Integrating User-centred Design in an Early Stage of Mobile Medical Application Prototyping

A Case Study on Data Acquistion in Health Organisations

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Abstract: This paper reports on collaborative work with an SME, developing a system for data acquisition in health care organisations, providing mobile data support. We briefly introduce the ICF and the ICD classification scheme from the WHO as a foundation for our mobile application. A two-staged usability evaluation in a very early stage of development allows us to integrate user-centred design in the mobile application development process. Our procedure comprises interviews and usability tests with a limited number of users and thus can even be performed within a resource-constrained setting as it is typically found in smaller software development teams. We discuss the consolidated results of the usability tests quantitatively and qualitatively. From these results we deduce recommendations (and open issues) concerning the user interface design of the mobile application.

1 INTRODUCTION

For almost 40 years, experiences have shown that software engineering methods (e.g. the waterfall model, V model and recently agile methods such as Scrum) often result in poor user experience (Holzinger and Slany, 2006). One of the reasons for this is that requirement specifications (in particular regarding the user interface and interaction design) often do not reflect the real needs of the users.

Over the past decades, work in usability engineering has shown that one of the best ways to evaluate the quality of a user interface is to carefully watch users interacting with the user interface (Norman and Draper, 1986); however, this alone is not enough, also the context and the environment is of importance and we can speak of a total workplace usability (Holzinger and Leitner, 2005). Depending on the concrete development process and stage of development this can be done with the application (if already in place) or a mock-up in the form of a paper prototype (Snyder, 2003).

Numerous projects have also shown that substantial resources are needed for an adequate interaction design and usability engineering However, in practice software projects always struggle with limited resources. Thus, today's challenge is to use fast, cheap and still efficient usability engineering that can be used iteratively throughout the development process (Hussain et al., 2009).

This particularly holds for the development of mobile business applications that typically do not only have to fulfil high usability requirements but also business-critical requirements. Moreover, the sector specific contextual knowledge will influence how user interface designs are perceived and interpreted. Consequently, it is of uttermost importance to integrate human-centred design into the software development process as early as possible (Holzinger et al., 2005).

In this paper we report on the design and development of a mobile application for data acquisition within healthcare organisations. Typically, such an application is used by the nursing staff, physiotherapists and other medical professionals.

The application requires some basic knowledge of standards such as the ICF (International Classification of Functioning, Disability and Health, WHO2) and the ICD classification (International

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Classification of Diseases, WHO1). This prerequisite has to be taken into account when addressing usability engineering methods from the very beginning.

In this article we briefly provide an introduction to the ICF and the ICD classification and outline some surrounding success factors for mobile business applications in general. In Section 4 we focus on the user-centred design of our application. We briefly explain the research questions, outline the design of our usability tests and their execution and describe the specific tasks our test users had to fulfil. Afterwards we summarize the (1) results quantitatively and briefly show the (2) outcome of our qualitative evaluation. As a concrete outcome for the next iteration within the software development cycle we come up with recommendations even before a single line of code has been written. Our procedure is fast, cheap in terms of resources and can be repeated at any point in the development lifecycle. Notably this procedure helped to discover usability flaws in a very early stage of mobile application development.

2 ICF / ICD CLASSIFICATION

Our goal is to develop a software system, including an application running on mobile devices that supports acquisition and documentation of the health state of a patient. Therefore we make use of the ICF and the ICD standards (WHO1, 2012); (WHO2, 2012). Internationally endorsed classifications like ICF and ICD facilitate the storage, retrieval, analysis, and interpretation of data. For example, this allows one for comparison of data within populations over time as well as the compilation of nationally or regionally consistent data.

