Healthcare Professionals' Perception of Mobile Learning in Singapore

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Abstract

Mobile phones have great efficiency, are affordable and have greater connectivity. This potential can be utilized to promote learning with deeper understanding and excitement that allows personal development. Medical educators are now embracing the use of technology to equip medical students with necessary tools to succeed as doctors. This study explores the attitudes of healthcare professionals towards the use of mobile technology to find out the value of promoting mobile learning in Singapore. Healthcare professionals, consisting of doctors, nurses, and allied health professionals, were administered a questionnaire through Google Forms. The results show that the majority of the respondents utilized their mobile devices for a variety of internet-related activities. The general perception of the use of mobile learning was accepted amongst the respondents but less so for formal professional education, especially in the clinical setting.

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Introduction

Mobile learning has become popular, with the ubiquitous nature of smartphones and tablets. The devices have become more efficient, convenient and affordable, and they have greater connectivity.[1] With mobile technology Learning can happen anytime, anywhere, and just-in-time to maximise its effectiveness.[3] Mobile technology gives education a more exciting shape, ensures broader access to higher education, and allows personal development and cultural enrichment.[4]

Singapore has a high percentage of smartphone users per capita. It reached 4.65 million in 2020, which translates to 90 percent of its total population. Singapore has a mobile penetration rate of 159.1 percent, making it very attractive for mobile companies, with Apple being the market leader with approximately a third of the Singapore market share. There are now 11 telecommunication companies in the country, with Singtel, M1, and StarHub being the major players. Data is affordable, with island-wide coverage, and many companies offer lower cost and off-contract plans. The government has plans to operate 5G networks island-wide by 2021.[5] Singaporeans are now using their smartphones for calling and messaging, social networking, work and school-related activities, and online transactions.

Technologies have transformed higher education institutions into centres of collaborative inquiry and self-directed learning under the guidance of a facilitator.[4] Teaching practices in higher education are more learner-centred, and the teacher's role has shifted from a source of knowledge to facilitator. It has accelerated the need for a re-evaluation of the role of teaching and instruction and strategically planned faculty support.[6] Learning and conceptual understanding improve when learners assume responsibility for their learning by being actively involved in the learning process. This change in pedagogy has increased learner motivation and overall learner satisfaction.[7] Medical educators are also embracing the use of technology to equip medical students with the necessary tools to succeed as doctors. The Lee Kong Chian School of Medicine in Singapore has been providing their medical students with iPads, loaded with course content that has been developed by Imperial College, London, to prepare them for their team-based learning sessions.[8] During the Covid pandemic, medical education had to rely heavily on technology, with face-to-face teaching and clinical postings suspended.

Mobile learning using portable electronic devices is transforming the healthcare environment. Health professionals, especially trainees and medical students in the clinical years, use them for

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convenience and to improve efficiency in their work, as they can provide instant learning experience at the point of care. These devices allow easy access to a wide variety of educational resources to support learning in the clinical environment,[10,11] which are verified, evidence-based information, and up-to-date enhanced knowledge that will shape their clinical decisions. However, they will have to follow existing guidelines and respect patients' acceptance and privacy when they decide to use their mobile devices in the clinical setting.[12]

Recent studies have shown the effectiveness of using mobile technology in healthcare. Lall and colleagues indicated that mobile learning can play a significant role in medical and nursing education as learners are familiar with their devices and can personalise them towards their learning needs.[13] Yap underlined that, with the growing use of smartphones, mobile apps could potentially be used as a platform to train pharmacy students for clinical practice [14] Chang *et al.* showed that resident physicians in resource-limited settings effectively used smartphones loaded with point-of-care tools for accessing medical information at the bedside and for self-directed learning.[15] In another review, O'Donovan *et al.* showed that mobile learning was a promising tool for educating and training community healthcare professionals in developing countries.[16]

The literature has identified the following key factors for the success of mobile learning:[17]

- The pedagogical integration of the technology into the course assessment.
- Teacher modelling of the pedagogical use of the tools.
- The need for regular formative feedback from teachers to learners.

The appropriate choice of mobile devices and software to support the pedagogical model underlying the course.

