

Nursing Information Systems

Applying Usability Testing to Assess the Training Needs for Nursing Students

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Summary

Objective: In order to ensure the successful implementation of a nursing information system (NIS), nurses and nursing students must be adequately trained. In order to do this effectively, it is essential to understand their training needs. This study focuses on the training needs of nursing students in particular through the identification of the usage problems they encounter. Usability testing, which involves observing users' interaction with an NIS, overcomes the deficiencies of traditional approaches of training needs analysis such as interview and survey. The study applied usability test to assess training needs of nursing students to learn to use a specific NIS, the "Care Planning Assessment Tool" (CPAT).

Methods: An experiment in which novice CPAT users were expected to learn to use the software through task-based exploration was conducted. Eight nursing undergraduate students who had never used the software were recruited. Participants' interactions with the system were captured by screen capture software. Meanwhile, participants' "think aloud" verbal expression of their usage problems was audio-taped.

Results: A coding scheme was used in analysing the captured audio and video data. Ten common usage problems were identified. From these problems, three areas of knowledge gap that this cohort of novice users experienced were identified.

Conclusion: The training needs of nursing students learning to use an NIS was conceptualised in a model consisting of three types of knowledge, i.e. computer skills, knowledge about the NIS and knowledge about procedure of nursing documentation. The knowledge gap must be filled in order to ensure effective training.

Keywords

Training needs analysis, nursing students, nursing information systems, usability testing

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1. Introduction

Despite the benefits of nursing information systems (NIS), they are not commonly used by nurses in Australia. Ineffective end-user training is one of the major barriers to the adoption of NIS by the nursing profession [1]. Many training programs have simply not been tailored to the nurses' training needs specific to a particular information technology solution [2]. For example, some training programs provide nursing students with a great deal of unnecessary information. This can lead to information overload and can reduce the effect of training [3, 4]. In order to better understand nursing students' training needs for mastering an NIS, a careful training needs analysis (TNA) is required [5]. The primary purpose of the TNA is to identify what knowledge and skills nursing students should have to enable them to effectively interact with a particular NIS. The results of these findings are beneficial to the development of training strategies that target what users need to know.

Through identifying the problems a user encounters in mastering a new IS [6], the gap between the necessary and the actual knowledge or skill that a user has for effectively interacting with an information system (IS) can be inferred [7]. In other words, users' usage problems, mistakes or inefficient behaviours are good indicators of what they do not know, which, in turn, suggests what they need to know.

The common approaches in assessing computer users' training needs are interviews with end-users or questionnaire surveys [5, 6, 8, 9]. These methods enable users to express their perceived difficulties in using an IS. However, these conventional methods are not adequate in assessing the

needs of novice users who may not have sufficient knowledge of a new IS to identify their usage problems. Furthermore, these methods fail to capture the human cognitive processes in interacting with the IS [10]. To overcome the weakness of the conventional methods, Kushniruk introduces a laboratory-based usability testing method to evaluate the effectiveness of human-computer interaction (HCI), in particular, the cognitive needs of end-users in learning to use a new IS [10, 11]. By engaging a user to perform typical tasks, this approach gathers data about the actual process through which a user interacts with an IS. It focuses on classifying users' cognitive skills and then identifying the problems they encountered in their journey of mastery.

Although this method was originally designed for testing the usability of an IS, it is also applicable in training needs analysis. For example, in the early 90s, Simpson proposed a framework to describe how testing methods could be used in the planning phase of design for an online help system [12]. A recent case study has used novice users' interaction with a search engine to reveal the knowledge and skills that these novice users need [13]. However, usability testing methods have rarely been used to assess nursing students' training needs for learning a new NIS.

2. Objectives

This study adopts the usability testing approach suggested by Kushniruk [10, 11] to assess novice users' training needs in learning to use an NIS, known as the "Care Plan Assessment Tool" (CPAT). The objective of the study is to conceptualize these nursing

students' training needs for mastering this particular NIS. This is achieved through identifying the problems these novice users experience and the cognitive processes they follow to solve the problems.

3. Methodology

3.1 Design

A usability testing experiment was conducted in the computer laboratory of the Nursing School in the University of Wollongong (UOW) in which novice CPAT users were expected to learn the system through task-oriented exploration. The whole session lasted for fifty minutes.