ICF is a comprehensive classification of the health state of a person. “Comprehensive” in this sense means that the health state of a person is not exclusively assessed by relying on physical functions or disorders but also by taking into account the possibility of an active lifestyle and factors regarding the environment of the patient. The ICF consists of several components (a hierarchical structure grouped into physical functions, activities, means of participation, environmental factors, factors regarding the person itself), where each component is assigned a set of ICF codes. The assessment for each ICF code is done with the help of a five-valued scale. The value increases with increasing limitation of the patient. Details regarding the assessment are explained in the ICF application and training tools (WHO3).

The ICD is a classification system of medical diagnoses. Within the ICD each medical diagnosis is assigned to a three or four digit code. ICD also supports hierarchies in terms of chapters, groups and categories. In general the relevance of ICF codes depends on ICD diagnoses. Therefore ICF-CoreSets have been developed. ICF-CoreSets contain ICF codes that are of particular relevance for groups of ICD diagnoses.

3 SUCCESS FACTORS

The development of mobile applications for professional usage in the healthcare field challenges mobile software development in various ways.

First, there is the question of the platform being supported. As the current landscape for mobile operating systems is rather heterogeneous we need to trade off advantages and drawbacks particularly for the healthcare sector.

Second, and in contrast to the mainstream consumer market, mobile business applications must fulfil business critical requirements like a certain degree of quality of service and requirements with respect to security and privacy. The communication of the mobile device and the data synchronisation mechanism has to be robust and reliable independent from place, time or usage context.

Third, as the application being developed is highly interactive, the acceptance among the staff members is crucial (Holzinger et al., 2011). This success factor becomes even more crucial, as the exposure to occupational stress in health care organisations typically is extremely high. Unclear user requirements pose a further challenge in developing a user-centred and useful application. In the following we particularly address this aspect.

4 USER-CENTRED DESIGN

Today it is well-known that usability engineering methods have a huge impact on the perceived quality of a software product or a software service. However, in practice high costs and stringent time planning prevent the use of these expensive methods (Boivie et al., 2003), (Cooke and Mings, 2005), (Larusdottir, 2011). In order to address user-centred design in spite of limited resources, we propose to integrate usability evaluation in a very early stage of software design in terms of paper prototypes.

Particularly within a fast-paced and innovation driven setting, under presence of rather fuzzy requirements, the early feedback of potential users may considerably improve the quality of the obtained design and product. Due to this, we prohibit development efforts that do not match market and user requirements. Our core element in integrating usability engineering techniques into the software development lifecycle is the interview-guided usage of usability tests in combination with paper prototypes.

Rubin and Chisnell (Rubin and Chisnell, 2008) emphasize that the usage of usability engineering techniques is appropriate as soon as obvious usability flaws have been removed. Due to this, prior to conducting usability tests we carried out several walk-throughs within the small development team. Further the initial design considered the usability guidelines for mobile applications according to Inostroza (Inostroza et al., 2012) as well as the design guidelines for Android and iOS.

According to Rubin and Chisnell (Rubin and Chisnell, 2008) we conducted an exploratory and formative part of the usability evaluation. The exploratory part of our usability tests aims to clarify whether or not the assumed user profiles match with the reality and whether our app provides assistance in the daily work. In addition to the tests, we emphasized this aspect by conducting interviews questioning the state of practice in acquiring health-related data. The formative part of our usability tests aims to verify whether our design supports the user in an optimal way.

4.1 Research Questions

As we relate usability tests with interviews about the common work practices we decided to classify the research questions accordingly. The interviews being performed intend to strengthen the exploratory component in our evaluation. In the course of the interview, we reveal typical working procedures in order to confirm our assumptions on user profiles and the usage context.

As we interrelate usability test to the everyday work in data acquisition in health care organisations we break down our research questions according to this. The interviews are supposed to strengthen the explorative part of our evaluation and involve the following questions:

- What are typical working procedures for the documentation of the health status of a patient in the course of care and therapy?
- To what extent are these procedures standardised? For example, do you use standardised questionnaires?
- Is ICF used in practice or is the term ICF known at all?
- To what extent are medical doctors involved in the documentation of a patient's health status?

