess HIS end users training needs. This innovative method is able to precisely reveal the training needs for different levels of HIS users. A case study, which applied this method on assessing the training needs for users of a nursing information system, demonstrates its feasibility.*

## Keywords:

Health information systems, end users, training needs assessment, usability testing

## Introduction

A well designed Health Information System (HIS) could not only save staff time in entering and retrieving client data, but also increase accuracy and completeness of such data. However, the adoption of HIS is not common in current Australian healthcare sector [1, 2]. One of the reasons is that shifting from the traditional paper-based documentation to electronic documentation requires the users of a HIS to have basic computer skills, familiarity with the HIS, and change their work practice of information management [3]. Managers are more

and more aware that end user training is an essential strategy to achieve the above goals [4, 5]. As failure to do so, staff will feel frustrated and threatened by the new system [6]. The worst case is that they would even reject the new system or quit the job. This will lead to loss of organizational resources like skilled healthcare workers. Therefore, significant investment should be made into end user training or support in order to ensure that the introduced HIS will be accepted and used by the healthcare workers.

An effective end user training program should have the capacity to deliver timely, effective, efficient and enjoyable learning experience to the end users [4, 7]. In other words, it plays the role of closing the gap between complexity of a HIS and users' cognitive capacity to master it. However, the majority of existing training programs are not as effective as they promise [8, 9]. The most common problems of these training programs are that they are ill-directed and inadequately focused [10]. For example, some training programs provide healthcare professionals with huge amount of unnecessary information as they have been developed as a "one size fits all" solution [8, 9]. This could lead to information overload and thus reduce the effect of training. The fundamental flaw is that training needs analysis, [give your definition here], is not properly conducted [11] these programs. Therefore, the training program designer could not accurately envisage the problems end users may encounter when performing specific tasks using the HIS.

In the research field of end user training, the importance of TNA for the development of effective training programs has been increasingly recognized. For example, Nelson *et al.* [12] proposed that TNA sets the scene for training program development. They suggested that scientifically conducted TNA are needed to guide improvements in training [12, 13]. In addition, Boydell and Leary [14] emphasized the importance of building an effective training program by clearly and precisely analyzing and identifying the learning needs that the training program should address. Thorough TNA are required for improving end users' learning outcomes and enable them to familiarize with a new HIS easily and efficiently.

In order to conduct a thorough and accurate TNA, the method of analysis should be scientifically designed, which is the topic to be discussed in this paper. Firstly this paper will critique the traditional methods for TNA, afterwards it will propose a novel method for TNA, followed by a discussion about how to integrate the traditional methods with the new approach.

## **A Need for New Way of Approach in Training Needs Assessment**

The primary purpose of the TNA is to identify what knowledge and skills end users should have to enable them to effectively interact with a HIS in health care setting. The results of the assessment are foundation for the development of effective training strategies and programs.

Through identifying the problems a user may encounter in using a new Information System (IS), the gap between the necessary and the actual knowledge and skills that a user has for effectively interacting with this IS can be inferred [15]. In other words, experimental Human Computer Interaction (HCI) data such as users' usage problems, mistakes or inefficient behaviors, are effective indicators of what they do not know [16], which, in turn, suggests what they need to know. However, traditional methods lack their ability to collect such detailed information about the cognitive process an end user follows in their interaction with a new IS.

The common methods in assessing computer users' training needs are self-reported questionnaire surveys and interviews with end-users [12, 13, 16, 17]. Questionnaire survey has a number of distinct advantages, including ease of distributing questionnaires to a large number of users and automated analysis of the results with statistical calculation packages. The typical process of quantitative assessment consists of managers setting the required level of skills for a particular task, then a staff was requested to rate his/her skill level against this standard [14]. Then a comparison between these two sets of data could suggest the skill gap for this staff to conduct the particular task that requires this level of skill. However, following this routine could be a tedious process that requires huge amount of resources. Besides, data gathered from such assessment could only provide pre-defined aspects of difficulties the designers or skilled external consultants are already aware of [17]. There is often no way of identifying other barriers that a user may experience. Also such method could not detect the challenges or mistakes that a user may face or make in using a particular HIS.

Similar problems underlie other commonly used methods like interviews or focus group discussion, where end users are asked to reflect on their prior experience with an IS. Such qualitative assessments provide opportunities for users to express their perceived difficulties in using an IS. However, such conventional methods are not adequate in assessing the learning needs of users either, particularly, for users with different level of experience with the system. For example, novice users may not have sufficient knowledge about this new IS to enable them to realize the problems they may encounter in using this system [18, 19]. Even for experienced users, they may not be

able to clearly recall their problems [20]. Verbalizing the process that a person follows to complete a task is also problematic, as it involves expression of sequences of psychomotor movement (i.e. using computer) [21]. Besides, users' perceptions of the same problem may be different because of variances in users' educational or technical levels [22].

