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Enhancing teaching and learning of evidence-based practice via game-based learning

Rosy Swee Cheng Tay¹, Debby Regina Wegner², Li Siong Lim³, Joshua Ting⁴ & Shu Ting Ong⁵

¹University of Glasgow Singapore, Singapore; ²Singapore Institute of Technology, Singapore; ³Singapore Institute of Technology, Singapore; ⁴Alexandra Health, Singapore; ⁵Gleaneagles Hospital, Singapore

Abstract

Introduction: The Singapore Institute of Technology-University of Glasgow (SIT-UofG) Nursing Programme has traditionally taken a didactic teaching approach in the delivery of the Evidence-Based Practice (EBP) module. A hybrid approach was introduced using Game-Based Learning (GBL) to encourage active learning through gameplay.

Methods: A Randomised Controlled Trial (RCT) was undertaken encompassing a cohort of 100 Nursing students taking the EBP module in their first year at the Singapore Institute of Technology (SIT) in the 2021/22 academic year. The experimental group (n=27) worked through the online GBL intervention and the EBP module, while the control group (n=27) took the EBP module alone. The GBL included five Learning Quests and three case studies.

Results: High levels of satisfaction were reported by both the experimental group (n=22) and the control group (n=15) on the traditional content and delivery of the EBP module. High levels of engagement were reported by the experimental group on the GBL intervention; a one-sample statistics analysis confirming a significant level of engagement ($p < 0.001$). A Mann-Whitney U Test, however, found no significant difference in the Continuous Assessment (CA) scores of the two groups ($p = 0.507$ and 0.461).

Conclusion: The introduction of GBL designed to deliver educational content directly associated with the learning outcomes increased the nursing student engagement in the EBP module. These findings and discoveries can be utilised to improve the GBL intervention to the EBP module to have a more positive impact the student CA scores and therefore on student learning.

Keywords: Evidence-Based Teaching, Evidence-Based Practice (EBP), Nursing Education, Game-Based Learning (GBL), Teaching and Learning EBP, Nursing Students, Gamification

I. INTRODUCTION

The Singapore Institute of Technology-University of Glasgow (SIT-UofG) Nursing Programme has traditionally taken a didactic teaching approach in the delivery of the Evidence-Based Practice (EBP) module. Numerous undergraduate nursing programmes have taken a similar approach aimed at preparing students to be informed knowledge generators, rather than the more effective savvy consumers of research, or “evidence users” (Melnyk & Fineout-Overholt, 2019). These undergraduate nursing programmes continue to teach “traditional” nursing research courses that fail to address many of the skills, attitudes, and critical knowledge needed to foster EBP, doing little to promote the

development of competencies critical for engaging in EBP in clinical contexts (Davidson & Candy, 2016).

EBP is mandated by the Singapore Nursing Board as a key entry to nursing practice competency (Singapore Nursing Board, n.d.) and yet new graduate nurses still lack the knowledge, skills, and attitudes that nurture EBP. In addition, the COVID-19 pandemic brought about unprecedented challenges when classes moved from face-to-face to online, with one of the side-effects being a marked deterioration in the active engagement of the students in their classes. Active engagement is seen as critically pertinent to the learning development of nursing students in preparing them to be future-ready graduates.

Gamification, or the application of game design elements like levels and badges to non-game activities, has been avidly adopted to support contextual teaching and learning, assignments, and assessments in efforts to strengthen student creativity and retention (Caponetto et.al., 2014). Although, as reported by Tavares (2022), results have been varied, Game-Based Learning (GBL) is being increasingly utilized in nursing education. -The aim of this short communication is to describe the development and evaluation of an innovative teaching strategy to evaluate student satisfaction, perception, level of engagement, and overall achievement of the learning outcomes via the gamification of the EBP module.

II. METHODS

A Randomised Controlled Trial (RCT) was undertaken using the 100 Nursing students taking the EBP module in their first year at the Singapore Institute of Technology (SIT) in Trimester 3 of the 2021/22 academic year. All the students were invited to participate in the study and complete the Informed Consent form. The participants were randomized into either the experimental/intervention group (n=27) or the control group (n=27).

The control group attended the traditional EBP module made up of lectures, workshops, and seminars. The intervention group completed both the EBP module and the GBL intervention. The web-based, mobile-optimized GBL was composed of five levels or Learning Quests (LQs) and three case studies. The LQs followed six different EBP steps (Melnik & Fineout-Overholt, 2019), with each LQ calling for increasing levels of knowledge and proficiency to cultivate a spirit of inquiry for the undergraduate nursing students. The intervention group was informed to access the GBL only after the key EBP concepts and teaching were delivered to both groups.

Two surveys were used to evaluate participant satisfaction, perception, level of engagement, and overall achievement of the learning outcomes. At the end of the trimester, a university-wide Module and Teaching Feedback survey (Appendix 1) was used to assess how satisfied both groups were with teaching and learning within the EBP module. The GBL Module Learning

Outcomes Feedback survey was to get a sense of how the intervention group evaluated the effectiveness of the four main GBL outcomes (Appendix 2).