After having conducted these interviews in a very early state of app development, we conducted the formative component of the evaluation to evaluate the quality of the user interface design. This part of the evaluation strived to answer the following questions:

- Does the user benefit from using ICF, that is, does ICF provide assistance in the working procedures?
- Is all the relevant information processed?
- Are overall usability and navigation within the app intuitive?
- Which kind of previous knowledge or which kind of training is required in order to use the app in everyday work?

This first and very early evaluation of the usability in the software lifecycle mainly serves the purpose of providing feedback regarding the suitability of the user interface design. Taking into account the lack of resources and the current practice in software engineering this can be done even with a small amount of test persons. It is well-known that the number of test persons has an economic as well as a qualitative impact. The more test persons are being considered, the higher the costs are and the more relevant the results of the tests are. Thus, the main challenge in the given context is to reveal as many usability problems as possible with a small number of test persons.

According to Bastien (Bastien, 2010) the optimal number of test persons is discussed since the Nineties. At that time, about four to five test persons were considered adequate to reveal 80 to 85 per cent of all usability problems. In the meanwhile more recent studies recommend a considerably higher number of test persons (Bastien, 2010).

The number of persons is further determined by the complexity of the tasks scheduled for the usability test and is still an open research issue at the moment. Up to now many successful research works with practical relevance (Holzinger and Errath, 2007), (Horsky et al., 2010) follow the recommendation from the Nineties (Short et al., 1991), (Nielsen, 1994) to conduct usability tests with four to five persons. According to Rubin (Rubin and Chisnell, 2008) this number is sufficient to reveal the majority of the usability problems.

Furthermore, Rubin (Rubin and Chisnell, 2008) notes that the number of test persons can be smaller, if the tests are carried out in an iterative manner. Usability tests that consider the Thinking-Aloud method can be conducted in an adequate manner even with three persons per user group (Holzinger, 2005), (Holzinger, 2006), (Holzinger and Brown, 2008). As we used the Thinking-Aloud method, supported the test in terms of interviews and performed these tests in an iterative way, we considered three persons as lower bound for obtaining meaningful results. This holds for the relevant user groups of nursing staff and therapists. Medical doctors are considered as a fringe group, as they turned out not to be the main users of our application.

4.2 Test Design and Execution

After conducting the interview regarding the common practice of collecting health-relevant data we explained the basic idea of our application and the concept of ICF. This was followed by a demonstration of paper prototype tests and an introduction to the Thinking-Aloud method.

For the usability tests we selected problems that reflect the most common working procedures in the daily business. The sequence of the individual tasks was chosen to represent the typical sequence of tasks in daily business with an increasing difficulty. After conducting the usability tests the critical issues observed during the test have been discussed with the participants. In the following we briefly summarize the individual tasks that had to be carried out:

Task 1: Remembering the concepts of ICF and ICD in order to establish optimal prerequisites for the test. Participants were given the design of a patient sheet(see Figure 2). Based on this design, we asked the participants to describe the functionalities behind the individual ICF- and ICD-related buttons.

Task 2: Assigning an ICD diagnoses and the appropriate ICF-CoreSet to a patient. This test is intended to establish the relationship between an ICD diagnoses and an ICF-CoreSet. This relationship aids in documenting the health state of the patient at a later stage.

Task 3: Documenting the health status with ICF. This task deals with the core of our application, the recording of health-relevant data based on ICF codes. The participants were asked to evaluate the code “d450 Gehen”. For this purpose we provided further information (diagnostic findings of nursing staff etc.).

Figure 2: Patient sheet.

Task 4: Analysing the health status based on ICF data. The final task considered the visualisation and analysis of the ICF recording. First, the participants were asked to retrieve those ICF codes that have improved in the recent past (Task 4.1). Second, we asked the participants to retrieve details about the evolution of the ICFcode “d450 Gehen” (Task 4.2)

5 RESULTS AND RECOMMENDATIONS

According to the questions raised in the previous section, we summarize the results of the interviews and usability tests. Large parts of the interviews confirmed our assumptions about the common working practices of our potential users.

