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Developing a mobile application for recording learning experiences in nursing practice

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Abstract

Objective: In complex clinical on-the-job training a seamless and target-oriented incorporation is crucial to assure a good medical care. The reliable transmission of specific and relevant facts, besides education knowledge, is a key factor to ensure sustainable quality in care processes.
Materials and methods: We present the clinical field study *WITRA care*. A possible way to capture hidden clinical care knowledge with assistance of mobile devices will be described.
Results: Basic functions to collect learning experiences with mobile devices as well as a secure and confidential manner to support a reliable transmission procedure in the hospital network area are implemented. A user experience questionnaire and a semi-standardized interview illustrate first positive acceptance evaluations and time-saving effects.
Discussion and conclusion: With mobile devices, tacit knowledge gaps can be tapped in a clinical care unit. The study provided first insights and proved its feasibility in general. However, advanced problems and questions arose and will be considered in the future.

Keywords: Inpatient care study, knowledge transfer, mobile devices, tacit knowledge

Introduction

As part of the project *Witra Care* an application for mobile devices was developed that allows nurses to record their learning experiences in the clinical area. The project *Witra*

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Care is funded by the German Federal Ministry for Education and Research (*BMBF*). Aim of the project is to develop methods to deal with the transfer of tacit knowledge in nursing in explicit, systematic knowledge by using information and communication technologies.

Sharing tacit knowledge has become increasingly important for many organizations, particularly in healthcare [1, 2]. Since tacit knowledge becomes visible in learning situations, nurses should be encouraged to collect their learning experiences. Therefore in the project *Witra Care* members of the nursing staff who are newly incorporated document their learning experiences in various situations of their daily work. Also the seasoned employees who instruct the new employees collect their experiences. The analysis of these learning experiences in the training of new employees can give indications to the tacit knowledge of the nurses.

The nurses were equipped with mobile devices like mobile phones and tablets with a special application that allows them to create their own digital learning diaries. In the developing of the application for the collection of learning experiences various aspects regarding usability, data security and documentation of the meta-data had to be considered. The article describes conception and implementation of the application and the first result of the evaluation of the user experience.

In many ways mobile devices can be used to support nurses in their daily work. With mobile applications, learning material is available for nurses independent of location and time. Thus, learning in the context of clinical work and according to the learners' needs is possible [3]. Thereby the mobile access to learning resources and the possibility to share knowledge with others can help nurses to solve problems in specific critical situations [4].

1. Methods

Newly hired nurses obtained care unit-specific knowledge and additional information from supervisor care professionals with long-term experience during a six-week initial period. Therefore *Witra Care* study accompanied in total eight tandem-teams across different departments over three collection waves for half a year.

After an agreed training session, each of both participants was provided with an android-based mobile device with a specially designed study application. Senior care professionals were equipped with a *Samsung Galaxy Note 8* tablet with an eight-inch display, and the entrant nurse with a *Samsung Galaxy S4* smartphone. Both devices were small enough for a lab coat pocket.

Every possible radio-transmission-based communication was totally blocked during that period. Automatic data transmission was organised by *USB*-plugin to a small linux-based barebone-system at the end of the working day. The system was integrated into the hospital network separately. Therefore, essential daily routines on existing workstations were not compromised by the study. In addition, the wire-connected solution increases the transmission safety and promotes a stable procedure. No further steps were required by the participants.

The system recognized the individual device with the universal unique identifer (*UUID*), idvendor, idproduct and the given device name for an unambiguous

identification. Only study devices were mounted. This link is also used for energy charging during non-working hours. All study devices can be integrated into a workbench with a lockable drawer. Power cable and network cable were laid through an opening outside.

To guarantee data safety and security, every mobile device created a two-folder structure. The main folder contained the entries that were made by the user along the entire period. The transfer folder contained a duplicate as well as system log-files in a separate transmission folder.

Endowed with declared read and write permission, the linux-based barebone was able to encipher and copy all content on its solid state disk. After the files have been archived successfully in an individual backup, verification and removal folder items of the mobile device completed the first part of the transmission process.