III. RESULTS

A total of 54 students out of the 100 (54%) taking the EBP module agreed to participate in this study. A total of 22 (81.5%) participants from the intervention group and 15 (55.6%) from the control group completed the surveys. There was a 44.4% attrition from the control group.

A. Grade Performance

There were two types of Continuous Assessment (CA) used – a group presentation worth 40% of the total grade, and an individual essay worth 60%. For the group presentation the mean score and standard deviation of the intervention group was 79.56 (3.70) and the control group was 78.70 (4.03). For the essay, the mean score and standard deviation of the intervention group was 69.6 (11.93) and for the control group was 67.81 (10.76). The Mann Whitney U Test found that there was no significance difference between the CA scores of the intervention and control groups ($p = 0.507$ and 0.461).

B. Level of Satisfaction

Overall, there was a high level of satisfaction for the EBP module for both groups (intervention: 95.5%; control: 93.3%) with no significant difference ($p=0.658$) found between the two groups.

C. Level of Perception

Both groups demonstrated similar positive perceptions about the EBP module.

5 themes emerged from the thematic analysis of the open-ended questions (Table 1)

D. Level of Engagement

The GBL was reported by the students to have deepened their learning of EBP.

4 themes emerged from a thematic analysis of the open-ended questions (Table 1).

Level of Perception

- 1) Achieving learning outcomes
 - *'A step-by-step guide allow recapping throughout the module'*
 - *'A good flow of module delivery and depth'*
 - 2) Systematic approach to learning EBP
 - *'I learnt how to systematically search for relevant articles via various databases'*
 - *'A good approach to critique articles to gather most relevant evidence'*
 - 3) Appreciating the guidance
 - *'EBP requires a lot of teamwork with good input from faculty. The journey was tough but the outcome was satisfying'*
 - *'Prompt feedback with clear explanations were given by faculty'*
 - 4) Scaffolding to thesis
 - *'Foundational learning scaffolds well to the Honours Thesis'*
 - *'Gives a good head start to the writing of Honours Thesis'*
 - 5) Seeking clarity
 - *'Standardize teaching and instructions to manage expectations'*
 - *'Move the learning to game-based learning'*
-

Level of Engagement

- 1) Applied learning
 - *'The game provided opportunities to apply and enhanced my learning'*
 - *'The case studies/questions provided opportunities to apply what I have learned'*
 - 2) Clear understanding of the EBP concepts/process
 - *'Interactivity of game allow better learning of concepts and engagement'*
 - *'Reinforcement of key concepts via quests. Learnt more than what was taught during lessons'*
 - 3) Level of engagement and interactivity
 - *'The activities were helpful as assessments...a good way to enhance learning'*
 - *'A more game-based approach to quests for more engagement'*
 - 4) Enhancing user experience and interface
 - *'The user interface was a bit hard...especially when the case scenarios were squeezed all the way to the left side of the screen'*
 - *'Hard to navigate between articles. Can provide side by side scrolling for better navigation'*
-

Table 1. Themes and associated subthemes

Note. This table lists the themes and associated subthemes that were identified from the student responses to the open-ended questions under perception and engagement. Selected student comments are included.

IV. DISCUSSION

There were several key findings from the development of GBL for the EBP module. Although no significant difference was found on the CA grade performance between the groups, both groups expressed a high level of satisfaction upon completing the EBP module.

Despite facing challenges with the usual didactic approach of teaching and learning of EBP, participants expressed appreciation to the faculty for the close stepwise guidance and prompt feedback in facilitating synergistic class teamwork. The systematic flow helped create a positive perception of the module delivery. This well-structured learning scaffold also provided a solid foundation for writing their Honours Thesis.

Gamification using case studies provided good interactivity for applied learning to enhance student engagement and learning. With regards to the interface

itself, the navigation of the case studies via the user interface was found to be challenging, so side-by-side scrolling can be considered to improve future user experience. Standardizing teaching and instructional methods to manage student expectations can also be considered, as there was definite support for moving the EBP module towards game-based learning.

This development of GBL for the EBP module was an innovative hybrid approach to the teaching pedagogy of the educational and healthcare institutions in Singapore. The employment of both didactic and GBL teaching and learning served to enhance the learning experience of the students and helped clarify the future translation of EBP into their respective clinical practice. While the feedback from the intervention group indicated the GBL interface can be improved, the high levels of satisfaction and engagement experienced by this group demonstrated the incorporation of game mechanics in the design of a

teaching-learning process can help engage learners in a more productive learning experience.

With no significant difference between the grades of the two groups, it could be argued that the nursing students are already being well guided and supported by Faculty in the teaching and learning of EBP and that the intervention was built upon a firm foundation. Leveraging upon authentic digital learning with a sound pedagogical approach, however, can help to further promote critical thinking, active engagement, and positive learning experiences for the nursing students. Future enhancement to the GBL intervention can consider levelling up the basis of gamifying learning for higher immersive learning experience. As there was a high attrition from the control group of 44.4%, future studies can consider a larger sample size for better generalizability. As this study only employed the GBL after the key concepts and teaching of EBP was delivered, future studies can consider the teaching and learning pedagogy of GBL along with seminar sessions to evaluate its viability.