5.1 Consolidated Findings from the Interviews

Documentation of Health Status in Practice: Typically the workflow related to the documentation of the health status is perceived as tedious and intensive in writing. Both, in health care and therapy standardised metrics and questionnaires are used (e.g. Barden index, Barthel index, or Morse-Fall index). Besides the questionnaires particularly physiotherapists mentioned the usage of the “Visuelle Analogskala” (VAS) which is used for subjective evaluation of pain intensity. The standardised tools being employed capture a specific aspect of the health state of a patient. Relevant additional information is usually captured in the form of free text. Questionnaires regarding the health state are employed on a regular basis, however, the period of usage largely varies depending on the patient. Besides the questionnaires and the indexes most of the documentation work is carried out in the form of free text. In care, almost every action is documented in the form of free text. Furthermore, the actions carried out by physiotherapists and the goals of the therapy are documented using free text.

Separation of Areas of Activity and user groups: Nursing staff and physiotherapists consider ICD diagnoses from medical doctors as a starting point for their work, whereas the medical doctor emphasised not to use the documentation and questionnaires of nursing staff and physiotherapists. This confirms our decision to put the focus of the usability tests on nursing staff and physiotherapists rather than on medical doctors.

ICF in Practice: The ICF schema is not used in practice but is known from time of studying. Particularly this holds for physiotherapists as the ICF has been considered an important part of vocational training. However, none of the interviewed physiotherapists has used the ICF in practice.

IT Support: Yet mobile technologies are not used in daily work by the interviewed persons. In some cases ward rounds are carried out with a mobile laptop computer on a creeper. However, aside of using mobile devices in healthcare, even the usage of IT in the field of health documentation is not very common. For example, some of the interviewed persons mentioned that standardised questionnaires are not processed automatically but printed out and handwriting is used to fill out these forms. Thus, for every patient there is a bulk of paper to document the state of health and care.

5.2 Consolidated Findings of the Usability Tests

In the following we provide a summary of the quantitative results of our tests. However, our main focus regarding the usability tests is on the qualitative feedback from our test persons regarding our design concept. Figure 1 outlines the degree of fulfilment of the tasks discussed in the previous section (percentage of fulfilled tasks) with (light shaded) and without (dark shaded) assistance. On average six out of eight participants were able to fulfil the given tasks.

Table 1 outlines the comparison according to our target user groups whereas Table 2 breaks the results down according to whether a participant is

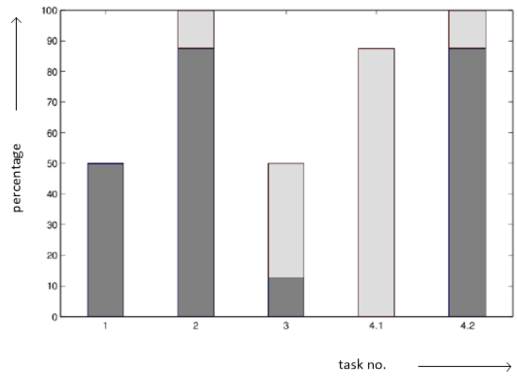

Figure 1: Percentage of fulfilment of the individual tasks.

experienced in handling a smartphone. Notably, the results among physiotherapists are considerably better than among the nursing staff and smartphone users provided better results than test persons that have no experience with smartphones at all. However, it is important to note that all physiotherapists in our test setting had experience with smartphones whereas this only holds for about 50 per cent of the nursing staff. This fact has to be taken into account when interpreting Table 1 and Table 2.