Lundin and colleagues suggested that universities integrate learners' own mobile technology which they use daily to create social interactions, a collaboration between peers, sharing experiences, and improvements in knowledge into their educational activities.[18] Mobile learning using technology that is widely available and familiar facilitates its acceptance by learners. Research has shown that, in Singapore, mobile learning in higher education, combined with social media and other educational tools that have been effectively integrated into their course design, has greatly enriched learners' experience and produced valuable learning outcomes.[19,20]

Mobile learning and blended learning allow for the combination of hands-on, skills-based training, as well as self-directed, knowledge-based learning. Tudor Car and colleagues reported that mobile learning may promote better engagement of learners and enable easy, on-the-go access to education.[21] The use of mobile learning in schools in Singapore is well researched and documented.[22] Despite a growing trend where education authorities mandate teachers to apply modern digital technology in teaching programmes, research has shown that teachers may not be compliant unless they can see the value of mobile technology and are confident and competent to use them effectively in their teaching practice. Teacher educators should inculcate positive attitudes towards technology in their training programmes and encourage pre-service teachers to harness them in their classrooms.[23] Overall, mobile learning has much to offer, especially when learning content is designed to work on any device.[24]

The current body of knowledge provides the conceptual framework that mobile learning is effective and an efficient means of delivering health professional education. In order to maximise the role of mobile learning in health professional education, we will need to understand and overcome the gaps in knowledge that support or impede its implementation and use. This research will determine the perception, acceptance, and competencies of teachers and learners and the critical success factors of mobile learning in health professional education in Singapore.

Aim
The aim of this study is to explore the attitudes of healthcare professionals towards the use of mobile technology in their graduate and post-graduate education in Singapore. The results of this survey help to guide the planning of mobile learning in health professional education in Singapore.

Methods
Participants
Healthcare professionals, consisting of doctors, nurses, and allied health professionals, at the Khoo Teck Puat Hospital, a regional public hospital in Singapore, were invited to participate in the study from 1 September 2015 to 31 July 2016. One hundred and thirty-three participants were recruited through a purposive and convenience sampling approach, including snowball sampling. Informed consent was obtained from all participants. They were informed that their contributions in the study were entirely voluntary and their responses were confidential. The questionnaire was administered online using Google Forms.

Ethics approval was obtained from the hospital's Ethics Review Board.

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Questionnaire Development

The items included in the survey were adopted from prior literature but adapted to the context of mobile learning in healthcare professional education. From our literature review, there was no prior validated instrument to evaluate the perception amongst healthcare professionals on mobile learning.

A test was conducted to assess the content validity of the initial questionnaire. A total of 30 health professional students were invited to do a pilot questionnaire, and their feedback was solicited. The questionnaire was refined based on their comments, sentences were rephrased, and ambiguous questions were eliminated.

The final version of the questionnaire comprised 26 items. The first four items represented demographic data, and 21 items pertained to themes on mobile device use and learning. The themes were 1) the utility of mobile device (two questions), 2) participation in learning with the use of a mobile device (four questions), 3) ease of learning with the use of a mobile device (four questions), 4) knowledge of online learning (three questions), 5) professional use of a mobile device (two questions) 6) assessment of learning through mobile devices (three questions), and 7) future use of mobile learning (three questions). The final question was an optional, open-ended question to poll respondents.

Questions under themes 1) and 7) were multiple-choice questions. Questions under themes 2) to 6)

were a five-point Likert scale, with "1" = strongly disagree, "2" = disagree, "3" = neither agree nor disagree, "4" = agree, and "5" = strongly agree.

Statistical Analysis

Descriptive analyses were done to report the demographic information and frequencies of variables. The relationships between demographics and the questions were examined using independent t-tests and one-way analysis of variance (ANOVA) tests. Cronbach's alpha reliability statistics were performed for questions within the themes. Stata v16 was used for the data analysis, and statistical significance was set at 0.05.

Results

The mean age of the 133 respondents was 33.6 ± years 9.9 (range 21 – 74). There were 97 females (72.9%), and 70 (52.6%) respondents were nurses. The majority of the respondents did ward-based work. The breakdown of the professions and the locations where respondents worked can be seen in Table 1.