To reduce unnecessary traffic overload in the complex hospital network area, a server-controlled cronjob retrieved the data during the night via openssl-encryption into a database. Finally, a php-script mapped study items into a content management system and provided new data entries for clinical nurse specialists. On the one hand, the expert had the possibility to review the collection by relevance and correctness. On the other hand based on all data entries an extended category system will be developed systematically in the future.

The home screen menu was designed with a flat top-level domain and a stable alignment to identify tools intuitively. A navigation drawer supports selections on device attributes for media content. Correspondingly, the observer and the action listener retained the cache memory into *SQlite*-database. Furthermore, a service class captured events and activities (also e.g. display click events) via broadcast receiver into a main log-file. Current timestamps, data paths, previously discarded or still existing, and important text annotations of the user are also recorded. The focus was laid on maintaining a balance between energy-saving, memory management and sufficient quality of data.

Relevant status information, additional functionalities like dictionaries for help for a better understanding for foreign patients or calendar with a free adjustable message alarm were additionally integrated in an upper action bar.

2. Results

A reliable and safe transmission of data, an easy-to-use application was built, referring to the defined android design principles and patterns.

To support ease of use, the app provides the basic functions to collect learning experiences. After logging in, the user can select a media form in which she or her would like to create a learning resource. The app supports the creation of notes, photos, video or audio data. For each resource a title and an annotation can be added. Subsequently, the user can save the resource in a self-created category. In this category, users can always access their learning experiences. In addition, the following metadata is recorded: user name, date, used device and medical ward. Each user creates her or his own account, so several people can share a device. The user interface was designed with black background to reduce energy consumption.

The first team started in July 2014, two other teams started in August and October 2014. So by the end of October, seven people had created 232 records. Most resources of learning experiences were pictures (102 records) and notes (103 records), videos (14 records) and audio files (13 records) were created less often. In the morning and in the afternoon, the activities were approximately equal (Table 1).

Table 1: Time of activity

Time	Morning 6.00-12.00 h	Afternoon 12.00-18.00 h	Evening 18.00 -00.00	Night 00.00-06.00
Number of records	84	92	44	11

Until now, in a semi-standardized interview, the first team was asked about its experience. Collecting learning experience with the app was rated by the users very positively. By collecting learning experiences, the users learn more consciously and gain deeper understanding. The app was a good reminder and has supported a better structuring of training. Overall, the collection of learning experience had resulted to perceived savings in time.

3. Discussion

The *Witra Care* project started with the question how knowledge can be collected, so that it can be shared with others in a mobile and web-based manner.

Previous experience shows that the developed application can be used by the nurses very well. The application supports them to reflect their learning experience and to collect their knowledge. Thereby, the ease-of-use of the application promoted the acceptance among the nurses. In addition, further studies have shown that the acceptance of mobile devices in clinical setting is high [5].

An unobtrusive and stable integration of mobile devices in inpatient care processes is a compulsory precondition. Thus a lot of various needs and restrictions with different background and personal competences had to be regarded within the research field study.

The daily working routines of all participants and the particular environment, including the existing building and technical infrastructure behind, had to be determined previously. Especially the institutional review board, data security officer, and personnel representatives of the company area had been informed and agreed.

All occurred redundancies of the data have been clearly intended for backup purpose. Until now, all collected data are exclusively assigned for the individual participant and the nursing expert. The questions of the future are, how should a possible learning platform be designed and who should have access to its content? Are there reliable common standards for new ascertained content?

Another investigation should focus on the choice of the mobile handheld devices and their user-friendliness. For example, does a voice control service make the enabling

technology even easier to use? As part of an interim step, the *VUZIX M 100* data glasses are just tested for the support of the preparation of surgical intervention in a skills laboratory.

4. Conclusion

The preliminary study shows that mobile devices could help to overcome some obstacles of knowledge transfer. Before the study launch and directly at the end of the study, user experience questionnaires were taken to evaluate the participants' view [6].

The study provided first insights and proved its feasibility in general. However, advanced problems and questions arose and will be considered in the future.

Annotations and media data as well as attendant time patterns have to be analyzed. A better understanding of possible difficulties in sharing tacit knowledge and the expected possible barriers is a basic prerequisite to develop a consistent workflow.

Other devices and new features should be taken into account. Also feedback and other controlled back-coupling processes, maybe together with clinically relevant data of the hospital information system, could be included as well.

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