Table 1: Results grouped by profession.

	nursing staff		physiotherapist	
Task no.	with. assist.	without assist.	with assist.	without assist.
Task 1	50 pc.	0 pc.	75 pc.	0 pc.
Task 2	75 pc.	25 pc.	100 pc.	0 pc.
Task 3	25 pc.	25 pc.	75 pc.	0 pc.
Task 4.2	0 pc.	75 pc.	0 pc.	100 pc.
Task 4.1	100 pc.	0 pc.	100 pc.	0 pc.

Table 2: Results grouped by experience of user.

	exp. user		non-exp. user	
Task no.	with. assist.	without assist.	with assist.	without assist.
Task 1	75 pc.	0 pc.	0 pc.	0 pc.
Task 2	100 pc.	0 pc.	67 pc.	33 pc.
Task 3	20 pc.	60 pc.	0 pc.	0 pc.
Task 4.2	0 pc.	100 pc.	0 pc.	67 pc.
Task 4.1	100 pc.	0 pc.	67 pc.	33 pc.

For the individual tasks, we obtained the following qualitative feedback:

Task 1: Figure 2 shows the design of a patient sheet. The bad results we obtained in this task of our usability test are mainly due to a term ("Krankheitsbild" in the German speaking test environment corresponds to clinical picture or disease pattern) we used to describe ICF-CoreSets. Most of the test persons associated this term with the term "diagnosis" and were not able to associate the functionality of our application with this specific term.

Recommendation: Choose a unique and well-known term that captures the functionality of the app also for users with a low knowledge of ICF so that these users are able to associate the right functionality with the term.

Figure 3: Acquisition of ICD diagnosis (left) ICF classification (right).

Task 2: Figure 3 outlines the designs for the acquisition of diagnoses and ICF classifications. All participants have been able to fulfil this task. At the very beginning of the design process, the relationship between acquisition of ICD diagnoses and ICF-CoreSets in everyday practice was an open issue. Our interviews revealed that nursing staff and physiotherapists partially carry out documentation of a patient's health status by relying on medical diagnoses but do not fully rely on these. Therefore the acquisition of ICF-CoreSets independently of the medical diagnoses (given an appropriate hint) appears to be suitable. The good results obtained from this task emphasize that the user interface design manages to convey the relationship between both categories (ICF, ICD) and that navigation within our application is intuitive.

Task 3: Figure 4 outlines the design of the ICF acquisition supporting the documentation process. The rather bad results obtained at this task primarily result from the fact that around half of the test persons did not use the supplemental information regarding the assessment of the ICF codes. Retrieving this supplemental information has been a part of the finishing criteria for this task. Without this finishing criterion the success rate would be 100 per cent. In Figure 4, each value is associated with concrete criteria that a patient has to fulfil. This supplemental information can be retrieved by pressing the central buttons with the numbers.

Figure 4: Dialog for acquisition of the ICF values.

We identified several issues for this problem:

The meaning of the numbers for assessment is not clear: A part of our test users did not understand the meaning of the value. Figure 4outlines the value for the code "d450 Gehen" which is displayed two times (the green number 1). Although we had briefed the participant that the assessment is based on a 5 step scale, they could not associate this value with the ICF number.

Recommendation: The problem revealed can be addressed in two different ways. Training on the ICF codes is a prerequisite for using our application. Once it is clear to the users, how exactly an ICF assessment is carried out, the interpretation of the numbers should be quite obvious. On the other hand, it might be possible to hide the numbers and use a colour palette instead. Due to the problems with colours used in our application (see the following recommendation) we recommend to use numbers. However, this issue should be an integral part of the next iteration.

The relationship between assessment buttons and the value for the assessment is not obvious: Several test persons did not recognize the relationship between the assessment buttons and the number in the centre. Although our test persons understood that red, yellow and green buttons denote a degradation of the health state, stable state or an improvement regarding the health state, the fact that hitting one of these buttons affected the ICF value in the centre was not obvious to them. This problem has already been revealed in the very early walk-throughs and yielded to the decision to place the ICF value in the centre of the assessment buttons. However, the majority of our test persons preferred positioning the value for the ICF assessment left to the assessment buttons.