Figure 1 shows that the majority of the respondents utilised their mobile devices for a variety of internet-related activities, such as accessing the internet (90.9%), looking up information (85.0%), accessing a social networking site (80.5%), and sending an email (77.4%). Comparatively, Figure 2 shows that a lower proportion of respondents felt that learners used their mobile devices to look up information (76.7%), engage in social networking (69.2%), and communicate with peers and teachers (67.7%).

Table 1: Demographic information of participants

Profession	Medical (n=30, 23%)
	Allied Health (n=27, 20%)
	Nursing (n=70, 53%)
	Educator (n=6, 4%)
Workplace (more than one place)	Ward (n=85)
	Clinic (n=34)
	Theatre (n=20)
	Field (n=15)
	Classroom (n=9)

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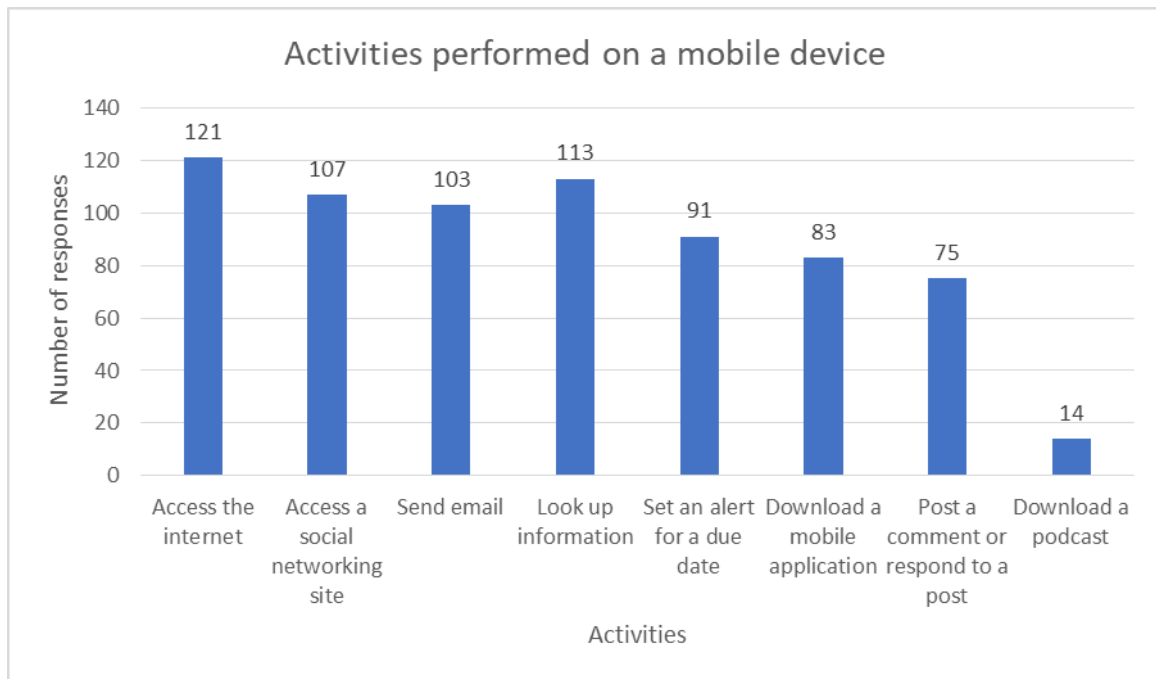
Figure 1: Activities participants performed on a mobile device in the past week
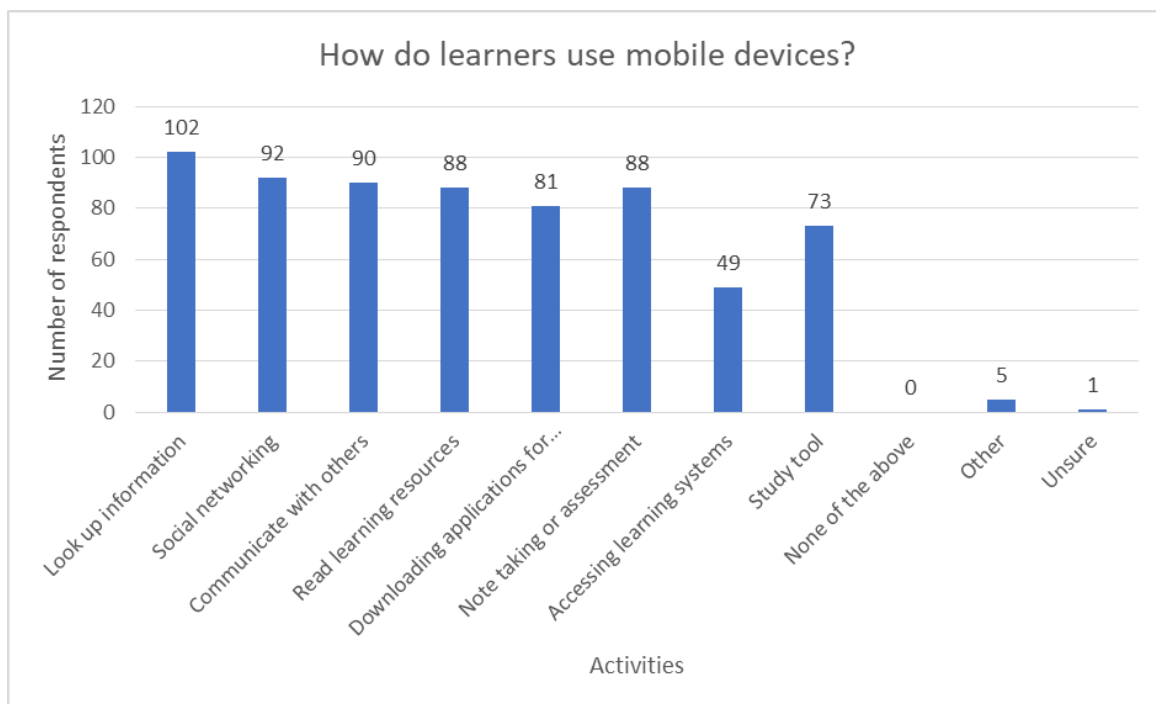