Thus the use of surveys or interviews alone may not reveal how end users actually use a particular HIS to perform a particular task, because these methods lack the ability to collect data about the process that a user follows in interacting with a particular HIS [22, 23]. Therefore, data gathered from these methods are not adequate to identify end users' training needs. In other words, basing the selection of training strategy on analyzing such incomplete data may lead to ineffective programs because there is a significant gap between what is perceived and what are actual problems that a user may encounter. Therefore, traditional methods in TNA need to be complemented by more effective new approaches. We propose that a careful observation on how users encounter and react on problems in interacting with a particular HIS is helpful. The next section will discuss our proposed method. Afterwards, we will suggest strategies for dealing with the identified problems.

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## **Cognitive Usability Testing Method**

There is a growing role for the cognitive and behavioral sciences, in health informatics, particularly as it pertains to human factors, and other areas such as information retrieval and educational research [23, 25]. From the perspective of informatics, cognitive science can provide a framework for the analysis and modeling of complex human performance in IS [25]. Theories and methods from the cognitive sciences can illuminate different facets in design and implementation of IS [23, 25]. They can also play an important role in understanding and enhancing human performance on a wide range of tasks. These tasks may include developing training programs to reduce errors or increase efficiency for healthcare [25].

Usability testing encompasses a range of methods for identifying how users actually interact with a complete software product. Empirical testing is a form of usability inspection that observes actual user interactions with an interface (Nelson, 1994). Due to the knowledge that many HISs are failing due to usability problems, organizations are starting to show interest in usability testing. Some preliminary studies have been performed testing clinical information systems. For example, Kushniruk [26] introduces a laboratory-based usability testing method to evaluate the effectiveness of HIS. According to Kushniruk [26], usability testing refers to "the evaluation of IS that involves testing of participants who are *representative* of the target user population, as they perform *representative* tasks using an IS". During the experiment, all user computer interactions are recorded (e.g. video recordings made of all computer screens or user activities and actions). In addition, this technique generally includes the collection of "think aloud" re-

ports, involving the recording of users as they verbalize their thoughts while performing particular tasks [26].

In brief, this approach focuses on classifying users' cognitive skills and then identifying the problems they encountered during their interaction with the IS. With its ability to gather rich experimental HCI data, this method can provide excellent opportunity to complement the weaknesses of interview or questionnaire for assessing training needs. Although this method was originally designed for testing the usability of an IS, it is also applicable in identifying training needs. In the early 90s, Simpson proposed a framework to describe how testing methods could be used in the planning phase of designing online documents [27]. A recent case study has used novice users' interaction with a search engine to reveal the knowledge and skills that these novice users need [19].

[Yiyu, you may need to cite some of the findings reported in the paper that is going to appear in *Methods of Information in Medicine*. Always try to cite your own work to increase your own citation rate as it is an indicator of the importance of your work.] Also this section is weak and need to be enhanced.

## **A Multi-Method Approach for Training Needs Assessment**

After appreciating the distinguished feature of cognitive usability testing methods in capturing the process data on how an end user interact with a particular IS, we propose that a multi-method approach, which combines usability testing with conventional methods like interview or questionnaires, can precisely and thoroughly understand the process the end users follow in processing information in a particularly HIS. It can also suggest what knowledge and skills that these users need to learn for using this HIS.

Our proposed approach is to:

- Observe how novice, intermediate and veteran users use a HIS to complete representative tasks.
- Before or after the conducting of cognitive usability testing, interview or survey these users to gather further information about their knowledge and skills that is relevant to a particular HIS that they are trained to use
- Extract patterns of strategies used by the novice, intermediate and veteran users to complete various tasks with this HIS.
- Identifying the key knowledge gaps (learning needs) of different levels of learners based on the different interaction patterns that they displayed when using the HIS.

[There is no connection words between what has been written and what follows from here. Please add up some sentences here to establish the connections between the paragraphs.]

## **Naturalist Observation: Usability Testing Approach**

.[The meaning of this sentence has been repeated many times in this paper. Too repetitive, suggest to be deleted]. [You have introduced a new concept, naturalist observation here, you need to justify what it is. Why are you using this method, what are the purpose of this approach. This type of usability method can be performed using the observation technique.

