Research Article - Education in Anatomy and Embryology

Use of mobile learning by first year undergraduate students in a medical college in India

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Abstract

Mobile handsets are emerging as technology enhanced learning media in medical education. However not much research has been undertaken to explore usefulness of mobile learning among students. This study assessed the perception of first year undergraduate medical students, who are undergoing training in preclinical subjects, towards the application and effectiveness of mobile learning in medical education curriculum. A self-designed, pre-tested questionnaire was framed to explore the outlook towards mobile devices as a learning medium and the questionnaire was administered among 100 first year undergraduate medical students; summative assessment and their responses were collected and analyzed. The completed questionnaire was returned by 98 students after documenting their responses. It was observed that 85.7% respondents had access to smart phones and mobile handset was the preferred learning medium for 49% students. The students had a multifaceted outlook with regards to advantages of mobile learning and in their opinion, it supported a diverse bouquet of learning components. Moreover 44.9% and 25.5% students rated mobile device as an effective and very effective learning medium respectively. A majority (70.4%) of the students admitted that they would continue with mobile learning in future and 73.5% students opined that they would actually recommend their juniors to utilize their mobile devices as a learning medium. First year undergraduate medical students are using their mobile devices as an effective learning medium. Mobile devices have the potential to converge as a one-stop medium that could cater to learning needs of a divergent population of medical students.

Introduction

Advancements in technology have had a remarkable influence in the field of education and there is enough evidence to suggest that technology can enhance teaching as well as learning, when used thoughtfully and appropriately (Järvela et al., 2007; Tully et al., 2015; Berman et al., 2016; Bois et al., 2016). The evolution of wireless technology and introduction of advanced mobile devices such as 'smart' cellular telephones have enhanced the scope of mobile learning in the present day education set up (Burdette et al., 2008; Dimond et al., 2016). In fact many higher educational institutions are implementing mobile learning to provide flexibility in learning as wireless mobile devices enable learners to use them anywhere and anytime for network-

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ing with other learners on a collaborative basis (Wang et al., 2009; Ally and Prieto-Blazquez, 2014; Boruff and Storie, 2014).

By definition mobile learning constitutes learning by means of handheld mobile devices (Koehler et al., 2012). In last few years mobile learning has made rapid inroads within the domain of medical education as researchers have documented the usefulness of telecommunication devices in disseminating knowledge (Prgomet et al., 2009; Bullock et al., 2015). Medical educators have promptly identified this emerging medium of learning and mobile learning is being considered as an essential pedagogical component within the curriculum by medical schools across the world (Prasopoulou et al., 2006; Ellaway et al., 2014; Walsh, 2015).

After undertaking an extensive literature search, we could find little research regarding the perception of students, who are the biggest stakeholders in medical education curriculum, about using mobile devices as a learning medium. Two recent studies have analyzed the mobile learning experience among students during their clinical training and reported a growing interest in using mobile technology for academic activities (Masters and Al-Rawahi, 2012; Deutsch et al., 2016). However an area of concern was accessing contents/files which were too large in terms of memory (Masters and Al-Rawahi, 2012; Boruff and Storie, 2014).

The objective of this study was to assess the perception of first year undergraduate medical students, who are undergoing training in preclinical subjects, towards the application and effectiveness of mobile learning in medical curriculum.

Methods

Setting and participants

The study was conducted at the Department of Anatomy, ESI-PGIMSR & ESIC Medical College, Joka, Kolkata, India. The medical college is under the responsibility of Ministry of Labour and Employment, Government of India. The study was approved by the Institutional Review Board (IRB) and Institutional Ethics Committee (IEC) of ESI-PGIMSR & ESIC Medical College, Joka, Kolkata, India. We requested all the first-year undergraduate medical students from 2015-16 academic session (batch strength is 100) to participate in this study.

