

## Scalability and Sustainability Issues of Mobile Learning in Health Professions Education

\*Nurunnabi ASM<sup>1</sup>, Rahman A<sup>2</sup>, Akter N<sup>3</sup>, Talukder MAS<sup>4</sup>, Tapu TT<sup>5</sup>, Rehana J<sup>6</sup>, Nahar NS<sup>7</sup>

### Abstract

Mobile learning has been used increasingly in the past decades in different health profession education, and advancement in technology have produced different forms of mobile learning development modalities such as simulations, virtual patients, online courses and many interactive contents. However, many of those efforts' outcomes failed to live up to their promises; hence, those were not widely adopted and became unsustainable. A literature review has been done through a literature search conducted across three databases – Cumulative Index to Nursing and Allied Health Literature (CINAHL), MEDLINE (Ovid) and Google scholar – for studies describing or evaluating different mobile learning platform as used for education and professional development of different health professions based on user experience, perceived barriers, facilitating factors to scale it up and make it sustainable. This paper tends to identify factors or actions which are considered to optimize the experience and satisfaction of different stakeholders, help scaling up and identify strategies for sustainability of mobile learning interventions for health professions education.

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### Introduction

Mobile learning is defined as “any teaching, learning and/or training intervention that is delivered through handheld mobile devices using wireless transmissions”.<sup>1</sup> In the past decades, mobile learning has been used increasingly in different health profession education.<sup>2,3</sup> Advancement in technology have produced

different forms of mobile learning modalities such as simulations, virtual patients, online courses and many interactive contents especially customized for formal education, continuing education and professional development.<sup>3,4</sup> This was enabled by a surprising growth of capabilities in mobile devices like laptops, smartphones, and tablets,<sup>5</sup> and other “convenience factors like

1. \*Dr. Abu Sadat Mohammad Nurunnabi, Graduate Student, Mitch and Leslie Frazer Faculty of Education, Ontario Tech University, Oshawa, ON, Canada.
  2. Dr. Ashiqur Rahman, Assistant Professor, Department of Dental Public Health, Mandy Dental College & Hospital, Dhaka-1209, Bangladesh.
  3. Nahida Akter, PhD Fellow, Ross and Carol Nese College of Nursing, Pennsylvania State University, University Park, PA, USA.
  4. Dr. Mohammad Abu Sayeed Talukder, Assistant Professor (Curriculum Development), Centre for Medical Education (CME), Mohakhali, Dhaka-1213, Bangladesh.
  5. Dr. Thanadar Tamjeeda Tapu, Assistant Professor (Medical Education), Centre for Medical Education (CME), Mohakhali, Dhaka-1213, Bangladesh.
  6. Jinnat Rehana, Faculty, Department of Mental Health and Psychiatric Nursing, National Institute of Advanced Nursing Education and Research (NIANER), Mugda, Dhaka-1214, Bangladesh.
  7. Niru Shamsun Nahar, Principal, Grameen Caledonian College of Nursing (GCCN), Uttara, Dhaka-1230, Bangladesh.
- Address of Correspondence:**  
Email: shekhor19@yahoo.com

'omniusability', 'affordability' and 'accessibility to the internet' and more".<sup>5,6</sup>

Mobile learning can provide access to educational content and information in daily pre-registration education, clinical practice and post-registration professional development,<sup>7-11</sup> enable conversations and the sharing of information and knowledge with other learners; and elicit support from peers and instructors regardless of geographic distance.<sup>8,9,12</sup> Handheld computers can be used to keep track of students' skill development and progress in assignments,<sup>10</sup> promote self-directed and self-regulated learning,<sup>7</sup> display audio-visual information relating a specific place, scene or situation; and inform situated learning.<sup>11</sup>

The term 'scalability' indicates how well the initiative is able to grow. When an initiative reaches equilibrium at one stage and is able to refine or add to the considerations within the areas of concern that should be dealt with in the next stage, it may have a transition from one stage to the next. However, scalability is the measure of how many such transitions the initiative can accomplish, while 'sustainability' is the measure of how well the result fits the intended setting and persists. An initiative that has reached a stage with realistic and "final" concerns and reached equilibrium at this stage is considered sustainable.<sup>5,13,14</sup>

Several studies have underlined the potential of mobile learning interventions but also stressed upon the need for further research and reviews on the topic.<sup>1,3</sup> Moreover, research showed that many of those efforts could not produce any lasting outcomes,<sup>3,6</sup> and failed to reach a larger scale or wider communities or settings.<sup>5,15</sup> It was evident that some of these initiatives were with

complex settings, less user-friendly and subsequently outcomes failed to live up to their promises; hence, those were not widely adopted and became unsustainable.<sup>6,15</sup> We all know that during the COVID-19 pandemic, health professions education has changed dramatically, with the distinctive rise of e-learning, whereby teaching is undertaken remotely, on digital platforms and using many types of devices including mobile phones.<sup>16</sup> This review considers the broader issues of implementation, adoption, and the educational impact of mobile learning. This is important because mobile learning is a relatively new area of development compared to other e-learning approaches. Moreover, a systematic and in-depth exploration of the range of potential barriers and facilitators to adoption, use, scalability and sustainability of mobile learning in health profession education would deepen understanding of the topic. Hence, the present study aims to identify the facilitators and barriers to scalability and sustainability in mobile learning in health professions education.