Figure 2: Activities performed by learners on their mobile devices

All dimensions received a majority average percent positive dimension score. The ease of learning on mobile devices ranked the highest (75.7%), followed by knowledge of mobile learning (71.7%), assessment of learning through mobile devices (71.5%), professional usage of mobile learning (66.9%), and, finally, participation in learning with the use of mobile devices ranking last (66.6%) (Table 2). There is strong internal consistency for the use of mobile

devices for the various activities in mobile learning (Cronbach Alpha >0.8). However, the respondents' perception of mobile learning use in the clinical setting and health professional education had low internal consistency (Cronbach Alpha approx. 0.5). Therefore, the general perception of the use of mobile learning is acceptable amongst the respondents but less so for formal professional education, especially in the clinical setting.

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Table 2: Participants' responses towards mobile learning (n=133)

Dimension	Positive response rate	Mean ± SD	Cronbach Alpha
Participation	**66.6%**		
7. Learners would be more likely to participate in teaching sessions if they could use their mobiles devices	61.7%	3.7 ± 0.95	
9. My healthcare learners would be more likely to participate in learning sessions if they could do so through their mobile devices	67.8%	3.8 ± 0.89	0.8834
10. Learners would be more engaged if they could communicate through their mobile devices	65.4%	3.8 ± 0.93	
15. Learners should be able to participate in online discussions from their mobile devices	71.4%	4.0 ± 0.86	
Ease of Learning	**75.7%**		
8. Learners would better manage learning time if they could access materials anytime, anywhere on their mobile devices	76.7%	4.1 ± 0.88	
12. Learners should be able to easily view educational resources, course content and practice skills on their mobile devices	85.7%	4.2 ± 0.81	0.8522
18. I believe using mobile applications for learning would benefit healthcare learners	76%	4.0 ± 0.86	
19. I think learners would be more motivated to learn if they could use mobile devices	64.2%	3.8 ± 0.93	
Knowledge	**71.7%**		
16. Learners know how to use a mobile application designed for health care learners	67.7%	3.9 ± 0.82	
20. I would like to learn more about incorporating mobile learning in my teaching practice	69.2%	4.0 ± 0.91	0.8090
22. I am aware of the potential of mobile technology for health profession education.	78.2%	4.0 ± 0.73	
Professional Use	**66.9%**		
11. Mobile learning should be incorporated into health care education	70.7%	3.9 ± 0.88	0.5803
21. I find it acceptable to use medically related mobile phone applications or internet sites when attending to patients.	63.1%	3.7 ± 1.01	
Assessment	**71.5%**		
13. Healthcare learners should be able to access Learning Management Systems (e.g. Blackboard) in a mobile format on their devices	76%	4.0 ± 0.88	
14. Learners should be able to perform assessment on their mobile devices	70.7%	3.9 ± 0.89	0.8193
17. It would be easier for learners to complete their assessment if they could use their mobile devices	67.7%	3.9 ± 0.79	

