AR virtual patient and interactive self-assessment in a nursing clinical lab

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Abstract

A novel Augmented Reality (AR) mobile application to support nursing students in clinical labs is presented. The nursing mobile AR (NMAR) tool has been used by 34 students, and both quantitative and qualitative data were collected from the students via questionnaires, to identify how they perceived the experience of using NMAR. The qualitative data were subject to a thematic analysis, which suggests that use of the NMAR application was effective, efficient, useful, and enhances clinical learning. The results point to the role of interactive self-assessment in motivating nursing students to activate their self-regulated learning.

Introduction

In nursing education, scenario-based learning is a widely accepted teaching approach which bridges the gap between theory and practice learning. Also, it provides a safe environment for nursing students to practice the necessary skills. This research aims to establish the feasibility and effectiveness of using AR in a clinical nursing context.

Camba & Contero (2015) state that learning a complex concept can be improved if the teachers incorporate teaching methods that are interactive and student-centered, and which take advantage of new technology. In this regard, AR technology supports attractive and engaging learning materials by promoting the development of visualization, self-assessment and Self-Regulated Learning (SRL). Moreover, AR has been used in nursing education to provide a more authentic learning experience than the traditional manikin can do. It holds the promise of improving the realism of the simulation lab, and students have reported that practicing in a real experience environment enhances their motivations (Vaughn et al., 2016). Within the context of the clinical skills laboratory, where outcomes are measured in terms of clinical competence, the challenge for educationalists is to achieve the fine balance between giving instruction and promoting inquiry, so that efficient and effective skills acquisition occurs in a short-time (Docherty et al., 2005). AR, on the other hand, can build capacity in the lab session, as having the AR resources available on mobile devices and at the bedside reduces the learner's frustration from not getting immediate support from the lab supervisor (Garrett et al., 2018). With AR learning, teachers can perform an active role in directing the students and facilitating their learning, rather than being the center of the learning experience. Moreover, the enjoyment effect of the AR may impact on nursing students' learning and motivate them to be active learners.

Methods

We have developed an AR mobile application called NMAR which includes two sections. **The patient's scenario** allows students to visualize a real patient's symptoms and all corresponding information needed to understand the scenario .The second is **interactive self-assessment**, the mechanism of which works by providing a list of options together with instant feedback linked to each option, then calculating the correct and incorrect answers for the final score.

A lab experiment was used to evaluate the user experience and was conducted at the nursing clinical lab of the university with 34 participants. During the session students were given a list of tasks to complete, then they answered a post-session questionnaire. The evaluation combined two data analysis aspects to understand the user experience, namely students' behavior while using the NMAR application (screen-recordings) and students' perceptions (questionnaires).

Results and Discussion

Students' behaviors with Interactive Self-assessment (ISA)

Melrose (2017) emphasizes that "learning is demonstrated when a change in behavior occurs as a result of experience". It is noticeable from the results that students have different behaviors when they assess themselves with interactive self-assessment. Figure 1 shows that most of the students repeated their self-assessment to increase their grades. Additionally, all the students who failed their first attempt repeated their tests at least once. The majority of the students aimed to achieve the result of 100%, and most of them reached that goal from the second attempt. The reason is the "pass/fail" grading mechanism fosters the intrinsic motivation of the students and increases their motivation to learn and pass (Melrose, 2017). A recent study has found that self-assessment has a positive impact on students' academic performance and it increases their knowledge. It could be referred to as the fact that the curiosity of the students in judging their work, through the self-grading system, motivates them for further learning and test attempts (Sharma et al., 2016). When the students evaluated their results, they expected the next attempt grade, the expectation grade can increase their confidence not only in the correct answers but also in understanding the incorrect answers (Melrose, 2017). This might be the reason why students had more than two attempts to achieve the result of 100%. As nursing students, interactive self-assessment supports them to reduce medication errors and provide safer care to real patients. It allows them to pursue areas that need to be improved in their learning. The degree of confidence that learners have to correct their responses can affect their ability to invest effort into dealing with feedback information (Hattie & Timperley, 2007).

Students' perceptions

Students were asked to rate their experience with the NMAR application, They answered a 5 point Likert Scale questionnaire as presented in Figure 2. The mean scores for each item are in the range of 4.56 to 4.85, which indicates that the students were overall satisfied with the use of the NMAR application as a learning tool. The virtual patient in the application helps them to understand the patient's symptoms. The analysis determines that AR technology is effective, efficient, useful, and enhances clinical learning. On the other hand, a thematic analysis approach was used to identify patterns and themes in the open-ended comments of the students. It is the most appropriate technique to analyze the text into manageable components simply and effectively (Petty, 2014). An inductive approach was employed to identify the key concepts and categories in the analysis of qualitative data written by 24 students and 12

	Statement	Mean
1	NMAR helps me to create the clear mental image for the patient's symptoms.	4.65
2	NMAR helps me to access the clinical learning resources anytime and anywhere.	4.62
3	NMAR helps me to be self-reliable.	4.56
4	NMAR helps me to understand patient's scenario more quickly.	4.62
5	NMAR helps to improve my learning performance.	4.63
6	NMAR helps me learn effectively.	4.62
7	Overall, NMAR app is useful.	4.85

Figure 2: Students' perceptions

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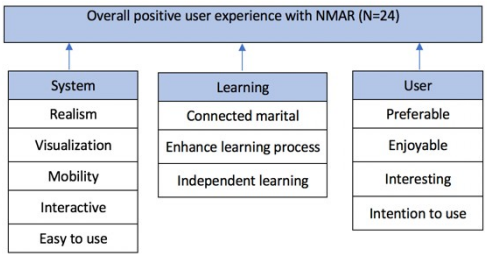

Figure 3: Thematic analyses of the open-ended responses

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The qualitative results explain that the usefulness of NMAR application is because it is "*like real*", "*more visual*", "*more effective*" and "*learning will be more easy to understand*". For example, in the current approach students read the scenario from a written paper, and they "*are becoming of imagining things[the patient's symptoms] in classroom*", but learning with virtual patient in NMAR makes it "*more interesting and realistic compared to current learning*", students do not "*lose attention*" and they "*really enjoyed the experience*". Moreover, NMAR motivates them to be an active learners as "*being interactive helps with [clinical] learning*" and allows them to perform the clinical tasks "*individually without supervision*", so "*it will be so much better if [students] currently regulate learning using NMAR*". However, it is worth noting that negative comments were mostly related to prior training and demonstration.

Conclusion

Overall, the findings from this study shows a positive user experience towards the NMAR learning approach, students found that the application realistic, useful, and that it enhances their learning. Also, it motivates them to activate their independent learning, and this result is in line with meta-analytic reviews (Panadero et al., 2017) which suggests that self-assessment interventions might have a positive impact on students' SRL skills. One of the student commented that "*I love the idea of learning independently in a skills lab*". Additionally, the importance of the self-assessment In the learning process according to Sharma et al. (2016), it helps in increasing learners' knowledge and motivates them to develop SRL skills. It has powerful effects on long term learning, by motivating them to enhance their learning, and become more active learners (White & Fantone, 2010).

In terms of clinical skills learning, hands-on interaction on the learner's part is critical to increase their confidence. Vaughn et al.'s (2016) study points out that a virtual patient is a beginning step toward improving the realism in a clinical lab, and motivating students to learn. Thus we have sufficient evidence here to suggest that AR seems to have the potential to facilitate SRL in a clinical lab and motivate the students to be an active learners. Further research in this area is needed to determine how AR can further enhance nursing students' SRL skills.

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