## Methods

A literature search and review were conducted across a range of health focused databases like Cumulative Index to Nursing and Allied Health Literature (CINAHL), MEDLINE (Ovid) and Google scholar for studies describing or evaluating different mobile learning platform for education and professional development of different health professions based on user experience, perceived barriers and facilitating factors to scale it up and make it sustainable. The key words used for searching were – "health profession education" (including medical education, dental education, nursing education, physiotherapy and other allied health sciences),

“mobile learning”, “mLearning”, “scalability”, and “sustainability”. Besides, appropriate subject headings (e.g., Medical Subject Headings-MeSH) were also used. Search filters were also used like – language: English; publication dates: From 2001 to 2023.

The selection criteria for the studies include: i) have an abstract in English, ii) be conducted in any geographical setting, iii) explored mobile learning interventions in pre- and post-qualification medical or nursing or allied health sciences education or mLearning being implemented in educational settings for health professionals and iii) where mobile learning includes interventions which use mobile phones, PDAs, PDA phones, smartphones, pocket computers, handheld and ultra-portable computers such as tablet personal computers (PCs).

A total of 147 articles were identified. However, after removing the duplicates, 87 abstracts were screened. Among those 55 articles were downloaded for further assessment. Full-text articles were assessed for the eligibility that focused on scalability and sustainability of mobile learning in health profession education. Finally, only 21 articles, 1 framework and 1 guideline were selected after all exclusion.

## Results

We selected a total of 23 published resources (including articles, framework and guideline) focused on purpose, adoption, effectiveness, scaling up and sustainability issues in mobile learning in health professions education. The studies included in this review covered a variety of areas within the medical, dental, nursing, physiotherapy, and other allied health sciences

and studied feasibility, acceptability, functionality and thereby determining their effectiveness and perceived barriers to scalability and sustainability. Mobile learning in health professions education is a broad construct describing a wide range of teaching and learning strategies that are exclusively based on the use of mobile devices as instructional, training, communication, and interaction tools.<sup>6-12,15,17-27</sup> The construct covers aspects that may pertain to educational approaches, concepts, methods and technologies.<sup>6-12,15,17-27</sup> Mobile learning facilitates distant learning, which may help address the shortage of health professionals and educators in settings with limited resources by reducing the constraints of time and geographic barriers to training.<sup>8,9,12,22-26</sup> Learning is changing and is increasingly becoming mobile in our modern era. The findings of this study suggest that mobile learning interventions are equivalent or possibly superior to traditional learning methods for improving knowledge and skill in pre- and post-registration health professions education.<sup>9,17,23-27</sup>

The two main barriers to using mobile device are related to personal issues and the device itself. Issues concerning the device included size, limited memory and battery life, and speed of data exchange.<sup>2,9,16,20</sup> The other concerns about the device include loss, breakage, and reliability.<sup>2,12</sup> Less common are concerns about security.<sup>8,21</sup> Although healthcare professionals expressed concern about secure patient data, they seemed unconvinced that handheld computers represented a greater threat than paper records.<sup>8,9</sup> Both pre- and post-registration learners' requirements for successful m-learning were specified as identification of learner's needs, structuring of the pedagogical material,

enhancement of the m-learning environment, motivation for learner participation, tutorials, collaborative mechanisms, supporting tools and combination of learning processes.<sup>8,9,11,12,23-27</sup> The impact of users' exploratory technology adaptation on learning was mediated by their task adaptation.<sup>2,5,22-27</sup>

Recent research has specified four abilities which define the sustainability of m-learning: i) ability to address current educational needs and intent of m-learning; ii) ability to have potential to be adopted by users; iii) ability to maintain a certain condition indefinitely or make progress; iv) ability to adapt to possible changes.<sup>28</sup> Community engagement and participation is crucial. It is important that the community must have shown its interest and motivation for the project and that it will indeed be used.<sup>2,5,22,27-29</sup> The community members also need some sort of training exposure to ICT to further their understanding of the project. They need basic training on how use mobile phones, related software and on handling information and services provided by these devices.<sup>5,8-11,22-29</sup> Collaboration with external sponsors is essential, as external funding helps to start and run the project, especially in the developing countries and a plan must be in place to guarantee financial viability in order to guarantee the project's sustainability.<sup>5,13,23,27-29</sup>