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Regarding differences in responses by gender, the data showed statistically significant differences in most of the questions, with males scoring higher. The use of mobile devices for assessment in learning was statistically significant in all questions in the assessment dimension among all groups ($p < 0.05$). Statistically significant differences from different professions were only seen in the areas pertaining to ease of access to resources, learning activities, and assessment. Overall, the younger respondents (under 30s group) had statistically significant lower mean scores in most questions except for some questions pertaining to participation, ease of learning, knowledge, and professional use.

Most respondents (80.8%) felt that mobile technology should be integrated into pre-clinical learning techniques as students would be able to learn at their own pace (Figure 3).

When asked about their attitudes towards incorporating mobile learning into their teaching (Question 25), 66.9% felt that they would be able to effectively incorporate mobile learning into their clinical practice, while 23.3% felt that they would be able to effectively incorporate mobile learning into their teaching. However, a lower proportion of respondents felt comfortable in designing mobile learning activities where, at best, only 60.9% felt comfortable using proper instructional techniques (Figure 4).
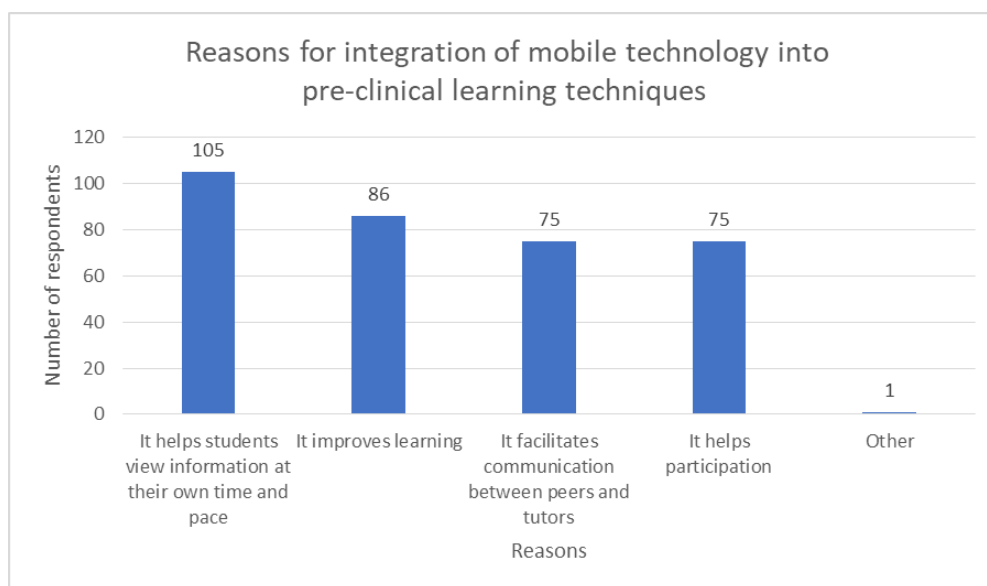