Recommendation: Relying on the obtained results, the value for the ICF assessment should be placed left to the assessment buttons. Moreover, a visual aid, e.g. flashing the number when hitting an assessment button, should emphasize the relationship between the assessment buttons and the value displayed for the ICF code.

Double meaning of colours: This task further revealed a weakness of our colouring concept. Several test persons were unsure about the (double) meaning of our colour concept. On the one hand we use the colours red, yellow and green for the assessment buttons to depict degradation of the health state, stable health state, and improvement of the state. On the other hand we associated colours to the ICF values. However, these colours do not denote the evolvement of the health state but rather a static assessment. For example, values 0 and 1 are displayed in green as these values indicate a small limitation of the patient whereas the values 3 and 4 are displayed in red correspondingly indicating a severe limitation of the patient.

Recommendation: To solve this issue, set aside the colouring for the ICF values. The colours green, yellow and red should solely be used to indicate the variation (degradation, stable state or improvement) of ICF values.

Discovering information regarding the ICF values: Our test persons had problems retrieving the supplemental information regarding the ICF values. Often the information for the ICF codes itself or actions and goal planning (Figure 5) have been retrieved.

Recommendation: To remove this problem, use visual means to emphasize that there is some relevant supplemental information regarding the ICF values.

Task 4: This task deals with the assessments of ICF codes. Notably the learning curve is strongly increasing (see Figure 1) when moving from Task 4.1 to Task 4.2. Whereas none of our test persons managed to solve Task 4.1 without assistance, 87.5 per cent of our test users were able to perform Task 4.2. This indicates that our user interface enables simple guidance of the user through the menu and our test users experienced some learning effect.

Task 4.1: Figure 5 (left) shows the alternation of certain ICF codes over a certain period of time. In this figure the current ICF assessment is compared to 100 acquisitions. Our test persons have not been able to correctly interpret this alternation. The following issues have been discovered due to this test.

Figure 5: ICF trend view (left) and details view on the ICF-code “d450 Gehen” (right).

Information visualisation: Our test users did not perceive that the values being displayed refer to a time period of 100 acquisitions in between. Intuitively our test users assumed that the current assessment is compared with the previous assessment. Our users did not pay attention to the information that is indicating the longer time period for acquisition (“100 Erfassungen”). Further, as in Task 3, the double meaning of colours was mentioned as a problem.

Recommendation: The time period over which the trend of the assessment (degradation, constant state, and improvement) is taking place has to be emphasized. If possible, also try to reduce the amount of information displayed to the user to ease interpreting the data. Use the colours red, yellow and green consistently but exclusively to depict the change of health state.

Task 4.2: As mentioned previously the learning effect from Task 4.1 was vast. Almost no one of our test users had problems in navigating through the menu. Figure 5 (right) outlines the detailed view for the ICF code “d450 Gehen” which lots of our test persons managed to retrieve without problems.

6 RELATED WORK

The number of health applications and research in the area of mHealth is growing steadily with lots of special applications for both the private and professional sector (Waegemann, 2010), (Zuehlke et al., 2009), (Phillips et al., 2010).

Applications for the consumer market cover a variety of fitness and wellness applications, the management of medication and assistance with self-diagnosis (Holzinger et al., 2010). Furthermore there is a variety of mobile health applications for professional use which ranges from medical applications to display medical images over applications of ICD to electronic recording of patient data.

Software solutions for using ICF are rather rare. Most of the work regarding ICF deals with the construction of ICF-CoreSets (DIMDI). In order to select the relevant ICF codes for patients out of the thousands ICF codes in general, there is a need for a standardised set of ICF codes. In general, the set of relevant ICF codes is related to the ICD diagnoses of a patient. Therefore there are ICF CoreSets that cover certain diagnoses or groups of diagnoses. Our research revealed that there are well-documented ICF-CoreSets for patients with backache, osteoporosis, Diabetes mellitus, pain disorder and depressive disorder (Rensch and Bucher, 2006).