### ***Participants***

Participants for the experiment are potential or actual end users. Based on their experiences with the HIS (e.g. measured by the time and frequency of their usage of the system), they can be categorized as novice, intermediate, and experienced users. The recommended sample size varies between usability experts. As Nielsen and Mack suggested [28], the usability testing can be carried out using only five participants, and the results will demonstrate 85% of the usability problems. Kushniruk et al. [22] suggests that up to 80% of usage problems can be detected from 8 to 12 participants evaluating it.

### ***Outcome measurement***

Kushniruk et al. [22] suggest that the usability testing should involve setting up recording equipment that would allow for continuous recording of computer screens during the process of human-computer interaction. To achieve this goal, Camtasia Studio, a screen record software, can be used to record each participant's mouse movement and keyboard strokes. In addition, participants' "think aloud" reports can be audio-taped. The data analyzed for usability analysis include both the video and the audio file.

### ***Data analysis technique***

A coding scheme developed by Kushniruk's could be used for analysing human computer interaction data [23, 26]. [What are the following sections try to explain, you need one or two sentences here to justify the reason why the dot points below is presented here]

- Navigation: used when the participant comments that he/her is navigating, or indicates that he/she is incapable of moving through the interface to find the relevant information or accomplish what her/her is supposed to do.
- Understanding: used when the participant comments on understanding the meaning of labels, instructions or errors.
- Ease of use: used when the participant comments on the level of "ease of use" of the system (from easy to hard) or any confusion or frustration that s/he experienced.

The above coding scheme is followed throughout the process to analyze the audio and video files captured in this experiment.

## **Interviews or Focus Group Discussion**

Focus group discussion is another common data collection technique for needs assessment [29]. It is a carefully planned and moderated informal discussion where one person's ideas

bounce off another's. This leads to a chain reaction of informative dialogue [30]. Its purpose is to address a specific topic, in depth, in a comfortable environment to elicit a wide range of opinions, attitudes, feelings or perceptions from a group of individuals who share some common experience relative to the issue under study [31].

In order to investigate how HIS end users learn to use the system and what their usage problems are, a formative focus group discussion among experienced users is part of the process for TNA for HIS. It is an efficient form of qualitative information gathering that could enable us to understand how and why the participants react to an experience in a particular way. In addition, it provides us with an opportunity to interact with the authentic end users. This interaction can give an "understanding of participants' experiences and beliefs" (Morgan et.al., 1993).

### Questionnaires

Questionnaire is utilized as an added method within the triangulation methodology, adding to the verification and validity of results. As Rubin suggests, questionnaires or surveys are an important component of usability testing (1994). Their advantage is that feedback is gathered from the "point of view of the user", and when a reliable questionnaire is used, the feedback can be considered a trustworthy sample of the population (Kirakowski, 2003).

During the laboratory-based usability testing, as suggested by Kushniruk and Patel, a background questionnaire is given [22]. This questionnaire can be used to obtain demographic information about the participants and to assess their level of computer literacy. The questionnaires can include items to assess levels of participants' professional practice, or experience with HIS [32]. This kind of information is important for understanding their behavior and performance during the test, as well as their capacity for adopting the nursing information systems.

### A Case Study

In this section of the paper we provide a case study based on our prior experiences on assessing the training needs for a nursing information system (NIS) end users, applying this multi-method approach. The NIS described in the example was the Care Planning Assessment Tool (CPAT), owned by the Hammond Care Group (an aged care and dementia services). The CPAT was introduced to help the nursing profession carry out systematic and comprehensive assessments for the residents. The "Clients" menu enables users to perform the most crucial functions of CPAT, i.e. doing data entry and assessments for clients (i.e. residents), see Fig 1 for a screen shot of the assessments screen in the "Client" menu. In the assessments screen, users can enter details about the assessment of a resident, and generate various reports which facilitate the management process of residential care.

This particular study aimed to assess the training needs for different levels of CPAT users, so as to develop the "right" training materials for the "right" groups of users:

- User Manual: this is usually for novice or first time users and is supposed to be very detailed.
- Online Help: this type of training is traditionally for the relatively experienced users that require help while using the product, it usually contains information on how to conduct a task.

