MOBILE LEARNING AND SIMULATION FOR THE DEVELOPMENT OF HANDS-ON CLINICAL SKILLS

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ABSTRACT

In relation to simulation-based health professions education (SBHPE), mobile learning offers new ways of developing clinical skills and is becoming a key component of how we teach and learn across the spectrum of learners. Learners typically practice hands-on clinical skills within simulation laboratories posing two issues that highlight the need to consider another SBHPE model: (1) logistical and financial barriers lead to restricted access, and (2) on-the-go learning is preferred by many learners. This proposed work-in-progress describes the development of GEN2GO, a mobile, decentralized model of SBHPE that offers learners the opportunity to practice clinical skills outside of these simulation laboratories. This model of mobile learning is based on a previously developed and tested web-based learning management system called the Gamified Learning Management Network (GEN) which promotes collaborative learning by empowering learners to participate in online educational activities via incorporating gamification. An important component of GEN includes the upload of video recordings by learners. However, bandwidth and connectivity issues experienced by some users with mobile devices, resulted in low uptake rates by the learners on a mobile platform. To address this problem, the mobile application GEN2GO was designed which allows learners to trim and recompress the video locally before uploading to GEN. GEN2GO is currently available on TestFlight for iOS users, and after completing ongoing pilot tests and modifications with stakeholder groups, we intend to expand GEN2GO into a fully functional application with access to all of GEN's features. In the future, we intend on incorporating crowdsourcing into GEN2GO to support peer-assisted learning as well as investigating the relative advantage of including content experts in feedback.

KEYWORDS

Health Professions Education, Hands-on Skills, Just-in-time Learning, Mobile Application, Learning Management System, Gamification

1. INTRODUCTION

Mobile learning is becoming a key component of simulation-based health professions education (SBHPE), where it is defined as the use of a simulative aide to replicate clinical scenarios for educational purposes acting as an adjuvant to clinical training (Al-Elq, 2010), offering new ways to develop clinical skills. To date, hands-on clinical skills, such as suturing, knot tying, and injection, have been taught in simulation laboratories (Dilly & Baillie, 2017; Al-Elq, 2007). These laboratories are experiential classrooms where learners practice in an environment that offers the practicality of a clinical setting without the risks to patient safety. This is referred to as the centralized model of simulation-based education (SBE) (Barth et al, 2022).

However, because of logistical and financial barriers (Isaranuwatchai et al, 2014), many learners prefer learning on-the-go, and therefore, another SBHPE model must be considered. Over the past two decades, we focused on the development of pedagogies and technologies underpinning a decentralized model of SBHPE, where learners practice clinical skills from home (Barth et al, 2022). Although promising, this model is web-based, thus anchoring the learner to a computer screen and a physical simulator. Consequently, we saw an opportunity to propose a mobile and decentralized simulation model. The key components required for this mobile learning model are (1) inexpensive and portable simulators, and (2) a learning management system (LMS) deployed on mobile devices.

Our research aim was to maximize accessibility to decentralized SBE by adapting an existing online learning platform so that it can be accessed on any smart device. In this brief communication we describe work-in-progress documenting how we adapted a LMS called the Gamified Educational Networking (GEN) to serve as a mobile learning system, referred to as GEN2GO.

2. BODY OF PAPER

2.1 Methodology

We have developed and tested a web-based LMS called GEN, and its functionalities and efficacy has been tested and described previously (Torres et al., 2019; Torres et al., 2021; Torres et al., 2023).

However, GEN is a web-based LMS, and although it has a responsive user interface (UI) that adapts to mobile devices, some limitations can only be overcome with a mobile application. The major problem faced was dealing with videos recorded by learners that were too large (over two gigabytes), too long (over 30 minutes), or both. Combined with a slow internet connection on the learners' end, this resulted in low uptake rates as the upload process took too long, often causing timeout errors. In addition, since Android devices are very heterogeneous (different UIs, workflows, and settings), it was not feasible to create a general guide to overcome the technical difficulties related to the video recording and upload procedure.