Another crucial factor is using mobile technology as basic platform. The main technological component must be mobile phones, because it is the only ICT that most of the people in developing countries have access to.<sup>5,13,23</sup> In most of the countries, the medium of instruction in health profession education is English; however, the software used must be able to adapt to the language of local people.<sup>17,21-26,28</sup> Moreover, it

needs to update the software locally i.e., having the ability to update and maintain the system with local capacity. Once the pilot project has finished the project must have a plan to maintain its sustainability. It may have to be scaled up which can be done locally.<sup>13,14,29</sup> Another approach to sustainability is to provide device and software to learners through assisting them to buy an inexpensive device and free software.<sup>2,9,10,22,23,29</sup>

## Discussion

In the last decade, mobile devices usage is increasing throughout the world and many educational institutions using advantages of the mobile devices. However, even if mobile learning is spreading rapidly in many regions of the world, it is still in its infancy especially in the developing countries.<sup>20,25,29</sup>

Over the next decade, it is anticipated that personal, portable, wirelessly networked technologies (i.e. mobile learning) will become ubiquitous in the lives of learners – indeed, in many countries, this is already a reality.<sup>1,20,28,29</sup> However, scalability factors are also crucial for adoption, use and effectivity in greater population. As discussed earlier, in health profession, for student learners some of the success factors in this regard are – the appropriateness of the technology for students, ease of use and reliability, costs, teaching and learning approaches, interactivity, organizational issues, novelty and speed are important factors; these are also true for post-registration healthcare providers.<sup>3,4,12,15,26,27</sup> Developing strategies to accommodate mobile devices in clinical practice may be advantageous for both the institution and the professionals, especially when the devices are used to access clinical information systems, promoting both enhanced

safety and improved time efficiency for healthcare providers.<sup>4,9,12,27</sup>

Finally, some important requirements for mobile learning projects scaling up and sustainability as identified are – changes in the traditional practices of educational institutions, motivation to change technology, time for customizing and adapting materials and content to different types of devices or platforms, budget for hardware and Internet connections, consolidation, and content and services for different sociocultural realities.<sup>13,14,27-29</sup>

There are few limitations to this review that need to be acknowledged. Firstly, the review was based on research literature from mainly the health sciences via CINAHL, MEDLINE and Google scholar. There could be other articles/book chapters published in other outlets not included in these databases. In addition, the use of English only language search tends to have excluded those studies published in non-English languages that fell within the subject area. The search was also confined to the studies/literature available between 2001 and 2023 and those are free of cost, due to time and budget constraint.

## Conclusion

This review paper was not much exhaustive, rather a modest effort to identify the facilitators and barriers to scalability and sustainability of mobile learning in health professions education and find out some possible solutions to the challenges identified. Our discussion is expected to contribute to the future planning and design of effective, scalable and sustainable mobile learning in health professions education and training. However, we have acknowledged the

limitations of this review paper. Further research is recommended with longer time span and in all possible diverse fields through searching more databases.

## References

1. Tudor Car L, Riboli-Sasco EF, Marcano Belisario JS, Nikolaou CK, Majeed A, Zary N, et al. Mobile learning for delivering health professional education. *Cochrane Database Syst Rev*. 2018;2018(6):CD011861.
2. Looi C-K, Seow P, Zhang B, So H-J, Chen W, Wong L-H. Leveraging mobile technology for sustainable seamless learning: A research agenda. *Br J Educ Technol*. 2010;41(2):154-69.
3. Doherty I, Sharma N, Harbutt D. Contemporary and future eLearning trends in medical education. *Med Teach*. 2015;37(1):1-3.
4. Cook DA, Levinson AJ, Garside S, Dupras DM, Erwin PJ, Montori VM. Internet-based learning in the health professions: A meta-analysis. *JAMA*. 2008;300(10):1181-96.
5. Xu Y, Li H, Yu L, Zha S, He W, Hong C. Influence of mobile devices' scalability on individual perceived learning. *Behav Info Technol*. 2020;40(11):1137-53.
6. Krishnasamy C, Ong SY, Yock Y, Lim I, Rees R, Car J. Factors influencing the implementation, adoption, use, sustainability and scalability of mLearning for medical and nursing education: A systematic review protocol. *Syst Rev*. 2016;5(1):178.
7. Alegría DA, Boscardin C, Poncelet A, Mayfield C, Wamsley M. Using tablets to support self-regulated learning in a longitudinal integrated clerkship. *Med Educ Online*. 2014;19:23638.
8. Mather C, Cummings E, Allen P. Nurses' use of mobile devices to access information in health care environments in Australia: A survey of undergraduate students. *JMIR Mhealth Uhealth*. 2014;2(4):e56.
9. McAlearney AS, Schweikhart SB, Medow MA. Doctors' experience with handheld computers in clinical practice: qualitative study. *BMJ*. 2004;328(7449):1162.
10. Tanaka PP, Hawrylyshyn KA, Macario A. Use of tablet (iPad®) as a tool for teaching