3.2 Participants

Kushniruk suggests that up to 80% of usage problems with an IS can be detected through analysing the interaction of 8-12 participants with it [10]. Therefore, we recruited eight third-year nursing undergraduate students (six female, two male). All the participants majored in geriatrics and were aged from 22 to 57. They were the potential users of the CPAT software but had no previous usage experience with the software.

3.3 Procedure

At the start, an information sheet was handed to every participant to explain the purpose of the study, confidentiality safeguard procedures were explained and the participants were asked to sign a consent form. To enable the participants to carry out systematic and comprehensive assessments of residents in a long-term care facility, they were given an oral introduction about the software by its designer. This included the general purpose and concepts about how to record assessment results using the software.

After the orientation session, the participants were asked to perform the following three representative tasks supported by the software:

- **Entering data for a resident:** The resident's demographic information had to be entered. The participants were expected to enter the information recorded in a hard-copy CPAT assessment sheet into the system.
- **Doing an assessment for a resident:** The resident had to be assigned a score for each item of the assessment criteria.
- **Generating a change monitoring report:** A graph needed to be produced that indicated which assessment areas were showing improvement or deterioration (in comparison with the data that were already stored in the software).

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.

3.4 Outcome Measures

Kushniruk suggests 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 [10]. To achieve this goal, a piece of screen capture software called Camtasia Studio 2.1.2 (Copyright ©2005, TechSmith Corporation, 2405 Woodlake Drive Okemos, MI 48864-5910, USA) was used to record each participant's mouse movement and keyboard strokes. In addition, participants' "think aloud" reports were audio-taped. The data analysed for usability analysis included both the video file and the audio file.

4. Results

There were eight sets of video and audio data gathered from this experiment. The richness of the video and audio data required application of a systematic method for coding and analysis. The first step was to transcribe the "think aloud" audio reports into a Microsoft Word document, based on the protocol designed by Ericsson and Simon [14]. This information served as supporting evidence for coding the video records while the user was "thinking aloud".

Prior to analysing the video data, a coding scheme had to be refined for classifying specific user problems.

4.1 The Coding Scheme

The coding scheme was adopted from Kushniruk's coding protocol for analysing human-computer interaction data [10, 15]:

- **Navigation:** used when the participant comments that s/he is navigating, or indicates that s/he is incapable of moving through the interface to find the relevant information or what s/he 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 was followed throughout the process to analyse the audio and video files captured in this experiment.

4.2 The Usage Problems that Reflect Novice Users' Training Needs

Analysing 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.

- 00:00 – User starts entering the main menu of the CPAT and playing with the system.
"Where should I start?"
Ease of use – being confused over how to start up the system.
- 02:15 – User enters data into 'location' list box instead of selecting one from the drop-down list.
Understandability – not recognising the drop-down icon in the selection field.
- 02:16 – A message box pops up to inform the user to select a location from a list.
"What does it mean?" "What do I do?"

Table 1 A classification of the novice CPAT users' usage problems, and the knowledge and skill gaps indicated by these problems

Categories of novice users' usage problems	Knowledge gap	Knowledge description
1) Users do not recognize the drop-down icon in the selection fields	Basic computer skills	The ability to type, edit, browse, and select information, and so on
2) Users do not understand the language used in the message boxes		
3) Users do not recognize the scrolling bar in assessment form		
4) Users are confused how to start up the system	Knowledge about the software	Applying the functions of the CPAT to do tasks like data entry, assessment, and report generating
5) Users are uncertain about the format of 'date'		
6) Users do not know where to score questions of assessment criteria		
7) Users do not know how to navigate through assessment criteria		
8) Users do not know how to find out the unanswered questions		
9) Users do not know the workflow of conducting a resident assessment	Domain knowledge about nursing documentation	Concept of resident assessment, workflow of assessment, etc.
10) Users do not understand some assessment questions		

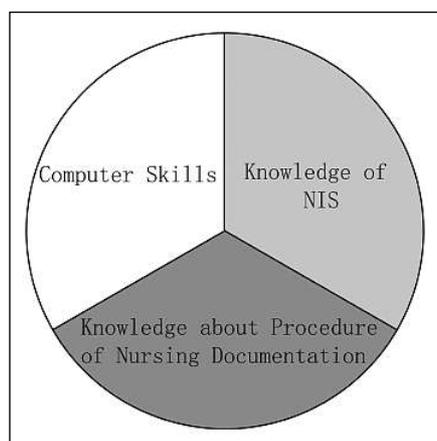


Fig 1 A conceptual model of nursing students' training needs in an NIS

Understandability – not understanding the language used in the message.