Study intervention

The study involved responding to a self-designed questionnaire (Box 1), which was framed to explore the perception of the students towards application and effectiveness of mobile learning. We would like to mention that the parameters selected for inclusion in the questionnaire for the present study were based on detailed analysis of the available literature and discussion among research team members. Moreover while selecting these parameters we took into consideration factors such as feasibility, reproducibility and applicability with respect to the study population. Internal reliability (Cronbach's alpha = 0.90) and test-retest reliability (0.90) of the questionnaire were found to be high. A pilot study was conducted with the study questionnaire among the first-year students of the previous batch (2014-15) to test and vali-

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Questionnaire for 1ˢᵗ Prof MBBS students (Please tick wherever applicable)

Please fill up the Questionnaire without discussing. It will not take more than 10 minutes to fill up completely

1. Sex: Male/ Female   2. Age (years):   3. Place of Residence: Rural/ Urban

4. Do you support the use of technology in learning?
    Yes/ No/ Not Sure

5. Has technology contributed in making learning experience better?
    Yes/ No/ No Sure

6. Do you use a smart phone on a daily basis?
    Yes/ No

7. Which is your favourite learning medium?
    Printed text/ Laptop or PC/ Mobile devices/ Class Notes

8. How many hours of mobile learning do you undertake in a week?
    Zero to ≤ 5 Hours/ >5 to ≤ 10 hours/ > 10 to ≤ 20 hours/ >20 hours

9. In your opinion which is the single most advantage of using the mobile as a learning medium?
    Ready access to recent information/ Sharing learning materials via social media/ Access to information on the go/ Interactive learning environment/ Pedagogically adventurous medium

10. Which component of learning is best supported by a mobile device?
    Building basic knowledge/ Providing additional data/ Quick revision/ Link between theory and practice/ Deep learning

11. In which mode do you prefer to use the mobile as a learning medium?
    Online/ Offline/ Both

12. In your opinion, how much effective is a mobile device as a learning medium?
    Very effective/ Effective/ Not sure/ Not effective/ Not at all effective

13. Would you continue with mobile learning in future?
    Yes/ No/ Not Sure

14. Would you recommend mobile learning to your juniors?
    Yes/ No/ Not Sure

THANK YOU FOR YOUR VALUABLE SUPPORT AND CONTRIBUTION

Box 1.

date the same. Significant differences ($p < 0.001$) between scores of the two groups of students indicated that the questionnaire had satisfactory construct validity. The students were made to understand that participation was voluntary and responses would remain anonymous. They were assured that absolute confidentiality would be maintained regarding their responses, the documents would be retrieved only for a short period of time and would be used only for research purpose. Written informed consent was obtained from all the participants and the objectives of the study were

Table 1. Outlook of first year undergraduate medical students towards technology, learning media and use of mobile learning

Question	Respondents (n)	Response	P-value
Do you support the use of technology in learning?	98	Yes – 70 (71.4%) No – 18 (18.4%) Not Sure – 10 (10.2%)	<0.05 for each comparison between values
Has technology contributed in making learning experience better?	98	Yes – 64 (65.3%) No – 14 (14.3%) Not Sure – 20 (20.4%)	<0.05 for each comparison between values
Do you use a smart phone on a daily basis?	98	Yes- 84 (85.7%) No – 14 (14.3%)	<0.05
Which is your favourite learning medium?	98	Printed Text – 14 (14.3%) Laptop or PC – 25 (25.5%) Mobile Devices – 48 (49%) Class Notes – 11 (11.2%)	<0.05 for each comparison between values
How many hours of mobile learning do you undertake in a week?	98	Zero to ≤ 5 hrs – 23 (23.5%) >5 to ≤ 10 hrs – 28 (28.6%) >10 to ≤ 20 hrs – 45 (45.9%) >20 hrs – 2 (2%)	<0.05 for each comparison between values

clearly explained to them to reduce the risk of participant bias. The study questionnaire were distributed among 100 first-year medical students in June 2016, prior to their summative assessment.