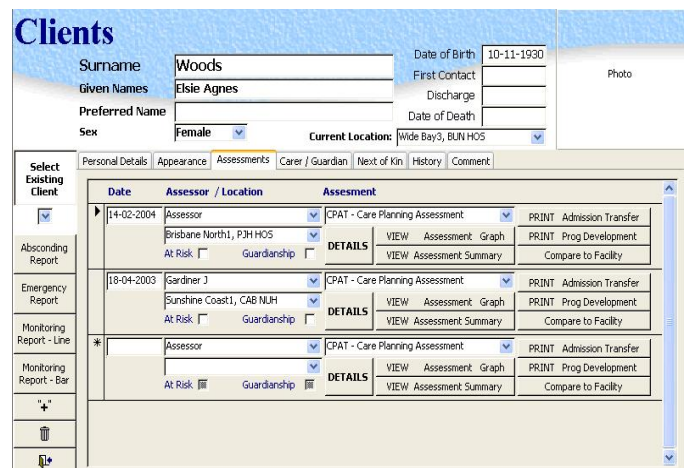


Fig 1. The assessments screen of the CPAT

### Procedure

Based on users' knowledge and experience with the CPAT, they are classified into two categories: novice and experienced users. The process of the training needs assessment in this case study was to:

- Conduct a laboratory-based usability testing to observe how novice CPAT users to complete a series of tasks by using the CPAT;
- Interview a cohort of experienced CPAT users regarding the problems during their usage of the CPAT and their preferences of online help;
- Analyze two sets of data to identify their knowledge gaps;
- Integrate the findings into the design of training materials.

### Usability testing experiment

The participants for the experiment were recruited from third-year nursing undergraduate students from University of Wollongong. All the participants majored in geriatrics. They were the potential users of the CPAT but had no previous usage experience with the software.

The participants were asked to perform the following three representative tasks supported by the software:

- Entering data for a resident;

- Doing an assessment for a resident;
- Generating a change monitoring report.

The participants were encouraged to “think aloud” or verbalize their thoughts if they were uncertain about how to conduct the above tasks with the software.

### **Findings**

There were eight video and audio data collected from the experiment. Analyzing the triangulation of audio and video data identifies a series of problems that novice CPAT users encountered in this training session. An excerpt of a coded section of such triangulation is given below to show how users’ interaction with the software was coded.

20:40 – user finished scoring “communication problems” and intended to answer the next group of assessment questions.

“How should I go to the next group of questions?”

*Navigation - having problems navigating between assessment criteria.*

By coding all of the participants’ usage problems, three groups of problems users encountered were identified:

- Basic computer skills, e.g., users do not recognize the drop-down icon in the selection fields.
- Knowledge about the software, e.g., users do not know where to score questions of assessment criteria
- Domain knowledge about nursing documentation, e.g., users do not understand some assessment questions

### **Focus Group Discussion**

A focus group discussion involved nine veteran users from Hammond Care Group was conducted to explore their learning and work experience with CPAT. The participants were the actual users of the CPAT. They were staff in Hammond Care Group. Nine staff attended this meeting. Their roles included facility manager, trainer, consultant and dementia care worker. Majority of them have used the CPAT for more than 3 years.

The one-hour focus group discussion was semi-structured. Participants were prompted to provide their thoughts with regard to the following topics:

- How did you learn to use the CPAT?
- Could you recall any problems encountered when using the CPAT?
- What kind of help do you expect when you encounter problems?

The last part was followed by a demonstration of various templates of online help. The features of the templates were table of contents, search function, task-oriented and function-oriented structure, FAQ (Frequent Asked Questions), and multimedia means of presenting help information.

### **Findings**

The normal method of learning the CPAT was labor-intensive one-by-one coaching, followed by self-directed practice. If the user encountered any problems, they could either approach the trainer or try to solve the problem by themselves. A list of usage problems was collected in the discussion. It ranged from system-related problems to computer-related problems. In regard with the structure of an online help, FAQ seemed more favorable than the “search function”. Besides, the accuracy of language used in the training materials was emphasized. With respect to the video clip as a means to demonstrate operational information, the majority of the participants like the feature of video clip to show how to use a particular widget or complete certain tasks using the software.

### **Integrate into the design of training materials**

The results from the TNA certainly give significant indications about what contents and features should provide to both novice and experienced users to enable them more efficiently using the software. Both the User Manual and Online Help should emphasize the identified usage problems.

### **Conclusion**

In this paper we have firstly presented the strengths and weakness of a number of traditional methods (interviews and surveys) which have been applied to conduct computer users’ TNA. After appreciate the capacity of cognitive usability testing (i.e. capture the cognitive process of a HIS user in his/her interaction with the system), we argue that using the conventional methods alone have limitations and that they could benefit by complementing with a novel multi-method approach, which combines cognitive usability testing and the conventional methods. This proposed method has been described in details. In order to illustrate this proposed approach, description of a case study has provided, which involved assessing the training needs for users of a nursing information system.

### **Acknowledgement**

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