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## Continuous learning with a quiz for stroke nurses

**Abstract:** A continuous learning solution was sought which allows stroke nurses to keep the vast body of theoretical knowledge fresh, stay up-to-date with new knowledge, and relate theoretical knowledge to practical experience. Based on the theoretical background of learning in the medical domain, reflective and game-based learning, we carried out a user-oriented design process that involved a focus group and a design workshop. In this process, a quiz that includes both content-based and reflection questions was identified as a viable means of transportation for theoretical knowledge. In this paper we present the result of trialling a quiz with both content-based and metacognitive (reflective) questions in two settings: In one trial the quiz was used by nurses as part of a qualification programme for stroke nurses, in the second trial by nurses outside such a formal continuous learning setting. Both trials were successful in terms of user acceptance, user satisfaction and learning. Beyond this success report, we discuss barriers to integrating a quiz into work processes within an emergency ward such as a stroke unit.

**Keywords:** work-place learning, game-based learning, quiz, reflective learning, learning in the medical domain.

### 1 Introduction

Keeping professional knowledge up-to-date is amongst the major challenges for knowledge workers across industry sectors. The work described within this article is set in the context of a stroke unit, a hospital ward specialized on stroke treatment. Stroke nurses are highly skilled professionals. Only nurses with prior work experience are stationed in stroke units, or even start the formal professional qualification programme for stroke nurse. A continuous learning solution was sought which allows stroke nurses to keep the vast body of theoretical knowledge fresh, stay up-to-date with new knowledge, and relate theoretical knowledge to practical experience. We hypothesized that reflective learning would be the key to achieve a connection between theory and practice. During a user-oriented design process, a game-based learning solution – a quiz – was identified as a viable means of transportation for theoretical knowledge. The quiz contained both content-based and reflective questions and was trialled once within a formal continuous learning setting (a qualification programme for stroke nurses) and once outside such a formalised setting (within a stroke ward).

### 2 Background and Related Work

It is mostly agreed that nursing as a practice discipline can only be learned by a combination of teaching theory and practice (Papastavrou et al., 2010; Tiwari et al., 2006). However, these two parts of nursing education are still often separated instead of being intertwined as a whole. This ‘theory-practice gap’ is intensified by the fact that nurses are not very keen on reading and applying findings from nursing research to their clinical practice (Estabrooks, 2003; Nilsson Kajermo et al., 1998; Wallin et al., 2003). On

the other hand, it is known that it is crucial to breech the theory-practice gap if teaching is to be effective, relevant and applicable in the real world of practice.

With help of modern technology educators today can apply a variety of methods including interactive activities to keep the teaching fresh, up-to-date, interesting and enjoyable (Baid and Lambert, 2010).

Specifically, nurses are evermore able to access and use multimedia and other computer technologies, both for their own and for patients teaching and learning needs which contributes towards more efficient and safer health service (Lowry and Johnson 1999).

Reflective learning is the conscious re-evaluation of experience for the purpose of learning and as consequence of guiding future behavior (Boud et al., 1985; Schön, 1983). Reflecting on learning activities, e.g., in its relation to work, or on learning progress means considering what and how has been learned. Technology can provide support and guidance in that respect, e.g. by enabling learning applications for collaborative and creative development of new practices and solutions. If relevant material can be provided, such as data about learning practices, a person can reflect on these past experiences and gain new relevant insights which can influence her future behaviour. Reflection has also been recommended in particular within the nursing domain as a proven method to elicit knowledge from practice (Kuiper and Pesut, 2004; Löfmark and Wikblad, 2001).