Figure 3: Reasons for integration of mobile technology into pre-clinical learning techniques
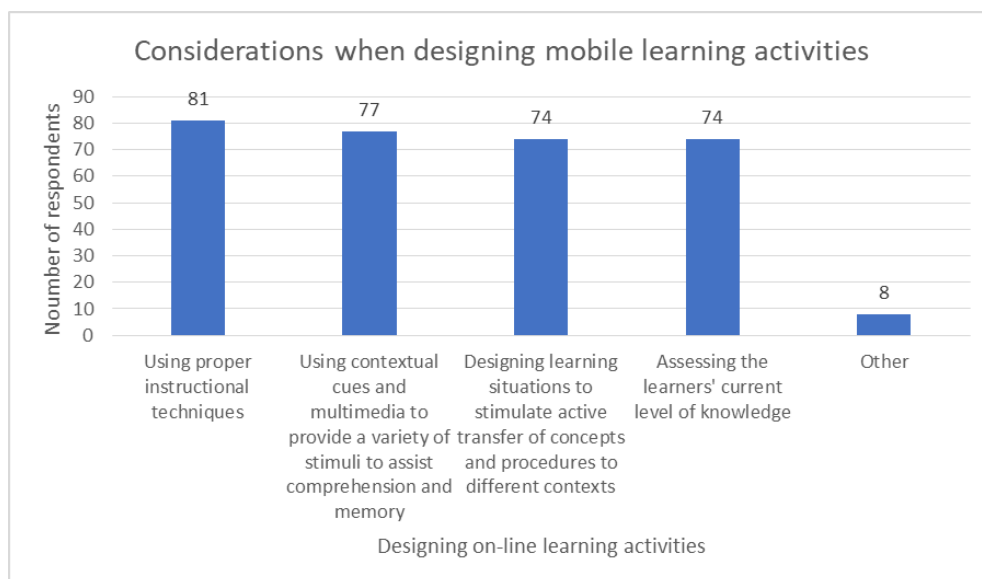

Figure 4: Considerations when designing mobile learning activities

Discussion

Mobile Technology Use for Learning

This is the first study conducted in Singapore with healthcare professionals about mobile technology use in education. Our data showed that healthcare professionals use mobile technology heavily for various activities, such as surfing the internet, social media use, email, searching information, digital reminders, using a mobile app, and interacting with others through a mobile device. In terms of using mobile technology for learning, learners are doing the following activities on mobile devices: looking up information, social networking, interacting with others, reading learning resources, downloading learning apps, and accessing learning systems and study aids.

The majority of participants are aware of the potential of mobile technology in healthcare education and perceive that mobile technology can improve learning and participation in learning. The majority think it is acceptable to use mobile devices when attending to patients and that they should be incorporated into clinical care. In addition, mobile technology should be used for assessment purposes.

Gender and Mobile Technology Use

Our data showed a significant discrepancy between female and male healthcare professionals in mobile learning. Overall, male healthcare professionals scored statistically higher average scores in advocating the use of mobile technology for learning (Q7, 15) and clinical care (Q11), estimating the advantages of mobile learning (Q8, 12, 18), learners' knowledge in mobile technology and learning (Q16, 20), and using mobile technology for assessment (Q13, 14, 17). The mobile gender gap has been well established and reported in international non-government organisations such as the *Role of Education and Skills in Bridging the Digital Gender Divide – Evidence from APEC Economies*, as well as the annual report for *the Mobile Gender Gap* by GSMA. For example, men in nearly all Asia-Pacific Economic Cooperation (APEC) economies used mobile technology more than women and have more skills and confidence in using digital technologies. Gender differences are observed in digital technology access, use and affordability, as well as socio-cultural norms. For our participants – healthcare professionals in Singapore - it is less of a problem for access, use, and affordability for these digital devices. We speculate that socio-cultural norms play a more prominent role. Men in general have been playing a more active role in digital transformation than women. In the Singapore healthcare system, all the Chief Information Technology Officers (CITO) have been males.

Age and Mobile Technology Use

Age has been an important factor in mobile technology use for learning. We categorised participants into younger or older than 30 years. A higher percentage of the older group (>30 years old) supports mobile technology use for learning when questioned about the use of mobile technology to participate in online teaching or discussion. A similar response was observed when questioned whether mobile technology made learning easily accessible and gave learners ownership. The older group with higher knowledge in using mobile technology in teaching advocates to integrate mobile technology for learning and assessment.

Profession and Mobile Learning

We surveyed doctors, nurses, allied health professionals and education administrators. A higher percentage of doctors favour mobile technology use in the following areas such as using mobile technology to deliver learning contents so learners can easily access this information, using mobile technology for learners to access online learning materials and to complete the assessments. For other areas, we did not observe differences among the different healthcare professions.

Conclusions

Similar to the other developed countries, mobile technology has been heavily used in healthcare professional education in Singapore. Most educators recognise the potential of mobile learning, despite the differences we observed in gender, age and profession. Future research should focus on identifying strategies to promote mobile learning among learners and faculty development efforts to get faculty members ready for planning and delivering mobile learning.

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