V. CONCLUSION

This research project was carried out at the Singapore Institute of Technology to assess the impact of a GBL intervention on teaching and learning in the EBP module for nursing students. Despite no significant differences in grades between the groups, the results show the intervention had a positive impact on the student engagement, satisfaction, and perception of the learning experience, offering an excellent option of combining traditional didactic teaching with the innovative approach of GBL to enhance the EBP teaching and learning of undergraduate nursing students and healthcare professionals in both educational and healthcare institutions.

Notes on Contributors

Assistant Professor Rosy Tay Swee Cheng spearheaded the development of this research project, conducted the survey and data analysis, contributed to the conception, drafted, and critically revised the manuscript.

Ms. Debby Regina Wegener is a Senior Librarian and assisted with the development of a part of this research project, and critically revised the manuscript.

Mr. Lim Li Siong is a Senior Educational Developer in CoLEAD and coordinated the development of the research project and contributed to the critical review of the manuscript.

Mr. Joshua Ting is a Staff Nurse, Alexandra Health and played a key role in the development, conducted the survey and data analysis of this research project, and assisted in the critical review of the manuscript.

Ms. Ong Shu Ting is a Staff Nurse, Gleneagles Hospital and played a key role in the development, conducted the survey and data analysis of this research project, and assisted in the critical review of the manuscript.

All authors gave their final approval and agreed to be accountable for all aspects of the work.

Ethical Approval

Ethical approval approved by Singapore Institute of Technology (SIT) Review Board (IRB Project No. 2021157).

Data Availability

As per institutional policy, research dataset is available on reasonable request to the corresponding author.

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Declaration of Interest

The authors declare no conflict of interest.

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*Rosy Tay Swee Cheng
University of Glasgow, Singapore,
10 Dover Drive, Singapore 138683
+65 6592 4521
Email: rosy.tay@glasgow.ac.uk

Appendix A: Module and Teaching Feedback Survey

Singapore Institute of Technology (SIT)

Control group & Experimental Group

The purpose of this research study is to evaluate a development of an innovative teaching pedagogy via the game-based learning for NUR3009 Evidence Based Practice module that you are currently undertaking as part of the study programme. Your inputs will be sought in areas of gamification of student satisfaction, perception, level of engagement, and overall achievement of the learning outcomes.

Module Code	: NUR3009
Module Name	: Evidence Based Practice
Name of Programme	: SIT-UofG Bachelor of Science in Nursing (Honours) Programme

Module Feedback

A. Please rate the module using the following scale: Strongly disagree, disagree, neutral, agree, and strongly agree.

	Statements	Rating				
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1.	I understood what was expected of me in the module	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	The learning activities engaged me in learning what I need to know for this module	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	The continuous assessment enhanced my learning in this module	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	The module was well organized	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	Overall, this module was effective for my learning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

B. What did you find useful this module?

C. How can the module be improved?

D. Please provide any additional comments?

Appendix B: Game Based Learning Module Learning Outcomes Feedback Survey

Singapore Institute of Technology (SIT)

Experimental Group

The purpose of this research study is to evaluate a development of an innovative teaching pedagogy via the game-based learning for NUR3009 Evidence Based Practice module that you are currently undertaking as part of the study programme. Your inputs will be sought in areas of gamification of student satisfaction, perception, level of engagement, and overall achievement of the learning outcomes.

Module Code	: NUR3009
Module Name	: Evidence Based Practice
Name of Programme	: SIT-UofG Bachelor of Science in Nursing (Honours) Programme

Module Feedback

A. Please rate the effectiveness of game-based learning in achieving the module learning outcomes using the following scale: Strongly disagree, disagree, neutral, agree, and strongly agree.

	Module Learning Outcomes	Rating				
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Module Learning Outcome 1						
1.	The understanding on the concepts of evidence-based practice is enhanced with the game-based learning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Module Learning Outcome 2						
2.	The knowledge on the development of clinical questions has enabled me to conduct effective search strategy to select literature with the game-based learning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	The application of PICO/PEO in relation to the clinical/review question is enhanced with the game-based learning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Module Learning Outcome 3						
4.	The appraise evidence game was a fun way to practice building my evidence appraisal skills	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	My participation in the appraising evidence game helped me to strengthen my	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	evidence appraisal skills					
6.	Considering the methods used by authors to prepare information presented in their articles helps me to determine how much weight to give to each source of evidence in clinical decision-making via game-based learning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Module Learning Outcome 4						
7.	My evaluation of the current evidence via game-based learning enables me develop clear recommendations towards an evidence-based nursing practice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.	My evaluation of the current evidence via game-based learning enables me develop clear levels of evidence towards an evidence-based nursing practice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

B. How can game-based learning be improved in achieving module learning outcomes?

C. How has game-based learning enhanced your learning?

D. How can game-based learning be further improved?

E. Please provide any additional comments on the game-based learning.