"Game-based learning refers to teaching-learning actions carried out in formal and/or informal educational settings by adopting games" (Kirriemuir and McFarlane, 2004). Several reviews of the literature on gaming have consistently found that games promote learning and reduce instructional time across multiple disciplines and ages (Van Eck, 2006). Especially quizzes are widely used in e-learning since they represent a familiar way to play (Bontchev and Vassileva 2010), are suitable for formative assessment within the scope of a given course or topic (Hudson and Bristow, 2006; Koch et al., 2010) and improve performance on summative examinations (Kibble, 2007). Learning can be encouraged by involvement in the quiz content-creation (Pollard, 2006) or by adding meta-cognitive questions to motivate students to reflect on and monitor their own learning (O'Hanlon and Diaz, 2010).

Earlier work on quizzes in the nursing domain that include meta-cognitive questions such as O'Hanlon and Diaz, 2010 situates quiz-based learning in higher education. In contrast, the trials we report on are situated in continuous learning settings once in a formalized context in the scope of a qualification programme, and once without a formal learning frame. A major difference between higher education and work-integrated learning is that all participants in our trials have prior work experience, to which they can relate when thinking about and answering reflective questions. Also, study participants with work experience can be expected to have a very clear picture on whether or not a learning solution impacts their work performance.

### **3 Goal and Research Questions**

The goal of our work was to design and implement computer support for continuous learning of stroke nurses. In the trials we were looking both at user acceptance and effect on learning:

1. RQ1: Does the target user group perceive the learning solution as useful with respect to (i) keep existing knowledge fresh, (ii) stay up-to-date with new knowledge and (iii) foster a close connection between theoretical knowledge and practical work experience?

2. RQ2: Would the target user group use the learning solution outside the setting of a research trial?
3. RQ3: Does the implemented learning solution lead to i) learning of theoretical knowledge and ii) connecting theoretical knowledge with work experience?

## **4 Setting**

The work described in this paper was carried out in the context of a German stroke ward, which is embedded in a neurological clinic. This unit is an emergency and intensive care ward that takes up patients suffering from acute stroke.

The stroke nurses are responsible for patients as well as for supplementary tasks such as filling up medication and material in the patients' rooms. The responsibility of nurses is to ensure medical treatment of patients as well as assuring their physical and mental well-being. The tasks they perform include the implementation of directives (e.g. given by physicians), the organization of patients' days including their transport to examinations and the documentation of both care given and physiological data measured during the day. For this, nurses use standard procedures as learned in nursing school as well as standards stemming from the hospital in which the ward is embedded.

## **5 Design Process**

To increase the likelihood of stroke nurses taking up the computer support for continuous learning we intended to develop, we followed a participatory IT design strategy (e.g. Kensing et al., 1996). There were three major collaboration activities with stakeholders: a focus group, a design workshop, and two trials of the quiz, the results of which are the main contribution of this paper.

### **5.1 Focus Group**

The goal of the focus group was to explore possible learning solutions with the intended target user group. Based on the above discussed theoretical knowledge, four impulses were brought into the focus group: Game-based learning to strategically develop own competencies, photo/video documentation of real work situations and activities, (physical) activity logging, and the role of emotion in nursing.

The focus group was carried out with four stroke nurses, aged between 20 and 59, with various levels of work experiences and attitudes towards computers. The nurses were asked to participate, because they were familiar with the work at the stroke unit and as well as the medical milieu. The concept of game-based learning was enthusiastically discussed. Intuitively, the nurses grasped that if learning was fun it would be possible to "squeeze" that into their lives. The most concretely evolving idea was a quiz application, with the statement of one participant being that "something like 'Who wants to be a millionaire?'<sup>1</sup>, would be cool".

## 5.2 Design Workshop

Based on the results of the focus group, it was decided to further develop the idea of a quiz. From an organisational point of view, we wanted to find out how such a quiz could be embedded in working or learning routines within the stroke ward. From a technical point of view, our aim was to define the functionality and graphical user interface of the quiz application using clickable mock-ups we prepared as discussion input.

The participants of the design workshop consisted of the project leader of the neurological clinic, the leader of the qualification programme for stroke nurses and a project coordinator of a tele-medicine project conducted at the same hospital. These participants were chosen because they were familiar with the work at the stroke unit and were in the position to decide on deployment of the learning solution at the stroke ward.