- anesthesiology in an orthopedic rotation. *Rev Bras Anesthesiol.* 2012;62(2):214-22.
11. Fernández-Lao C, Cantarero-Villanueva I, Galiano-Castillo N, Caro-Morán E, Díaz-Rodríguez L, Arroyo-Morales M. The effectiveness of a mobile application for the development of palpation and ultrasound imaging skills to supplement the traditional learning of physiotherapy students. *BMC Med Educ.* 2016;16(1):274.
  12. Hardyman W, Bullock A, Brown A, Carter-Ingram S, Stacey M. Mobile technology supporting trainee doctors' workplace learning and patient care: An evaluation. *BMC Med Educ.* 2013;13:6.
  13. Wingkvist A. *Understanding Scalability and Sustainability in Mobile Learning: A Systems Development Framework.* Kalmar, Sweden: Växjö University Press; 2009. p.44-6.
  14. Casany MJ, Alier M, Mayol E, Miquel Barceló M. *Integration of M-Learning and LMS: A Sustainability Approach.* 2013. Available from: [https://upcommons.upc.edu/bitstream/handle/2117/79580/integration\\_mlearning\\_lms\\_sustainability.pdf](https://upcommons.upc.edu/bitstream/handle/2117/79580/integration_mlearning_lms_sustainability.pdf). (Accessed on March 26, 2023).
  15. Triola MM, Huwendiek S, Levinson AJ, Cook DA. New directions in e-learning research in health professions education: Report of two symposia. *Med Teach.* 2012;34(1):e15-20.
  16. Nurunnabi ASM, Mozaffor M, Tabassum M, Akhter QF, Johora F. Integrating e-learning into medical education – Phase-I of MBBS programme in Bangladesh: Prospects and challenges for the students, instructors and policy makers. *Community Based Med J.* 2024;13(2):290-7.
  17. Alipour S, Moini A, Jafari-Adli S, Gharaie N, Mansouri K. Comparison of teaching about breast cancer via mobile or traditional learning methods in gynecology residents. *Asian Pac J Cancer Prev.* 2012;13(9):4593-5.
  18. Amer KM, Mur T, Amer K, Ilyas AM. A mobile-based surgical simulation application: A comparative analysis of efficacy using a carpal tunnel release module. *J Hand Surg Am.* 2017;42(5):389.e1-9.
  19. Baumgart DC, Wende I, Grittner U. Tablet computer enhanced training improves internal medicine exam performance. *PLoS One.* 2017;12(4):e0172827.
  20. Bracho-Blanchet E, Vives-Varela T, Alpuche-Hernández A, Avila-Montiel D. Usefulness of mobile devices in learning process for residents of pediatric surgical specialties. *J Surg Res.* 2023;291:466-72.
  21. Khatoon B, Hill K, Walmsley AD. Mobile learning in dentistry: Challenges and opportunities. *Br Dent J.* 2019;227(4):298-304.
  22. Guo P, Watts K, Wharrad H. An integrative review of the impact of mobile technologies used by healthcare professionals to support education and practice. *Nurs Open.* 2015;3(2):66-78.
  23. Wilson D, Aggar C, Massey D, Walker F. The use of mobile technology to support work integrated learning in undergraduate nursing programs: An integrative review. *Nurse Educ Today.* 2022;116:105451.
  24. Kim SJ, Shin H, Lee J, Kang S, Bartlett R. A smartphone application to educate undergraduate nursing students about providing care for infant airway obstruction. *Nurse Educ Today.* 2017;48:145-52.
  25. Greene LR, Spuur KM. Undergraduate use of medical radiation science mobile applications. *Radiography (Lond).* 2018;24(4):352-9.
  26. Singh Sodha T, Grønbaek A, Bhandari A, Mary B, Sudke A, Smith LT. mHealth learning tool for skilled birth attendants: scaling the Safe Delivery App in India. *BMJ Open Qual.* 2022;11(Suppl 1):e001928.
  27. Martin D, Bekiaris B, Hansen G. Mobile emergency simulation training for rural health providers. *Rural Remote Health.* 2017;17(3):4057.
  28. Setirek AC, Tanrikul Z. Significant developmental factors that can affect the sustainability of mobile learning. *Procedia - Soc Behav Sci.* 2015;191:2089-96.
  29. Muyinda PB. M-learning: Pedagogical, technical and organizational hypotheses and realities. *Campus-Wide Info Syst.* 2007;24(2):97-104.