Outcome measures

The participants were asked to sit in a designated space within the department and requested to respond to the hard copies of the questionnaires provided to them. They were requested to submit the questionnaire upon completion of their responses inside an earmarked box kept within the department. It was noted that the completed questionnaires were returned by 98 students after documenting their responses. These were subsequently collected by hand and taken for outcome analysis.
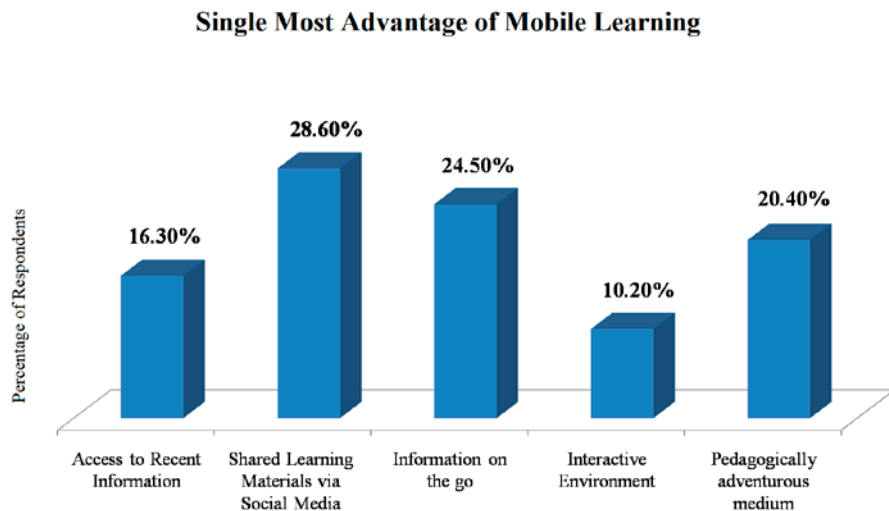
Single Most Advantage of Mobile Learning

Figure 1. Graphical representation depicting the advantages of mobile learning as perceived by first year undergraduate medical students. The data used in the figure is obtained from the response to question 9 of the study questionnaire (Please refer to Box 1). The given options were standardized with the help of the pilot study used to validate the study questionnaire.
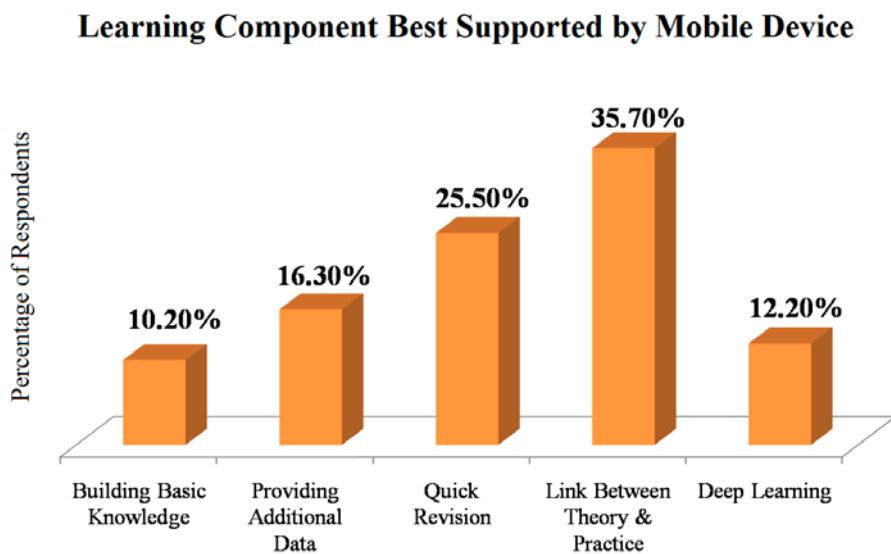
Learning Component Best Supported by Mobile Device

Figure 2. Graphical representation depicting the learning components supported by mobile devices as perceived by first year undergraduate medical students. The data used in the figure is obtained from the response to question 10 of the study questionnaire (Please refer to Box 1). The given options were standardized with the help of the pilot study used to validate the study questionnaire.