Two different settings for trialling the quiz emerged at the design workshop, namely i) as complement to the qualification programme and ii) at work. Furthermore, the leader of the qualification programme committed to provide the content-based quiz questions.

## 6 The Quiz as Continuous Learning Solution

The quiz was implemented with the open source eLearning platform Moodle<sup>2</sup> because Moodle provides a plug-in for the creation of quizzes of different types as well as user administration functionality. Furthermore, Moodle is a web-based application and can therefore be accessed via a browser on desktop PC's, notebooks as well as on mobile devices (e.g. tablets, smartphones).

Two different quiz types were implemented: a “Quiz against time” (answer as many questions as possible in a minute) and the “20er – Quiz” (answer twenty questions). For both quizzes content-based questions, consisting of single- and multiple choice questions, were randomly chosen from the pool. Reflection questions were also randomly selected from a pool, and added to two of the content-based questions within the 20er Quiz.

Reflection questions are open questions designed to induce the quiz players to reflect on their learning progress, as well as on the relation of quiz content to their practical work. The pool of reflection questions is presented in Table 1.

**Table 1:** Reflection questions randomly posed during the “20er Quiz”.

Reflection questions
If you think back regarding the question above to the qualification programme or a situation during work, which knowledge can you gain out of it?
If you reflect with the help of the above posed question about the qualification program or a situation during work, could you gain any relevant knowledge for you?
Could this question help you to learn? If yes, how? If no, how should this question be modified in order to help you to learn?
Does this question give you some hints about your learning progress in relation to the related topic?
Does the question posed above remind you on an interesting situation or discussion during the qualification program or during work and if yes, on which one?
If you have a look at the question stated above, would it help you to have more information about the related topic e.g. direct access to a medical book or to an internet page? If yes, which information would you like to have? If no, why don't you need any further information?
How important is the question above for your work?

Have you already needed this information in practice and if yes, how? If no, do you think you could use this knowledge in future for your work?

To what extent is the question stated above relevant to your work?

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## 7 Trial Methods

The first trial (Trial 1) was carried out in a form of a workshop in the context of the qualification programme „Special Care at Stroke Units”. Participants were informed about the goal of the trial, as well as its procedure. They filled in a consent form and a demographic questionnaire. Participants were divided into four groups. While one group was playing the quizzes in a separate office, the remaining groups discussed their expectations w.r.t. the quiz, the potential usefulness of the quiz, and the possibility to use the quiz during work. Directly after playing a quiz, every participant filled out a questionnaire on perceived usefulness of the quiz, learning experience and perception of the reflection questions as connecting theory and practice.

Nineteen nurses, who have enrolled in the qualification-training course, took part in the first trial. There were 13 female and 6 male participants, aged from 23 to 48 years, already working at stroke units in different German hospitals between 1 and 27 years.

The second trial (Trial 2) was conducted with nurses working at the stroke unit of the Neurological Clinic. Since it was not possible to make the quiz available on a PC within the ward (no internet access available and installation of software not allowed by the IT department) the nurses were asked to come to the office of the clinic representative responsible for the trial. They were introduced to the quiz and its goals as well as to the aims of the trial as a whole. Before playing the quiz they filled in the consent form and the demographic questionnaire, and afterwards they also filled in a questionnaire and were interviewed by the clinic representative. This trial was therefore not a trial of integrating the quiz within work processes, but a trial of user acceptance and potential for learning with the target user group of nurses outside a qualification program.

Eight nurses (1 male, 7 female) aged from 23 to 54 years, working in their current position between 2 and 34 years, participated in the second trial.

## 8 Results

### 8.1 Attitudes

In both settings the nurses' attitudes towards the quiz were very positive. The following results stem from the group discussions in the first trial, and were confirmed by the conducted interviews of the clinic representative:

**Experiences and Expectations of the quiz:** The nurses rated motivational aspects of the quiz such as ease of use and the playfulness of learning very positively. They expected the quiz to help them become aware of their knowledge gaps and improve individual self-control. In addition, they would have preferred different degrees of difficulty in the quiz.