2.2 Innovation

Our solution was to design GEN2GO, a mobile application that allows learners to upload videos into GEN. Since GEN2GO has direct access to the video file, the learner can trim the video directly on the handheld device, if necessary, before uploading it. Furthermore, GEN2GO also recompresses the video locally, ensuring that its size is more manageable to be uploaded. GEN2GO is available on TestFlight (iOS official platform for testing applications) for iOS users, and we are working on making it available on the Google Play Store for testing. Currently, GEN2GO is a level 4 prototype according to the ISC Technology Readiness Level Scale (Government of Canada, 2020). Finally, after the completion of ongoing pilot tests and modifications with groups of nurses and doctors in training, we intend to expand GEN2GO into a full-fledged application with access to all GEN's features. To integrate GEN2GO into at-home use, we plan to build onto a previously successful decentralized SBE approach during which our research lab produced 200+ take-home simulators for first-year nursing students (Barth et al, 2022). GEN2GO would augment this decentralization by providing instructions, guidance, and feedback via the students' mobile devices, allowing them to practice skills in a more flexible manner.

3. CONCLUSION

3.1 Discussion

Catalyzed by the recent pandemic and the advent of Industry 4.0 tools such as 3D-printing (Rubio & Camacho, 2020), SBHPE is undergoing a transformation where hands-on practice can happen both inside and outside of simulation laboratories (Barth et al, 2022). We are proposing a new mobile-decentralized model where it is possible to learn whenever and wherever learners are, if they have a modern mobile device connected to the Internet, and an inexpensive simulator. Following the principles articulated in Ericsson's deliberate theory Ericsson et al., 1993), several issues that need addressing by this SBHPE model relate to effective online instructional design, supervision and feedback, peer collaboration, and making the system captivating and easy to use.

In the design of GEN and GEN2GO, we have focused on three key characteristics which make mobile learning effective. First, all instructions follow the principles of microlearning (Buchem & Hamelmann, 2010), where instructions and video content are organized in 2-5 minute bursts of relevant information designed to maintain learners' attention and bolster knowledge retention. In GEN2GO, all instructional videos and learning

artifacts are brief and focused. Second, seamless access is becoming a crucial element of mobile learning solutions, especially in the fast-paced and high-stake work of healthcare (Mather et al., 2019). Evidence shows that removing the login process with seamless links or embedding content directly into the native app increases engagement, making training more accessible for health professional learners, such as nurses on the go (Mather et al., 2019). In the case of GEN2GO, we have implemented a simple and seamless login process that, with approvals from the information and technology departments from health delivery and education institutions, allows healthcare providers to log in to GEN2GO using their institutional email addresses. Finally, we utilized social learning (Moroney et al., 2022) to boost engagement as well as harness the power of crowdsourcing of information (Cheung et al., 2016). In the case of GEN2GO we especially focused on the idea of providing feedback to the learners by means of crowdsourcing (Cheung et al., 2016) and peer assisted learning (PAL) (Jauregui et al., 2018). That is, our learners now have an opportunity to tap into a community of both learners and instructors to provide them with feedback and enhance their learning.

3.2 Future Research Directions

Regarding crowdsourcing and PAL, there are two potential areas of research. First is the nature of crowdsourcing, and second is the advantage of including experts in the feedback. Crowdsourcing is a concept where ideas, or content are obtained through contributions from a large group of people (Crowdsourcing, 2023). There are different motivation-based theories behind participation and contribution to crowdsourcing efforts that are adaptable to contextual needs: (a) social and (b) monetary. In a context where resources or time are constrained, Social Exchange Theory proposes an optimal relationship for contributors in which costs are minimized and a mutually beneficial relationship is established (Stafford & Kuiper, 2021). Moreover, in a non-restricted context where the concern shifts to the end product, Transaction Cost Theory may provide a more suitable relationship since it supports pay-for-service principles that are optimal for crowdsourcing tasks efficiently (Celtekligil, 2020). Applying these crowdsourcing principles to the context of this work, online learners need formative assessments to receive feedback. Crowdsourcing feedback may provide a rich learning opportunity by augmenting skill acquisition via immediate peer and expert critiques, which also minimizes their risk of practicing bad habits (Burgess et al., 2020). Similarly, the presence of an expert versus purely PAL type of feedback is unknown. Research questions to explore in this area relate to trustworthiness of feedback, motivation, and engagement.

3.3 Summary

This paper described work-in-progress related to a shift away from the centralized model of simulation in health professions education towards a mobile, decentralized model. Once assessed through a rigorous research process guided by the Medical Research Council framework for the development of complex simulation-based innovations (Haji et al., 2014), this approach may provide an augmentation mechanism to the existing simulation practices in areas where access to simulation laboratories is limited.

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