Table 2. Perceptions of first year undergraduate medical students regarding the use of mobile devices as a learning medium

Question	Respondents (n)	Response	P-value
In which mode do you prefer to use the mobile as a learning medium?	98	Online – 55 (56.1%)	<0.05 for each comparison between values
		Offline – 28 (28.6%)	
		Both – 15 (15. 3%)	
In your opinion how much effective is a mobile device as a learning medium?	98	Very Effective – 25 (25.5%)	<0.05 for each comparison between values
		Effective – 44 (44.9%)	
		Not Sure – 18 (18.4%)	
		Not Effective – 08 (8.2%)	
		Not at all Effective – 03 (3%)	
Would you continue with mobile learning in future?	98	Yes – 69 (70.4%)	<0.05 for each comparison between values
		No – 11 (11.2%)	
		Not Sure – 18 (18.4%)	
Would you recommend mobile learning to your juniors?	98	Yes – 72 (73.5%)	<0.05 for each comparison between values
		No – 11 (11.2%)	
		Not Sure – 15 (15.3%)	

Statistical analysis

Pearson's chi-square test was used to assess the differences between frequencies observed in relation to the responses for a particular question. Fisher's exact test was employed when the frequency for any response was less than five. All statistical analyses were performed with the help of SPSS (Statistical Package for Social Sciences) version 18.0 (SPSS Inc., Chicago, IL). A p value <0.05 was considered as statistically significant.

Results

The study encompasses data from 98 respondents with a median age of 19 years (range 18-23 years) and among them 66 (67.3%) were male and 32 (32.7%) were female. 64 (65.3%) respondents resided in urban areas, whereas 34 (34.7%) were from rural parts of the country.

We observed that 70 (71.4%) respondents were in favor of the use of technology in learning and 64 (65.3%) opined that technology has actually made the learning

experience better. Remarkably 84 (85.7%) students had access to smart phones and 48 (49%) opted for mobile devices as their favorite learning medium. Moreover as many as 45 (45.9%) students admitted to have undertaken up to 20 hours of learning in a week through their mobile devices and 28 (28.6%) up to 10 hours in a week (Table 1).

The students were divided in their opinion when asked to identify the single most advantage of mobile devices as learning medium (Fig. 1). We noted that 28 (28.6%) students opted for sharing study materials via social media, whereas 24 (24.5%) were in favor of access to information that a mobile device provides on the go. 20 (20.4%) students were inclined to mobile learning as it was a pedagogically adventurous medium and 16 (16.3%) students liked the fact that mobile devices provide ready access to recent information. However with regards to the component of learning best supported by a mobile device, majority of the students (35/ 35.7%) were of the opinion that mobile learning provides a link between theory and practice. A substantial number of students (25/25.5%) responded that mobile devices were useful in quickly revising the study materials (Fig. 2).

Among the respondents, a majority (55, *i.e.* 56.1%) preferred to use their mobile devices in online mode for learning, whereas 28 (28.6%) students undertook mobile learning in the offline mode. On a five point Likert scale, it was noted that 44 (44.9%) and 25 (25.5%) of the respondents found mobile devices as an effective and very effective learning medium respectively. An overwhelming 69 (70.4%) students admitted that they would continue with mobile learning in the future and 72 (73.5%) students opined that they would actually recommend their juniors to utilize their mobile devices as a learning medium (Table 2).