**Usefulness and learning during the qualification programme:** The nurses saw the quiz as an additional learning instrument, which can be used at the end of a specific chapter, for self-control of new gained knowledge at the end of the course week. It was

seen as a learning method without grades and pressure, which could complement well the qualification programme and add a fun factor to learning.

**Usage during work at a Stroke Unit:** The nurses' opinions diverged on the viability of integrating the quiz into the normal work routines at a stroke unit. Constant availability, strengthening of own knowledge and possibility to see learning development over time were mentioned as positive features. In contrast to this, lack of time and computer skills, acceptance of staff members and integration within the work routines at a stroke unit were seen as critical issues by the nurses.

## **8.2 Research Questions**

The research questions are answered based on the feedback collected from the questionnaires nurses filled out after playing the quiz in both trials. The answers were given using the 5-point Likert scale from strongly disagree (1) to strongly agree (5).

**Does the target user group perceive the learning solution (quiz) as useful with respect to (i) keep existing knowledge fresh, (ii) stay up-to-date with new knowledge and (iii) foster a close connection between theoretical knowledge and practical work experience? (RQ1)**

Most of the participants in both settings (Trial 1: 17 out of 19; Trial 2: 7 out of 8) perceived the quiz as useful for gaining relevant knowledge for their work, as helpful for checking their knowledge, and motivating them to have another closer look at topics ( $M=4.22$ ,  $SD=.49$ ). Several participants (Trial 1) also found that taking the quiz strengthened their self-confidence and boosted their motivation to learn and continuously improve. Nurses in Trial 2 (at work) noted, that key elements of nursing are interpersonal work and social skills, which cannot be trained easily via quiz, and in any case no questions on these topics were contained in the quiz.

**Would the target user group use the learning solution outside the setting of a research trial? (RQ2)**

In both settings participants were motivated to use the Medical Quiz after the trial (Trial 1: 17 out of 19; Trial 2: 7 out of 8). Around 60% in both settings stated they would use the quiz voluntarily either regularly or at least from time to time ( $M=4.63$ ,  $SD = .49$ ).

The questions which cover new or challenging aspects regarding strokes would be of major interest to them, but in general it would be important to continuously enhance the quiz with new work-relevant questions and question types (e.g. using images or videos).

**Does the implemented learning solution lead to i) learning of theoretical knowledge and ii) connecting theoretical knowledge with work experience? (RQ3)**

The integrated reflection questions, which should serve as reflection trigger to make participants reflect about specific work-related experiences, have partly fulfilled their task. Reflection questions on learning progress were seen as very positive and mostly answered. Reflection questions that related the quiz content to practical work were answered by about half of participants in each trial (Trial 1: 10 of 19; Trial 2: 3 of 8). Reasons for this low acceptance were that reflection questions disturb the flow of playing. In addition, the relevance (for working and learning) of such reflection questions seems to have been unclear to some nurses.

## **9 Discussion**

The target users in both trial groups perceived the learning solution as useful in the context of the qualification programme (RQ1, RQ3). Frequent statements refer to the usefulness of the quiz for formative assessment. This also confirms existing literature such as (Hudson and Bristow, 2006; Koch et al., 2010). This relates mainly to the overall goal for the developed solution to help nurses stay up-to-date with new knowledge (RQ1, (ii)). Especially in the second trial, nurses reported that the quiz including the reflection questions was a useful way to refresh existing knowledge (RQ1, (i)) and connected well to their practical daily work (RQ1, (iii) and RQ3). However, we also noted that nurses require significant skills in their work which are not covered by the quiz, such as social skills or procedural skills, e.g. how to mobilize patients.