- 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, the most salient usage problems were summarised into ten categories (see Table 1). As mentioned above, the problems users encountered in the process of using the software provide first-hand information about the knowledge or skill gaps that prohibit them from effectively using the NIS, and hence the training needs are identified. The ten problems reflect the users' shortage of three types of knowledge (or skills). These are: basic computer skills, knowledge about the software and domain knowledge about nursing documentation itself (see Table 1).

5. Discussion

The results give certain indications about novice nursing students' training needs focusing a particular NIS (see Table 1). There

are three areas of knowledge that nursing students should possess to enable them to effectively utilize an NIS (see Fig. 1):

- computer skills,
- knowledge of the NIS, and
- knowledge about procedures of nursing documentation.

The following sections will explain each aspect of the knowledge gap.

5.1 Computer Skills

Coiera believes that there are deficits in both computer and information literacy among undergraduate medical student groups [16]. His observation appears to apply to the undergraduate nursing students who participated in this experiment. The difficulties encountered by the students in using the CPAT software indicate that their level of computer literacy is not adequate for interacting effectively with the software. For example, they were not familiar with some basic GUI (graphical user interface) icons such as scroll bars or dropdown lists, and they did not understand technical terms used in the system, such as form, field, and value. The different ways to use these tools should be demonstrated to the students. The content of the training needs to cover even such basic computer operation as the use of the mouse and keyboard. The results of our experiment suggest that in order to achieve a successful transformation from a paper-based nursing documentation system to an electronic one, computer training must be emphasised.

5.2 Knowledge about the NIS

Our observation suggests that in order for students to conceptualise how the software can be used for their purposes, that is, nursing documentation, it is necessary to provide an overview of the organisation of the functional components of the software at the start of the training session. The difficulties that some participants encountered in using this software were caused by a lack of knowledge about the process of recording the results of resident assessment using this

software because this involves grouping a series of individual commands together to complete a particular task. Without this knowledge, a user is unable to recover from usage errors or, in fact, to use the NIS at all [7]. Nursing students can acquire this kind of “know-how” knowledge through accepting “procedural” training [17], such as following step-by-step demonstrations, or task-oriented tutorials.

For example, one large-order task might be the above-mentioned resident assessment. This involves, among other things, entering data regarding the resident’s demographic information. Once students understand how the software can accomplish the ‘larger’ task of data entry, they can then make better use of the practice of the smaller tasks (covered in the demonstrations or task-oriented tutorials) – activities such as typing, copying, pasting, deleting, etc. – which they will need to master in order to accomplish the larger task.

5.3 Knowledge about Procedures of Nursing Documentation

In their “think aloud” expression, some participants mentioned that they were not familiar with the process of doing resident assessment. Hence it was not surprising that they were not able to record the results of assessment in the CPAT software. Their lack of the knowledge of procedure of assessment itself led to their inability to record the assessment tasks. Because of this issue, a few participants were quite confused about what they should do with the system and why. Questions like “tell me why I am doing this first”, “what would it be used for” were often heard in their initial stage of exploring the system. This was not caused by their lack of knowledge about the computer or the CPAT software, but a lack of knowledge of processing resident assessment.

This evidence reflects that nursing students need to understand the procedure of conducting nursing documentation before they begin to learn to use an NIS. It includes such knowledge as what should be documented at each process, what the next procedure is, and how to document. The train-

ing session must not only explain how to use the software, but must also explain the relevant conceptual knowledge, i.e. what the software is meant to achieve, how it is structured, its basic functions and the links between different software components.

6. Conclusion

This paper demonstrates the application, in a laboratory environment, of a usability testing method to assess the training needs of undergraduate nursing students in regard to a particular NIS. Whereas interviews or surveys, the conventional methods for identifying training needs, may fail to capture the cognitive process of a novice user of a particular software in his/her interaction with the system, the usability testing method discussed in this paper can overcome this difficulty. This method categorized the ten usage problems which were identified into three areas of knowledge gap and suggested relevant training strategies to address each of these.

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