Discussion

The popularity of mobile learning among the study population was evident from the outcome that 49% of respondents went on to choose mobile devices as their favorite learning medium and 45.9% undertook up to 20 hours of learning in a week through their mobile devices (Table 1). The findings are not surprising considering the young age of the students (median age 19 years) and that a majority (65.3%) of them came from urban areas. Inclination of the students towards mobile learning could also have been influenced by the fact that we are dealing with a tech savvy, gadget friendly generation of students as 85.7% of the students had access to modern day smart phone devices (Table 1). We also noted that the students were very much in favor of utilizing the technological advances while learning, which is in accordance with adult learning principles (Fakoya, 2013; White et al., 2014; Ghosh and Chakraborty, 2015). Moreover mobile devices also enable students to explore the domain of self-learning, which is an integral element of active learning environment (Walton et al., 2005; Grasso et al., 2006; Baumgart et al., 2015).

An interesting observation was that 28.6% respondents were using their mobile devices in offline mode while learning (Table 2), which shows that modern day mobile handsets with enhanced memory (courtesy powerful SD cards) can be used to access stored materials and shared files at the convenience of the user. This could well be a possible solution to the concern reported in previous studies (Masters and Al-Rawahi, 2012; Boruff and Storie, 2014). The students had a multifaceted outlook

with regards to the advantages of mobile learning (Fig. 1) and in their opinion it supported a diverse bouquet of learning components (Fig. 2). Thus mobile devices have the potential to converge as a one-stop medium that could cater to the learning needs of a divergent population (Kukolja Taradi and Taradi, 2016; Mackayet et al., 2016). Moreover as a learning medium mobile handsets are affordable and accessible to all sections of the society. Additionally mobile handsets are handy and cost effective learning tools as compared to books. It is understood that students have to go through the text books as the primary medium of learning, however by availing mobile learning they need not to rush to the library nor buy multiple reference books. Mobile learning can actually enable students to have fast access to learning resources available in the internet whereby they can update their knowledge at continuous pace. These possibly could be reasons behind the outcome of the study that 44.9% of the students rated mobile devices as an effective learning medium (Table 2).

In the present study our observations were based on a study population which although has a small size nevertheless is representative of the target population that is first-year medical students. That study population could be considered as a cross section of the first-year medical students in the country. We would like to emphasize that when sample size is small but the representativeness of the same is preserved, statistical inference might be compromised in terms of precision and/or statistical power but still could be considered as a reliable source to draw conclusions about the reference population (Suresh et al., 2011). We acknowledge that randomization of the study population could not be performed in the present study, as randomization in a small sample size could potentially lead to an imbalance in distribution of sample and emergence of baseline characteristics (covariates). In other words it would have led to discrete distribution for p-values which possibly could have made it mathematically impossible for a p-value to attain a particular degree of significance (Gadbury et al., 2003).

Our study has several limitations, like a small study population and being conducted in a single centre, which perhaps leads to a limited understanding of the research topic. However it would be unwise to overlook the statistical significance of the observations recorded in a single center study as it has been documented in the literature that a consistent team, coupled with the use of consistent methodology applied in a consistent environment has the potential to reduce the variable factors that may undermine the outcome of multicenter studies (Kaul and Diamond, 2006). Despite the limitations, we have presented a baseline data which suggests that mobile learning is emerging as a popular learning medium among medical students even during their preclinical training. This could enable them to gain tacit knowledge of how to integrate mobile resources with patient care during clinical postings. We are in the process of coordinating with other medical schools in the country to conduct similar studies with their students. Hopefully we can present more in-depth data in future to provide greater insights on this issue.

Conclusion

Medical education is evolving at a rapid pace and it is critical for medical educators to recognize the perceptions of students to the emerging learning methods. From

the findings of the present study, it is apparent that first year undergraduate medical students are using their mobile devices as an effective learning medium. The ongoing advances in mobile technologies have enriched the potential of this medium of learning and significantly contributed to the field of education as such. Moreover the quantum of popularity of mobile learning among students may encourage educators to develop learning tools/educational materials involving mobile technologies in future.

Acknowledgements

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