Bender (Bender, 2010) points out that numerous health organisations experience problems when applying the ICF classification in practice. According to (Bender, 2010) the reason for this is the lack of guidelines for practical application of the complex ICF classification scheme.

The Rehab-CYCLE software from the RehabNet AG (DIMDI) to our best knowledge has been the first ICF-based desktop application for rehabilitation. This software allows describing the health status of a patient by using the ICF as well as the formulation of rehabilitation goals and the planning of the corresponding activities. This functionality is supported in terms of an ICF-browser and ICF-CoreSets for numerous diseases. As in our case Rehab-CYCLE has been developed in close collaboration with universities and has been successfully used from 2004 to 2011 within hospital facilities in Switzerland and Germany.

In the meanwhile Rehab-CYCLE has been substituted by the web-enabled application RehabNET-IPS. As this application can be accessed via a browser, the access via mobile devices is possible. However, to our best knowledge there has been no effort in adapting the application towards the usage with mobile devices.

Our market research revealed only a single ICF-based documentation system explicitly supporting mobile devices, the ICOSys application developed by Management Partners (ICOSYS, 2012); (ICOSYS.MOBIL, 2012). The possibility to use the ICF-classification is embedded within a module system which is providing functionalities ranging from the management of resources and patients to time recordings for employees. ICOsys.mobil runs on the Windows Mobile operating system. It is an open issue whether there have been attempts to port ICOsys.mobil to state of the art platforms like iOS or Android.

The German company MediFox (MEDIFOX) offers a mobile software solution on the Windows Phone platform. However, to our best knowledge this application does not support the usage of the ICF classification but offers a spectrum of metrics to measure the health status of a patient, e.g. the Braden-Skala. Notably, there is a major difference to our ICF-based approach: Each of the metrics and assessments captures a part of the health status in a highly specialized but isolated manner. Opposed to this, ICF considers the health status as a whole and uses a uniform and quantifiable assessment scheme. However, today it is an open issue whether a documentation based on the ICF can fully substitute this spectrum of metrics.

7 CONCLUSIONS

In this article we presented collaborative research conducted in association with an SME dealing with the integration of user-centred engineering methods into mobile application development in a very early phase of development. The application that has been designed and developed is part of a larger system that allows one for acquisition and documentation of the health state of a person. Our mobile application is primarily used by nursing staff and physiotherapists. In this context usability questions are tied to domain knowledge and practices and thus this has to be taken into account in particular.

The article gives a brief overview on the documentation of the health state of a person using the ICF and the ICD classification scheme according to the WHO. In our research it turned out that the scheme is known by physiotherapists but not used in practice yet. However, our research further revealed that additional training on the basic ideas of the ICF and ICD might be necessary in order to establish acceptance among nursing staff. The authors of

(Ziefle et al., 2011) also point out the need for additional training and thus further support our findings. Nevertheless, the ICF and the introduction of mobile devices appears to be beneficial as it simplifies the prevailing working procedures.

Regarding the mobile application development for the healthcare domain we identified three success factors: choosing the appropriate platform, the fulfilment of business-critical requirements and the integration of user-centred design into mobile application development.

In integrating user-centred design into the software development lifecycle we conducted a two-staged procedure based on walk-throughs, interviews and usability tests. Notably this can be performed in an (1) early stage of development and with (2) a limited amount of resources and thus is suitable for smaller development teams and SMEs.

Our procedure is repeatable and revealed design flaws in the user interface in a very early stage of development. We briefly summarized quantitative and qualitative results (with emphasis on the latter one). From the results we deduced some recommendations and issues to be investigated in the next iteration. Finally we summarized related work on acquisition and documentation of the health state of a person focusing primarily on products and studies that use the ICF and ICD classification for documentation.

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