In both trials, nurses were positive that they would use the quiz outside of a research setting – under certain conditions however (RQ2). For nurses in both settings, the content of the quiz was crucial: If such a quiz should be used for a longer period of time, the quiz content would need to be maintained. Old content would need to be replaced in order to keep up the attraction and to make the players curious to re-visit the quiz as often as possible. This in turn would require a content manager for the quiz. It is not obvious who of the involved stakeholders would take up such responsibility in addition to the existing workload. It has become very clear that the deployment of the quiz as a continuous learning solution is much easier in the setting of the qualification programme than within the work setting even though the target user groups (the individual participants) were comparable in their ages, educational background and overall attitudes.

### **9.1 Barriers to successful implementation of a quiz at stroke unit**

The trials revealed several barriers to using a quiz as a continuous learning solution on an individual level, collaborative and organisational level. First, the usage of an online quiz requires computational skills, even if the required skills are not very high. Less computer-experienced nurses did not have a problem when answering the multiple-choice quiz questions, but answering free text questions (the reflection questions) was a major challenge for them. When introducing such an IT based learning solution, computer-inexperienced nurses need to be slowly guided and strongly supported in order to strengthen their confidence in the use of computers. Second, even though nurses stated that they have flexible task assignments, and regularly had a little bit of time during their shifts, during the trial it was difficult for them to find the time to play the quiz. This is also related to the fact that the PC with access to the quiz was not directly available at the stroke unit itself. Third, the nurses deal with emergencies and therefore they do not know how much time is at their disposal before the next emergency arrives. The type of their job limits their time and learning opportunities in that sense they always have to be available in case they are needed.

Further, the workshop participants suspect that neither patients nor relatives or other nurses working on different wards would like to see that stroke unit nurses are allowed to use mobile devices for “gaming” purposes during work. This obstacle could be overcome with more understanding for learning needs of nurses. Organisational culture would need to change in that taking time to learn or refresh the knowledge directly at work has to be accepted by not only other staff members (colleagues and management) but also by patients and visitors. Within the second trial, this fear was confirmed, as even within the

setting of a research trial, nurses’ “going off to play” was not unanimously accepted by colleagues. Finally, IT security is a major organisational barrier. Since computers in a hospital setting deal with very sensitive patient data, the hospital’s IT department understandably was reluctant to install additional software on existing PCs. Secondly, for security reasons there is neither WLAN available in a stroke unit and nor mobile reception at all. Therefore it was also not possible that the quiz ran on an outside server and nurses use it on their own mobile devices during their work. While the first barrier was a real problem for our study, the second one will mean that quizzes or every other work-integrated learning solution will be played only offline and on a particular desktop PC or notebook provided only for this purpose.

## **10 Conclusion**

A continuous learning solution was sought which allows stroke nurses to keep the vast body of theoretical knowledge fresh, stay up-to-date with new knowledge, and relate theoretical knowledge to practical experience. Based on the theoretical background of learning in the medical domain, reflective as well as game-based learning, we contribute to the existing body of scientific work by having designed, developed and trialed a quiz with reflection questions with target users within a continuous learning setting as well as outside such a learning setting. The quiz contained both content-based and reflective questions, which aimed to direct the quiz users’ attention towards their learning progress and to relate theoretical knowledge to practical experience.

Both trials were successful in that user acceptance of and satisfaction with the quiz was very high, and in that the target user group acknowledged its effectiveness for learning. As a direct result of these trials, the quiz has been taken up as part of next year’s qualification programme. While nurses were similarly positive about the quiz outside the formal learning setting, integration into the ward’s work processes and IT infrastructure is not immediately clear. As discussed, computer skills, the nature of work in an emergency ward, and IT infrastructure are some barriers for adoption. The most challenging however, in our opinion, is the acceptance of colleagues, patients and their relatives, of nurses “at play” – however serious – in a setting such as a stroke ward.

## **Acknowledgement**

This section has been removed in order to ensure anonymity.

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## Notes

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1 A game show where participants can win money by answering questions. 2 Moodle: <http://moodle.org>