

***SOS Educational App for Healthcare:
Improved Clinical Reasoning through Simulation & Game-Based Learning***

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The Innovation

The SOS Educational App is designed to improve knowledge application and clinical reasoning. Consistent with modern pedagogy's focus on real-life skill development and 'burst' micro-learning, the App models reality via dynamic decision-making points and real-world options. Through a series of patient simulations, healthcare clinicians and students are challenged to recognize and prioritize symptoms, identify patterns, make efficient clinical decisions and rehearse communication.

A gamified virtual patient system links together 38 cases for geriatric medical conditions associated with preventable hospitalizations. Real patient cases integrate evidence from 27 clinical guidelines, 25 evidence-based syntheses, and 18 research publications. A Sensory Observation System (SOS) ensures systematic clinical assessment. SBAR (Situation – Background – Assessment – Recommendation) is used to structure each case and rehearse clinical communication.

The Evidence to Substantiate the Innovation

The App addresses four pervasive pedagogical challenges:

- i. **Passive learning** which leads to lower academic performance – for example, course failure rates are 55% higher with traditional lecturing, compared to active learning (Freeman et al., 2014).
- ii. **Inadequate depth of challenge** in post-secondary and continuing education which often focus solely on knowledge acquisition without evaluation of application and performance change.
- iii. **Insufficient opportunities for rehearsal** despite learner requests for more practice with immediate feedback to practice skills and self-monitor performance.
- iv. **Limited scalability** of resource-intensive simulated patient methods and instructor facilitated case-based discussions.

The App utilizes problem-based learning theory on pattern recognition, in conjunction with the neuroscience of decision-making. Gamification of simulation not only increases engagement (Fels et al., 2016), but more importantly, improves decision-making by forcing players to slow down to select the correct decision path and to reflect on clinical reasoning (Howard-Jones, 2016). The App's game mechanics require players to select the correct course of clinical action, focusing their attention on the unique details of the virtual patient encounter. Rather than applying knowledge sequentially to a known medical condition, learners must consider multiple conditions under real-world conditions and integrate evidence to solve cases.

Game mechanics include action point starvation, virtual earnings, randomization, time constraints, difficulty and player levels and power-ups to produce a deeper game. fMRI data (Howard-Jones, 2016) support the effective use of these types of gamified mechanics which have been shown to deactivate default mode processing in the brain and stimulate the ventral striatum, the main learning reward center (see video). Reflective prompts, leaderboards, statistics and badges also provide instant performance feedback.

The Value of the Innovation as an Agent of Change

The SOS Educational App addresses two healthcare employability issues. First, given the significant risk of patient morbidity and mortality in healthcare, analytical and reflective clinical reasoning is essential to reduce error rates and adverse events (Pham et al., 2012). Clinical reasoning, the process by which clinicians recognize, assess, reflect, intervene, and evaluate patient situations, requires self-awareness and the use of metacognitive processes in the application of a decision-making framework. Second, clinicians are required to integrate evidence and research into care in order to achieve quality standards.

Analytics enable educators and employers to monitor performance and respond 'just-in-time' to learning gaps. Any type of self-authored case content can be uploaded – the App platform can be readily adapted for other clinical populations and any number of healthcare disciplines/roles. The SOS Educational App can supplement blended learning and enables accessible and scalable mobile learning to an unlimited number of learners anywhere, anytime, on any device.

The Outcomes to Substantiate the Innovation

Based on pilots with 123 nursing students (n=2,102 games, n=17,586 cases), players were satisfied with the App (74%) and self-reported increased knowledge and confidence after 3-weeks of gameplay. Overall, 65% of the cases played were correctly solved (range 12-90%). The case solved rate was defined as the number of correct answers divided by the amount of time spent playing the case. After adjusting Poisson models for number of previous times the case was played, case solve rates differed significantly when the case was played for the first time ($p < 0.0001$). *Case solved rates generally increased as more cases of the same type were played indicating that the students were learning to solve the cases correctly with longer gameplay (i.e., with practice).* Case solved rates were associated with presentation type and level of difficulty and whether players 'powered up' their rewards (see appendix). Focus groups probed facilitators and barriers to playing the App.

References / Supporting Documents

Fels, D., Meyer, R., Chandross, D., Bajko, R., & Helfenbaum, S. (2016, June). *The adaptation of learning management systems for gamification-based learning in continuing education*. Paper presented at the Canadian Association for University Continuing Education and Canadian Network for Innovation in Education Conference, Waterloo, Ontario, Canada.

Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H., & Wenderoth, M. P. (2014). Active learning increases student performance in science, engineering, and mathematics. *Proceedings of the National Academy of Sciences*, 111(23), 8410-8415.

Howard-Jones, P. A., Jay, T., Mason, A., & Jones, H. (2016) Gamification of learning deactivates the default mode network. *Frontiers in Psychology*, 6(1), 1-16. <https://doi.org/10.3389/fpsyg.2015.01891>

Pham, J. C., Aswani, M. S., Rosen, M., Lee, H., Huddle, M., Weeks, K., & Pronovost, P. J. (2012). Reducing medical errors and adverse events. *Annual review of medicine*, 63, 447-463.

App Evaluation Appendix



Adobe Acrobat
Document

App – Video of Game-Based Learning Science and Principles Supporting the SOS Educational App

http://clri-ltc.ca/files/2017/12/2017_12_Wharton_Meyer_SOS-App_135sec_FINAL-7.mp4

App – Introductory Video for Educators

<http://clri-ltc.ca/files/2017/07/06-2017-SOSApp.mp4>